CHARACTERIZATION OF BACTERIA FROM THE SEDIMENT-WATER INTERFACE OF NEWFOUNDLAND COASTAL WATERS USING PATTERNS OF CARBON SOURCE UTILIZATION

E. DWAYNE GOUDIE

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BY

©E. DWAYNE GOUDIE, B.Sc. (Hons.)

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ABSTRACT

The functional diversity of marine bacteria from the sediment-water interface of Newfoundland coastal waters was characterized by examining carbon source utilization. Although some benthic strains utilized a broad range of substrates, many were considered fastidious. Bacteria with a strictly respiratory metabolism predominated at the sediment-water interface. Upon initial isolation, approximately 50% of the colonies observed on the plating medium, at 15°C, were pigmented. Most studies do not report a significant proportion of pigmented bacteria occurring in the marine environment. The proportion of pigmented bacteria was much lower if the plates were incubated at 5°C. The recovery of bacteria was higher at 15°C, than at 5°C, therefore the population studied was psychrotrophic rather than psychrophilic. Eighty percent of the strains isolated required Na^+ for growth, indicating that the population studied was mostly of marine origin. The Biolog-GN assay showed that strains were more metabolically active in September than in June. There was no functional difference in the substrates utilized by strains at each sampling date, isolation temperature, or between groups of pigmented and non-pigmented bacteria. Sixty-six percent of all cultured strains utilized glucose and 62% utilized glutamic acid. These were among the most widely utilized substrates on the Biolog microplate. They may, therefore, be the most appropriate choices as substrates for studies of heterotrophic potential as long as the percentage of the population actually metabolizing them is considered. Approximately 38% of the strains, subdivided as 17% of the pigmented strains and 54% of the non-pigmented strains, utilized thymidine and 20%

utilized leucine. These compounds can be used to estimate bacterial growth rates assuming that they are incorporated directly into DNA or proteins, respectively. If the bacteria metabolize these compounds as substrates their use in estimating microbial growth rates could result in an underestimation of the true microbial production occurring in this region, especially if non-pigmented bacteria are abundant. Based on the results of Biolog substrate utilization patterns there were significant differences between the regional strains and most of the reference cultures with the reference strains being more metabolically active and utilizing a broader range of substrates.

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INTRODUCTION

Diversity and role of bacteria in marine ecosystems

Within the past 20 years, many discoveries have been made that have contributed significantly to our understanding of the importance of bacteria in marine ecosystems. There is substantial evidence that bacteria are the major decomposers of organic matter in both the water column and sediments of marine ecosystems (Fenchel and Blackburn, 1979; Wetzel, 1982). The rapid growth rates and potentially high growth efficiencies of marine bacteria suggest that the production of particulate heterotrophic bacterial biomass represents an important link between detritus, dissolved organic matter, and higher trophic levels (Cole *et al.*, 1988 and references therein). As such, bacteria are major secondary producers and heterotrophic consumers in most marine ecosystems (Fuhrman *et al.*, 1993).

Despite the recognition of heterotrophic bacteria as major agents of organic degradation in the ocean, little is known about their identity, diversity, and population dynamics (Rehnstam *et al.*, 1993). Marine environments harbour a variety of autochthonous heterotrophic bacteria that, when culturable, have been characterized as weak to moderate halophiles, mostly Gram-negative organisms, that are motile by means of flagella. For the majority of taxa, strains recovered from these environments are isolated only rarely from non-marine or non-halophilic habitats, indicating that there is a moderate to sharp taxonomic discontinuity between seawater heterotrophic bacteria and their freshwater counterparts (Ortigosa *et al.*, 1994*a*).

A variety of bacterial genotypes that exhibit diverse metabolic capabilities have been isolated (Krieg and Holt, 1984). Gram-negative, culturable marine and halophilic aerobes and facultative anaerobes are members of several bacterial phyla. Many belong to the Proteobacteria γ subdivision. Genera in this subdivision include *Alteromonas*, *Shewanella*, *Acinetobacter*, *Methylophaga*, *Aeromonas*, *Vibrio*, *Listonella*, *Photobacterium*, *Colwellia*, *Halomonas*, *Deleya*, *Oceanospirillum*, *Marinomonas*, *Pseudomonas* (De Ley, 1992), *Marinobacter* (Gauthier *et al.*, 1992), and *Arhodomonas* (Adkins *et al.*, 1993). Others belong to the Proteobacteria α subdivision and include *Erythrobacter*, *Roseobacter*, marine *Agrobacterium* species, *Hypthomonas*, *Hirschia*, and *Caulobacter* (De Ley, 1992). Still others belong to the flavobacter-bacteroides branch that includes *Cytophaga*, *Microscilla*, *Flectobacillus/Cyclobacterium*, *Flavobacterium* (Gherna and Woese, 1992) and the planctomycetes, which include *Planctomyces* and *Pirellula* (Staley *et al.*, 1992). Some other genera, isolated from marine samples, such as *Mesophilobacter* (Nishimura *et al.*, 1989) and *Volcaniella* (Quesada *et al.*, 1990), have not been placed phylogenetically (Ortigosa *et al.*, 1994*b*).

Coastal zone regions, because of their dynamic nature, provide resident bacterial communities that adapt to large periodic and aperiodic changes in habitat. Diurnal and seasonal changes in salinity, light, temperature, nutrients, physical disruption caused by ice and storm events, predation, and parasitism all combine to cause stress and present new opportunities for bacterial colonization and growth. The bacterial populations in these marine ecosystems generally exhibit a high degree of physiological and nutritional

diversity. The maintenance of a high degree of heterogeneity is characteristic of these marine bacterial communities. It is an adaptive advantage to maintain diverse populations with physiological tolerances, the ranges of which may exceed those experienced within their habitat. The bacterial communities occurring within these marine ecosystems may possess a high degree of nutritional versatility (Atlas, 1982). Accordingly, many marine bacteria can, with equal facility, survive under starvation conditions (Morita, 1985) in a viable but apparently non-culturable state (Grimes *et al.*, 1986), or exhibit high growth rates on nonlimiting concentrations of organic nutrients. Oligotrophic bacteria also exist in the marine environment (Hirsch *et al.*, 1979; Poindexter, 1981). They are highly efficient in the utilization of low concentrations of (ca. 1-15 mg C L^{-1}) organic nutrients and comprise a fairly constant proportion of heterotrophs present in low nutrient environments (Kuznetsov *et al.*, 1979; Grimes, 1991).

The predominance of non-fermentative, Gram-negative rods in marine bacterial assemblages has been reported for temperate and tropical areas (Simidu *et al.*, 1980; Bianchi, 1981; Sugahara *et al.*, 1984). They have been reported at higher latitudes, such as the Arctic (Hauxhurst *et al.*, 1981) and Antarctic (Delille *et al.*, 1988; Delille, 1993; MacCormack and Fraile, 1990). Costerton *et al.* (1974) suggested that Gram-negative bacteria are fit for existence in dilute aqueous environments. He described a role for the periplasm, situated between the inner and outer bacterial envelope membranes, in retaining a variety of degradative enzymes in close association with the cell envelope. Discovery of the viable but non-culturable response (Xu *et al.*, 1982), also referred to as dormancy

(Stevenson, 1978), starvation survival (Novitsky and Morita, 1978), dwarfing (Humphrey *et al.*, 1983), somnicell formation (Roszak and Colwell, 1987), and slow growth (Chesbro, 1988) revealed versatility in the ability of Gram-negative bacteria to withstand chronic nutrient deprivation. These are adaptive features which make Gram-negative bacteria well adapted for life in aquatic habitats. While attributes such as the possession of an outer membrane, lipopolysaccharides, periplasm, thin cell wall, plasmids, pili, polar or lateral flagella, and somnicell formation may not all be uniquely Gram-negative, their colligative effects, along with the potential for short generation times, eminently adapt Gram-negative bacteria for the aquatic environment (Grimes, 1991).

The heterotrophic bacterial flora of cold-ocean water and sediments has been investigated in several numerical taxonomic studies. Two of the most extensive studies, that have a direct bearing on the present study, are those of Kaneko *et al.* (1979) and Hauxhurst *et al.* (1980). Alaskan outer continental shelf bacterial isolates were characterized by determining approximately 300 features per strain (Kaneko *et al.*, 1979; Hauxhurst *et al.*, 1980). Kaneko *et al.* (1979) showed that the dominant bacterial flora in water and sediments of the Beaufort Sea was different from the flora of temperate waters. Hauxhurst *et al.* (1980) compared strains from the Northeastern and Northwestern gulfs of Alaska. Their study showed that most strains tended to cluster with strains of similar regional origin and they attributed this to regional differences in nutrient availability in the water column. Both Hauxhurst *et al.* (1980) and Kaneko *et al.* (1979) recommended a medium containing yeast extract for the cultivation of pigmented bacteria which, they

reported, were difficult to subculture.

Most isolates from the Gulf of Alaska and the Beaufort Sea could be placed into one of seven categories. These were: (i) Gram-negative rods producing yellow or orange pigments [*Flavobacterium*, *Cytophaga*]; (ii) Gram-negative, full or partial ring-forming organisms [*Microcyclus*]; (iii) Gram-negative, non-pigmented, fermentative, facultative anaerobic, curved or straight rods [*Vibrio*]; (iv) Gram-negative, non-pigmented, weakly fermentative, facultatively anaerobic, pleomorphic rods [unidentifiable with any genus described in *Bergey's Manual of Determinative Bacteriology*, 8th ed. (Buchanan and Gibbons, 1974)]; (v) Gram-negative, non-pigmented, non-fermentative, aerobic rods [*Pseudomonas*, *Alcaligenes*, *Alteromonas*]; (vi) non-acid-fast coryneform bacteria showing branching and snapping division [*Arthrobacter*]; and (vii) Gram-negative coccobacilli [*Acinetobacter*] (Davis *et al.*, 1983).

Bacteria isolated from Newfoundland coastal waters have been the subject of several systematic and physiological studies. Powell (1978) investigated the heterotrophic bacterial flora of the giant scallop *Placopecten magellanicus* (Gmelin) and showed that about 60% of the strains had strict aerobic metabolism, whereas the remainder were facultatively anaerobic. Many of the former were identified as strains of *Alteromonas* and the latter were *Vibrio* strains. Gow and Mills (1984) established that the region can support a psychrophilic and psychrotrophic bacterial population and Powell *et al.* (1987) showed that microbial activity was low, especially during the winter months. As a result, biodegradation of organic matter can be slow in this region (Hollohan *et al.*, 1986;

Pomeroy and Deibel, 1986) and a significant proportion of detritus sinks to the sediment-water interface before it decomposes (Pomeroy and Deibel, 1986). In a study by Noble *et al.* (1990) pelagic and benthic surface-layer bacteria were described. The majority of the pelagic strains, which were from the water column, were identified as belonging to the genus *Vibrio*. The benthic or sediment bacteria showed a more diverse population structure and bacteria with strictly respiratory metabolism predominated. These bacteria were strains of *Alteromonas*, *Pseudomonas*, and *Flavobacterium*. The remaining bacteria isolated were strains of *Vibrio*, and some strains identified as *Vibrionaceae* (Noble *et al.*, 1990). Other studies of microbial processes in this region include those reported by Pomeroy *et al.* (1991) and Wiebe *et al.* (1992). These studies have explored relationships between temperature, substrate concentration, and substrate utilization.

Characterizing bacterial communities

The characterization of bacterial communities, as a prerequisite for understanding their function in the environment, relies primarily on isolate-based identification methods, although only small proportions of natural bacterial communities have been cultivated on agar media. Traditional tests for determining the increasing numbers of diagnostic traits to be applied for the identification of isolates are labour-intensive and slow. It is very time-consuming to examine the hundreds of strains necessary to compare bacterial communities from different environments or to follow seasonal trends in community structures (Rüger and Krambeck, 1994).

The *Microbial Diversity 21 Action Statement*, issued by the International Unions of Biologists and Microbiologists (Colwell and Hawksworth, 1991), recommended research into microorganisms of primary importance to ecosystem functioning, because taxonomic assessments on a large scale are clearly impractical. Moreover, a recent statement by the U.S. Soil Ecology Society noted a general lack of information relating taxonomic diversity to aspects of ecosystem function, e.g. decomposition and nutrient cycling. For these reasons, functional rather than taxonomic diversity may provide greater insight to microbial roles in ecosystems (Zak *et al.*, 1994).

Commercially available test systems have been developed that reduce the effort in determining metabolic traits of bacteria. Relatively recently, a redox-based technique for rapid identification of bacterial strains was introduced by Biolog Inc., Hayward, Calif., U.S.A. (Bochner, 1989*b*). This system uses the redox dye, tetrazolium violet, as an indicator for oxidation of organic substrates. A typical test is conducted as follows. A cell suspension is introduced into each of the wells. The wells contain the tetrazolium dye and appropriate nutrients, plus a test carbon source, for the cells to oxidize. Metabolism of a substrate results in the formation of NADH and, via an electron transport chain, in the irreversible reduction of the redox dye to purple formazan (Rüger and Krambeck, 1994). The tests are performed in standard 96-well microplates containing dried films of 95 different carbon sources and one negative control. The Biolog assay, then, is done by colorimetrically measuring tetrazolium dye reduction that is coupled to substrate oxidation. The degree to which each of the 95 substrates is oxidized is determined after a

fixed incubation period. A positive response is identified as an absorbance or optical density value greater than that occurring in the blank well. If the cells cannot oxidize the carbon source in the well, there is no respiratory burst and the coloured dye product does not form (Bochner, 1989*b*). The 95-test format has the potential to generate 2^{95} patterns (Bochner, 1989*a*). The resulting pattern of purple wells yields a "metabolic fingerprint" of the bacterium tested (Stager and Davis, 1992). According to the manufacturer, results should be read after 4 to 24 hours by means of a microplate photometer or visually. The metabolic profile of the test organism is then compared with those of known bacteria whose profiles are entered into Biolog's, or a user developed, data base.

Biolog currently manufactures five different MicroPlates™: GN, GP, YT, ES, and MT. The GN, GP, and YT MicroPlates™ contain carbon source utilization tests which are optimized for the identification of Gram-negatives, Gram-postives, and yeasts. The ES MicroPlate™ contains carbon source utilization tests for characterizing or biotyping *Escherichia coli* and *Salmonella* strains. Finally, the MT MicroPlate™ contains Biolog's redox chemistry without the added carbon sources allowing the user to tailor the plates for their own particular application (Biolog Inc., 1993). In the study presented here, the Biolog GN Microplate was used.

This technology has distinct advantages over conventional pH-based fermentation methods. For instance, the metabolic breathprint system allows testing for use of carbon sources by bacteria that do not produce pH changes. Many major groups of microorganisms are either slow acid producers or do not produce significant amounts of

acid in the course of metabolizing substrates. The method works equally well with fermenting and nonfermenting bacteria. Moreover, unlike the traditional pH-based method, the newer method is not biased towards sugar utilization tests. Thus, the redox method allows for much more broad and thorough surveys of the metabolic potentials of microorganisms (Bochner, 1989*b*).

The breathprint method is also more rapid than traditional pH-based testing, in which acid production or consumption must exceed the inherent buffering capacity of the medium. That process can take many hours or even days. In contrast, the time scale for the redox technology is minutes and hours. After a characteristic lag phase, presumably due to induction of enzyme synthesis, the subsequent steps, including consumption of the carbon source, respiration, and the reduction of the tetrazolium dye, occur very rapidly. Moreover, the final step of dye colour formation is irreversible - another plus that distinguishes this test from pH-based systems, where the acids or bases that are formed are volatile and may be lost, leading to reversal of the colour indicator (Bochner, 1989*b*).

Besides identifying microbes, the testing process also yields practical metabolic information. For example, it can aid in the development of growth media or selective enrichment media for the microorganism of interest. Data of this type are being used by the US Department of Energy's Deep Subsurface Microbiology Program to characterize the degradative capabilities of indigenous soil bacteria in the hopes of using them for pollution clean-up (Bochner, 1989*a*).

The Biolog system was originally developed for the rapid identification of pure

cultures of microorganisms, especially clinically important strains, on the basis of their substrate utilization profiles (Bochner, 1989*b*; Bochner, 1993; Biolog Inc., 1993). The system has been successfully used for the identification of clinically important isolates (Machtiger and O'Leary, 1973; Bernards *et al.*, 1995; Boe and Gjerde, 1980; Janda *et al.*, 1996; Wong *et al.*, 1992; Armon *et al.*, 1990; Carnahan *et al.*, 1989; Havelaar *et al.*, 1992; Mauchline and Keevil, 1991; Moss and Dees, 1976; Holmes *et al.*, 1994; Baille *et al.*, 1995). Biolog has also been used with environmental bacterial isolates (Knight *et al.*, 1993; Knight *et al.*, 1995*a*; Amy *et al.*, 1985; Foster and Fogleman, 1994; Fulthorpe *et al.*, 1993; Fulthorpe and Wyndham, 1992; Klinger *et al.*, 1992; Lipski *et al.*, 1992; Mallory and Sayler, 1984) and more specifically for the identification of bacterial pathogens of plants or fruit (Tourte and Manceau, 1995; Vauterin *et al.*, 1995; Hildebrand *et al.*, 1993; Chase *et al.*, 1992; Smilanick *et al.*, 1996; Toben & Rudolph, 1996; Harris-Baldwin & Gudmestad, 1996; Poplawsky and Chun, 1995; Ayub *et al.*, 1995; Black and Sweetmore, 1994; Jones *et al.*, 1993; Verniere *et al.*, 1993; Kobayashi *et al.*, 1995; Cottyn *et al.*, 1996; Bell *et al.*, 1995; Khetmalas *et al.*, 1996).

Comparisons of Biolog results with results obtained with other test systems have been performed (Fredrickson *et al.*, 1991; Amy *et al.*, 1992; Klingler *et al.*, 1992; Verniere *et al.*, 1993; Chung and Kou, 1994; Tonso *et al.*, 1995; Lacroix *et al.*, 1995). Perhaps because the culture collections used to develop the data bases on which these approaches rely for bacterial identification are heavily skewed toward clinical (vs. environmental) isolates, these rapid bacterial identification systems are generally less

successful when used for environmental isolates (Armon *et al.*, 1990; Klingler *et al.*, 1992; Tonso *et al.*, 1995; Rüger and Krambeck, 1994; Noble, 1995).

The utility of the Biolog MT plates for the determination of special degradative abilities of isolates has also been evaluated. It has been used to screen bacteria from such diverse environments as Kraft-pulp effluent-treatment plants (Victorio *et al.*, 1993*a*, 1993*b*), isocyanate-based biodegradable polymers (Oducha *et al.*, 1994) and a range of volatile and non-volatile toxic organic compounds (Strong-Gunderson *et al.*, 1992; Gordon *et al.*, 1993; Fulthorpe and Allen, 1994; Strong-Gunderson and Palumbo, 1994). Lee *et al.* (1995) validated the data obtained with the Biolog assay against more traditional methods and have found that the system can be used for the direct analysis of the biodegradation potential of whole bacterial communities without having to make an artificial selection during laboratory growth.

Similarly, others have used the Biolog GN and GP systems for the generation of whole community-level carbon source utilization patterns for comparison of microbial communities from the same and different habitats over time (Garland and Mills, 1991; Winding, 1994; Zak *et al.*, 1994; Gorlenko and Kozhevin, 1994; Haack *et al.*, 1995; Ellis *et al.*, 1995; Wünsche *et al.*, 1995; Knight *et al.*, 1995*b*; Garland, 1996*a*, 1996*b*; Vahjen *et al.*, 1995; Insam *et al.*, 1996; Bossio and Scow, 1995; England *et al.*, 1995).

More than 50 years ago, with the benefit of few data, ZoBell (1943) perceptively envisioned mineral-water interfaces as foci for bacterial activity. He proposed that interfaces promote enhanced rates of production because the higher local concentrations

of absorbed substrate, bacteria, and enzymes favour faster reaction kinetics (*cited in* Taylor, 1995). Chocair and Albright (1981) studied the marine waters and surface sediments of coastal British Columbia and found that the surface sediments carry greater standing crops of bacteria than overlying waters. Kemp (1994) studied the microbial carbon utilization on the continental shelf and slope during the SEEP-II experiment and found that sediment bacteria were not limited by nutrient availability. He concluded that water-column bacteria were controlled by both nutrient limitation and grazing, while sediment bacteria were controlled by grazing alone. Novitsky (1983*a*, 1983*b*) found that the microbial population at the sediment-water interface is able to respond quickly and repeatedly to relatively large nutrient additions. It is his opinion that, on a weight or volume basis, the sediment-water interface is the most active microbial habitat in the pelagic and benthic ecosystem.

Noble *et al.* (1990) found that a significant proportion of the bacteria found in the Newfoundland coastal- region were pigmented, but these investigators had difficulty maintaining many of them long enough to describe them. Rieper (1976) found that, in the Schlei Fjord, the bacterial population is effected by seasonal changes of the dominating phytoplankton species. The fjord is characterized by two successive blooms; *Chlorella* species in the spring and *Microcystis aeruginosa* in the summer. In the spring the proportion of pigmented bacteria is greatest, while in the summer the numbers of pigmented bacteria decrease and white or colourless forms dominate. Cultivation experiments proved that growth of a red pigmented *Flavobacterium* was enhanced by an

actively growing *Chlorella* population. With the breakdown of the *Chlorella* bloom, the numbers of pigmented bacteria decreased drastically, and, with the following *Microcystis* bloom, a new bacterial population becomes dominant.

All microorganisms possess pigments such as chlorophyll, bacteriochlorophyll, cytochromes, and flavins which can absorb light energy, become excited or activated, and act as photosensitizers. The excited photosensitizer transfers its energy to O_2 generating singlet oxygen ($^1O_2$). Singlet oxygen is a very reactive and powerful oxidizing agent that will quickly destroy a cell. Many microorganisms that are airborne, or live on surfaces exposed to light, use carotenoid pigments for protection against this photooxidation. Carotenoids effectively quench singlet oxygen; that is, carotenoids absorb energy from singlet oxygen and convert it back into the unexcited ground state. Both photosynthetic and nonphotosynthetic microorganisms employ pigments in this way (Prescott *et al.*, 1990). It was a purpose of the study presented here to determine the abundance and characteristics of pigmented bacteria at the sediment-water interface in a cold-ocean environment.

Data analysis for determining functional biodiversity among bacterial communities

The Biolog method is easy to use and produces data that are rich in information about functional biodiversity of bacteria. Moreover, these data are particularly suitable to multivariate analysis and other statistical procedures that are routinely used to examine taxonomic diversity (Zak *et al.*, 1994). Multivariate analysis is a branch of statistics

dealing with the simultaneous variation of two, or more variables. Extensive studies in multivariate analysis frequently start from a correlation matrix, which is a symmetrical table of the correlation coefficients of each variable, in a set of variables, with every other one. Such a matrix serves as a point of departure for numerous statistical techniques (Sokal and Rohlf, 1981).

From a matrix of correlations emerge patterns of structure. Various methods of grouping the variables according to the magnitudes and interrelationships among their correlation coefficients have been developed. These methods are generally known as cluster analysis. Cluster analysis is a generic name for a wide range of procedures involved with identifying groups within data. By organizing multivariate data into such subgroups, clustering may help the investigator discover the characteristics of any structure or pattern present (Everitt, 1993). Simply put, cluster analysis groups those variables that are highly correlated and similar to each other and excludes from clusters those variables that are dissimilar. Cluster analysis may have its greatest value in reducing a vast amount of data to a form that is useful to investigators by allowing them to see relationships that are not clear in the untreated data. This may then enable them to ask questions of the data that they were not able to formulate prior to treatment (Romesburg, 1984).

If the values for all substrate-containing Biolog wells are analysed by multivariate statistics, two types of distinctions between samples can be made. First, the presence or absence of a positive response to each of the 95 substrates or to groups of substrates (e.g.

amino acids) can be recorded. Second, the degree to which a particular substrate is utilized can be quantified by measuring the intensity of colour change caused by the incorporation of tetrazolium dye into a respiring culture. Thus, each Biolog microplate yields a specific pattern of activities representing the functional attributes of the inoculated bacteria with respect to a suite of substrates (Bochner, 1989*a*). The number and categories of utilized substrates, as well as activities, constitute a data set from which functional diversity can be assessed.

There are many clustering methods. In the study presented here, cluster analysis based on the presence or absence of substrate-specific catabolic activity for individual isolates was based on the squared Euclidean distances with the unweighted pair-group arithmetic average (UPGMA) and Ward's clustering methods. These have been used extensively when studying microorganisms (Sneath and Sokal, 1973; Romesburg, 1984; Zheng and Kellogg, 1994). The theoretical reason for favouring UMPGA is that it tends to give higher values of the cophenetic correlation coefficient. This means that, on average, UMPGA produces less distortion in transforming the similarities between objects into a tree (Romesburg, 1984). A tree is simply a map of sorts that shows, at a glance, the degree of similarity between all pairs of objects. Trees computed with Ward's clustering method have a well-defined look in which clusters usually jump out at the eye (Romesburg, 1984). The popularity of Ward's method partly stems from this characteristic, and was included in this study as a means of determining the stability, or robustness, of the classification.

When UMPGA is used as the main method, it is still often informative to perform a cluster analysis using the single linkage, or nearest neighbour, clustering method to verify whether or not the data may promote chaining in the tree. Chaining refers to the tendency of a technique to incorporate taxonomic units (i.e. bacterial strains) into existing clusters rather than to initiate new clusters. Whenever both clusters come too close to each other, even when this happens at just one point, the clusters immediately stick together and can not be separated in later steps. This is called the chaining effect because many objects may be chained together resulting in a drawn out cluster, some members of which are very far from each other. Chaining does not have to be unbroken to be informative about data. Partial chaining - chains that occupy separate branches of the tree - will also tell you something about how the objects are distributed in the distribution space (Romesburg, 1984).

Once a tree has been generated, the number of clusters we want the classification to have determines where we should cut the tree. Deciding where to cut the tree resolves the tradeoff between the desire for detail (many classes) and the desire for generality and simplicity (few classes). The decision is subjective (Romesburg, 1984). One strategy is to cut the tree at some point within a wide range of the resemblance coefficient for which the number of clusters remains constant because a wide range indicates that the clusters are well separated in the attribute space. This means that the decision of where to cut the tree is least sensitive to error when the width of the range is the largest (Romesburg, 1984).

As a further means of measuring robustness of the clusters some researchers have

used the agreement of classifications produced from the same data matrix processed by different multivariate methods (Romesburg, 1984). Bradfield and Orlóci (1975) and Green and Vascotto (1978), for example, coupled the use of cluster analysis with discriminant analysis. Cluster analysis classifies previously unclassified material. It is this that differentiates clustering as a technique for the analysis of multivariate data from discriminant analysis, where groups are known *a priori*. These researchers first used cluster analysis to make a classification, and then used the generated class memberships, to determine whether discriminant analysis could place the objects into their known classes.

Objectives of the study

The objectives of this study were to (i) characterize the functional diversity of marine bacteria from the sediment-water interface of Newfoundland coastal-waters (ii) determine whether there is a functional difference between pigmented and non-pigmented bacteria found at the sediment-water interface (iii) determine whether substrate utilization profiles can offer information about community function, metabolic potential, or functional diversity and (iv) evaluate the possibility, by using the Biolog assay, of detecting temporal changes in microbial communities in seasonally cold coastal waters.

MATERIALS AND METHODS

Study site and sampling procedure

The study site was located off Kellys Island, Conception Bay, Newfoundland (Lat. 47°32' N, Long. 53°00' W) (Figure 1). All samples were collected by scuba diving at a depth of about 9 m. Water samples, from about 1-cm above the sediment, were collected in 250-mL vacuum sealed, glass bottles fitted with approximately 35 cm of latex tubing (1.6 mm in diameter) (Figure 2). By visually observing the entire sampling procedure, undisturbed sediment-water interface samples were assured. Samples that were disturbed were discarded. Samples were collected on June 6 and September 15, 1995. Once on board the boat, samples were stored in seawater and ice until they were processed in the laboratory. Standard plate count procedures were initiated within 3 hours of collection. Bottom temperature was determined using a dive computer. Salinity measurements were made, once at shore, using a Guildline Salinometer "Autosal" Model 8400. Copenhagen water was used for the calibration and readings were done at a temperature of 24°C, giving a final accuracy of ±0.003‰.

Growth and selection of bacterial strains

Serial dilutions of samples were made in filter sterilized natural aged seawater collected from the Ocean Sciences Centre, Memorial University of Newfoundland, and plated on modified Lib X medium. Modified Lib X medium was made by dissolving 1 g/L Bacto Tryptone (Difco), 1 g/L yeast extract (Difco), 0.3 g/L tri-sodium citrate, 0.3 g/L L-

Figure 1: Study site located off Kellys Island, Conception Bay, Newfoundland, Canada (Lat. 47°32' N, Long. 53°00' W).

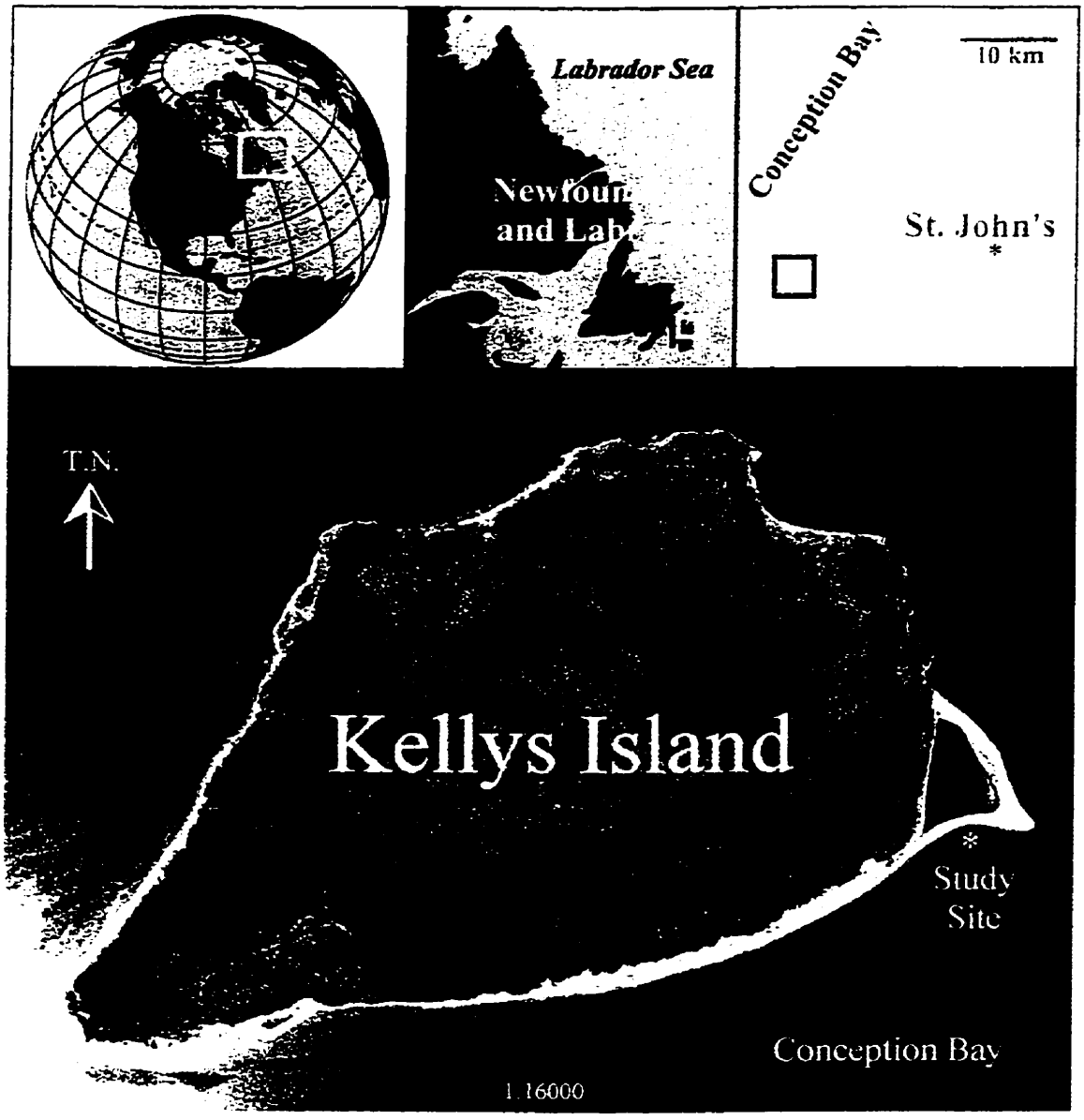
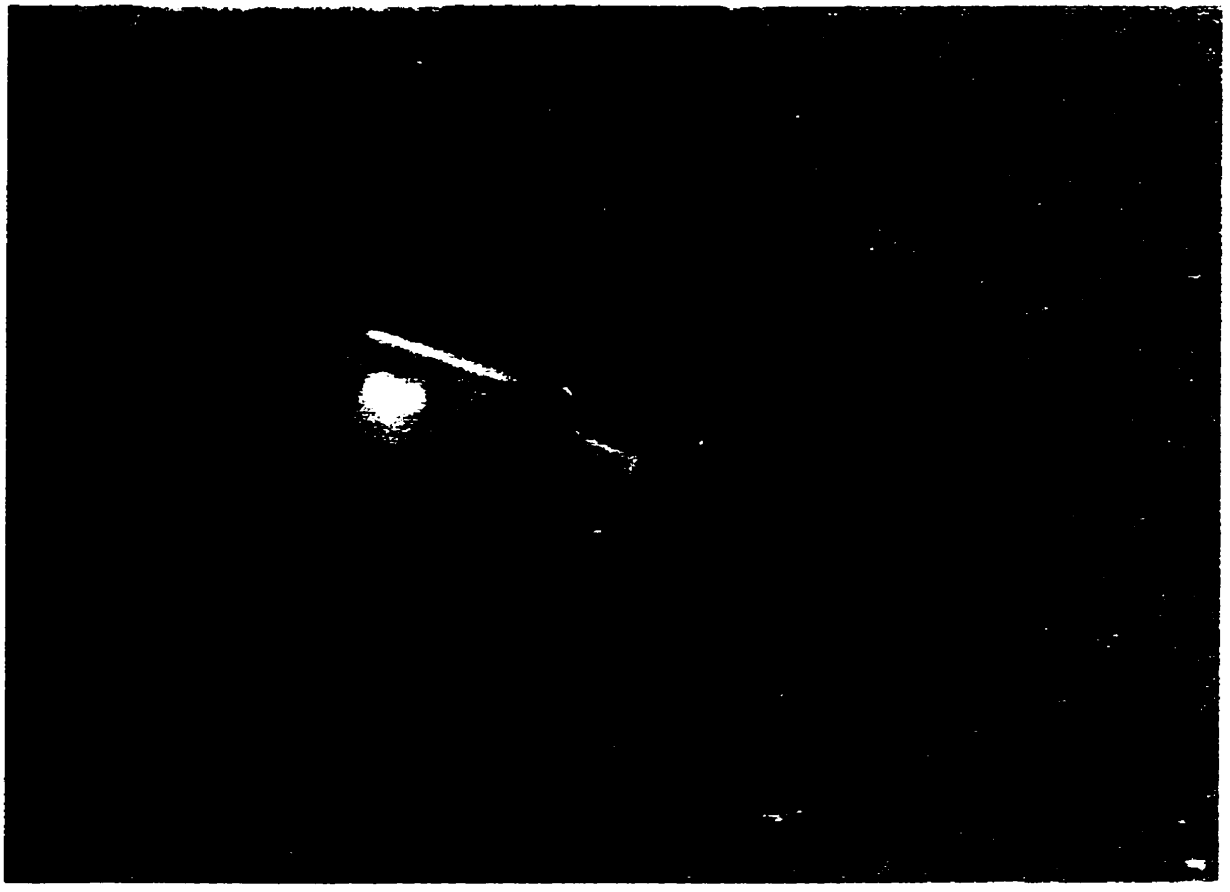

Labrador Sea
Conception Bay
10 km
St. John's
T.N.
Kellys Island
Study Site
Conception Bay
1:16000

Figure 2: Sampling procedure used to collect bacteria from the sediment-water interface. Divers collected samples in 250-mL vacuum sealed Pyrex bottles fitted with latex tubing (1.6 mm in diameter).



glutamic acid, 0.05 g/L sodium nitrate, 0.001 g/L ferric chloride, and 7.69 g/L Tris (hydroxymethyl) methylamine (adjusted to pH 7.3 with HCl) in 75% (w/v) natural aged seawater. Solidified medium was prepared using technical agar no. 3 (Oxoid) at 1.2% (w/v). The day before samples were taken, plates were brought to the temperature at which they would be incubated following inoculation. Plates were inoculated with by applying 0.2-mL portions of the sample evenly over the surface using prechilled 1.0-mL pipettes. The pipette was drawn from the centre to the edge while the dish was rotated on a turntable. For each sample, one set of replicate plates was incubated, for four weeks, in growth chambers at 5°C and another at 15°C as recommended by Gow and Mills (1984) and Noble *et al.* (1990). The drying effect of the incubation was minimized by storing the dishes in racks that were covered loosely with aluminum foil.

Colonies, with a diameter of 1-mm or more, were selected as representatives of the sampling date. Colonies were subcultured using Lib X medium, which was similar to the above modified medium but contained 2.3 g/L Tryptone and 1.2 g/L yeast extract instead of one gram of each. Additional subcultures were done, by streak-plating, until purity was assured. Stock cultures were preserved both on slants of Lib X medium, overlayed with sterile mineral oil and stored at 4°C, and with the Protect™ bacterial preservation system (Technical Service Consultants Limited, Heywood, Lancaster, U.K.). The following strains were successfully isolated; 35 from the 5°C June enumeration plates, 31 from the 15°C June enumeration plates, 22 from the 5°C September enumeration plates, and 43 from the 15°C September enumeration plates. Thirty-seven reference cultures of marine

bacteria, representing 12 genera, were obtained from the American Type Culture Collection (ATCC), Rockville, Maryland and used in this study. These are listed in Table 1. The ATCC strains were rehydrated according to the methods recommended by the ATCC, subcultured onto Lib X agar, and incubated at 20°C for 24 to 48 h. Isolated colonies were subcultured, by streaking, to ensure purity and incubated for 24 h.

Estimation of bacterial numbers

Total bacteria were enumerated by the acridine orange direct count (AODC) method (Hobbie *et al.*, 1977). For each sample, triplicate 10-mL subsamples were preserved in 0.2% formalin. Seawater samples were filtered through Millipore isopore track-etched membrane filters (0.2-μm pore size, 25 mm in diameter) which were previously stained black [Millipore filter type GTBP]. The bacteria were stained with acridine orange after drawing half of the sample through the filter. After the filtration step was completed, the filter was oiled, a coverslip applied, and then immersion oil was applied to the coverslip. Bacteria were counted at 1000X magnification with a Zeiss IV FL epifluorescence condenser microscope fitted with a no. 48-77-09 filter. Random fields, as delineated by a net micrometer, were examined. The formula for calculating the number of bacteria in a given volume of seawater was given by Powell (1980). Cells staining either green or orange, and having a clear outline and bacterial shape were counted.

Bacterial numbers were also estimated by the standard plate count method (SPC) (Greenberg *et al.*, 1992), using modified Lib X medium. Colonies were counted with the

Table 1. List of type cultures, from the American Type Culture Collection (ATCC), Rockville, Maryland, used to build the Biolog GN database for identification.

Alcaligenes *faecalis subsp. homari*	33127	***Pseudomonas*** *bathycetes*	23597
		P. doudoroffii	27123
Alteromonas *espejiana*	29659	*P. elongata*	10144
A. haloplanktis	14393	*P. nautica*	27132
A. macleodii	27126	*P. stanieri*	27130
A. rubra	29570		
		Serratia *proteamaculans* subsp.	
Chryseobacterium *indoltheticum*		*proteamaculans*	19323
(Flavobacterium indoltheticum)	27950	*S. rubidaea*	27593
Cytophaga *marinoflava*	19326	***Shewanella*** *putrefaciens*	8071
		S. alga	51192
Deleya *aquamarina*	27128		
D. cupida	27124	***Vibrio*** *alginolyticus*	17749
D. marina	25374	*V. carchariae*	35084
D. pacifica	27122	*V. cincinnatiensis*	35912
D. venusta	27125	*V. damsela*	33539
		V. furnissii	35016
Flavobacterium *marinotypicum*	19260	*V. metschnikovii*	7708
F. okeanokoites	33414	*V. mimicus*	33653
		V. mytili	51288
Marinomonas *communis*	27118	*V. vulnificus*	27562
M. vaga	27119		
Photobacterium *angustum*	25915		
P. leiognathi	25521		
P. phosphoreum	11040		

aid of a Quebec colony counter. The mean count, from ten plates, was recorded for each dilution and temperature.

Characterizing the bacteria

Colony Characteristic: When describing colonies the following characteristics were noted:

1. Shape or form - whether it be punctiform, circular, filamentous, irregular or rhizoid
2. Elevation - flat, raised, convex, pulvinate, umbonate, or umbilicate.
3. Margin - entire, undulate, lobate, erose, or filamentous
4. Size
5. Surface -smooth (shiny, glistening), rough (dull, bumpy or granular), or mucoid (slimy or gummy)
6. Pigmentation - colony itself is pigmented.

Growth in Broth: Subjective decisions were used in determining the amount of growth in Lib X broth culture, based upon the development of relative turbidity in a given time, which was scaled 1, 3 or 5, with 1 equal to slight growth, 3 equal to fair growth and 5 good growth, as per Pfister *et al.*, 1965.

Gram reaction and cellular morphology: Smears of 18-24 h cultures were stained and examined using light microscopy, for Gram reaction and cell morphology. The Gram

reaction was determined using the Bacto® 3-step Gram Safranin-S kit (Difco). With this kit, Gram-positive bacteria are purple-black to purple and Gram-negative bacteria are red-pink to fuchsia. Gram variable bacteria were further tested for the sensitivity to vancomycin as most Gram-negatives are resistant to impregnated disks containing 5 μg of vancomycin while most Gram-positives are sensitive to vancomycin (Biolog Inc., 1993).

Motility: Motility was determined by phase contrast microscopy after the test organism was suspended in 1/10 marine cation supplement [MCS]. The formulation of MCS was originally described by Farmer and Hickman-Brenner (1992) and consisted of 150 g/L sodium chloride, 3.7 g/L potassium chloride and 51 g/L $MgCl_2 \cdot 6H_2O$ in 1000 mL of deionized water.

Catalase Test: The catalase test demonstrates the presence of catalase, an enzyme that catalyses the release of oxygen from hydrogen peroxide. The test was performed by dropping several drops of 3% hydrogen peroxide directly on a colony growing on Lib X medium plates. The evolution of bubbles within 5 minutes was a positive test (Skerman, 1967).

Oxidase Test: This test was performed by using an sterile loop to smear a portion of a colony of the test organism on the surface of Whatman's No. 1 filter paper impregnated with a 2 to 3 drops of oxidase reagent (1% solution of tetramethyl-p-phenylenediamine

dihydrochloride). A positive reaction was recorded after the development of a dark purple colour within 10 seconds. A weak positive reaction was recorded with the development of a purple colour within 10-60 seconds. Reactions requiring longer than 60 seconds were considered negative (Skerman, 1967). As controls, *Pseudomonas aeruginosa* (oxidase positive) and *Staphylococcus epidermidis* (oxidase negative) were included.

***Oxidation/Fermentation*:** Oxidative or fermentative metabolism of glucose was tested using the ZOF medium of Lemos *et al.* (1985). ZOF tests were observed two, three, and seven days after inoculation, according to the protocol. ZOF medium was prepared by dissolving, in distilled water, 37.4 g/L of marine broth (Difco Laboratories), 0.01 g/L phenol red, 3 g/L technical grade agar, 0.5 g/L Tris (Sigma Chemical Co.), adjusted to pH 7.6. The medium was sterilized by autoclaving. Glucose was sterilized by filtration through a 0.22-μm-pore-sized membrane (Millipore Corp.) and added aseptically to the semisolid basal medium to give a 1% final concentration. The complete medium was dispensed in 4-mL portions in sterile culture tubes (12 by 100 mm). Tubes were stab inoculated in duplicate and one of the tubes was overlaid with sterile mineral oil. Following inoculation, the fermentative strains acidify both tubes while only the aerobic tube is acidified by the oxidative strains. Organisms that do not utilize glucose will not show any reaction, or will show an alkaline reaction indicated by the medium turning pink at the top. Organisms that gave an alkaline reaction were tested again in a similar medium in which mannitol was substituted for the glucose. As controls, *Pseudomonas aeruginosa*

(oxidative), *Staphylococcus epidermidis* (fermentative) and *Alcaligenes faecalis* (no reaction) were used.

Na^+ Test: Na^+ requirement was determined using tubes of 0 mM and 300 mM Na^+ buffered artificial seawater [BASW] broth supplemented with 2 g/L yeast extract. If growth was observed at 300 mM NaCl, but not at 0 mM NaCl, the strain had a growth requirement for Na^+. The tubes were incubated at 20°C for seven days and read at an optical density of 600 nm. The concentration of Na^+ in the medium prepared without added NaCl was determined by flame emission spectrophotometry (Greenberg *et al.*, 1985).

Analysis for coliforms and faecal coliforms

The multiple-tube technique, also known as the most probable number [MPN] method was used to determine whether or not coliforms and faecal coliforms were present at the sampling site. The method used has been described by Toranzos and McFeters (1997). Replicate dilutions, five per dilution, were scored as positive or negative and the pattern of positive or negative scores was used in connection with the appropriate statistical tables to obtain the MPN of viable microorganisms. The medium used was Fluorocult lauryl sulfate broth (BDH: Merk; Darmstadt, Germany) that contained 4-methylumbelliferyl-β-D-glucuronide [MUG]. Following inoculation, the tubes were incubated at 35°C and examined for gas production in inverted tubes and for fluorescence

using a long-wave UV lamp. Examination was done at 24 and 48h. If a tube was positive for gas production it was counted as positive for coliform bacteria. If it also fluoresced under UV-light, it was considered positive for faecal coliforms, which would probably indicate contamination with *Escherichia coli.*

Substrate Utilization using the Biolog System

Substrate utilization patterns of 95 carbon sources were determined using the Biolog system (Biolog Inc., Hayward, Calif.). The Biolog user's manual (1993) states that the choice of agar medium used to grow the test organisms is important because it must support growth and promote retention of full metabolic activity to accurately match the metabolic patterns in the GN data base. They recommend using Biolog Universal Growth Medium (BUGM) or Tryptic Soy Agar (TSA) for the identification of environmental isolates. Noble (1995) added 0.2% glycerol (Sigma) and 1/10 marine cation supplement (MCS) to TSA medium to obtain good growth of *Vibrio* bacteria. In the study presented here, Lib X medium was used to grow the bacteria for Biolog testing after it was found that growth on this medium provided sufficient inoculum to perform the Biolog test. In addition to the selection of an appropriate medium, Biolog recommends incubating environmental strains at 30°C, which turned out to be too high for most of the strains used in this study. Good growth was obtained on Lib X, described above, at 20°C after 24 to 48 hours. As a result, cultures tested in this study were subcultured twice on Lib X medium and incubated overnight at 20°C. Cells were

harvested, from the second subculture, by means of pre-moistened sterile cotton-tipped swabs which had been dipped into the sterile suspending salts solution and then rolled over the colonies so as not to carry over any nutrients from the agar medium. The sterile salts solution consisted of 1/10 MCS as recommended by Noble (1995). Cell density was adjusted to an acceptable turbidity range, approximately 3 x 10^8 cells per ml, using the Biolog turbidimeter in conjunction with the turbidity high and low standards supplied by the manufacturer.

Immediately after suspending the cells in the salts solution, the suspensions were transferred into sterile multichannel pipet reservoirs and Biolog GN microplates were then inoculated with 150 µl of the cell suspension per well by means of an 8-channel repeating pipetter. The inoculated microplates were incubated at 20°C and were read at 590 nm using the Biolog microplate reader with MicroLog 3, Release 3.7, software. The MicroLog software subtracts the background cell density from the negative control well. It then interprets all tests above a threshold, of at least 40% of the highest positive substrate response for that microplate, as positive. Negative values can be obtained. These were interpreted as non-oxidized substrates and, for further data processing, were transformed to '0' as recommended by Vahjen *et al.* (1995) and Garland (1996*b*). The substrates provided in the GN microplates, and their location on the plates, are listed in Table 2. Results were generally read at 24 hr intervals up to 96 hours.

Table 2. Categories, carbon sources, and their positions in the Biolog-GN Microplates.

Negative Control
- A1: Water

Polymers
- A2: α-Cyclodextrin
- A3: Dextrin
- A4: Glycogen
- A5: Tween 40
- A6: Tween 80

Carbohydrates
- A7: N-Acetyl-D-galactosamine
- A8: N-Acetyl-D-glucosamine
- A9: Adonitol
- A10: L-Arabinose
- A11: D-Arabitol
- A12: Cellobiose
- B1: I-Erythritol
- B2: D-Fructose
- B3: L-Fucose
- B4: D-Galactose
- B5: Gentiobiose
- B6: α-D-Glucose
- B7: m-Inositol
- B8: α-D-Lactose
- B9: Lactulose
- B10: Maltose
- B11: D-Mannitol
- B12: D-Mannose
- C1: D-Melibiose
- C2: β-Methyl D-glucoside
- C3: D-Psicose
- C4: D-Raffinose
- C5: L-Rhamnose
- C6: D-Sorbitol
- C7: Sucrose
- C8: D-Trehalose
- C9: Turanose
- C10: Xylitol

Methyl esters
- C11: Methyl pyruvate
- C12: Mono-methyl succinate

Carboxylic Acids
- D1: Acetic acid
- D2: cis-Aconitic acid
- D3: Citric acid
- D4: Formic acid
- D5: D-Galactonic acid lactone
- D6: D-Galacturonic acid
- D7: D-Gluconic acid
- D8: D-Glucosaminic acid
- D9: D-Glucuronic acid
- D10: α-Hydroxybutyric acid
- D11: β-Hydroxybutyric acid
- D12: γ-Hydroxybutyric acid
- E1: p-Hydroxyphenylacetic acid
- E2: Itaconic acid
- E3: α-Ketobutyric acid
- E4: α-Ketoglutaric acid
- E5: α-Ketovaleric acid
- E6: D,L-Lactic acid
- E7: Malonic acid
- E8: Propionic acid
- E9: Quinic acid
- E10: D-Saccharic acid
- E11: Sebacic acid
- E12: Succinic acid

Brominated Chemical
- F1: Bromo succinic acid

Amides
- F2: Succinamic acid
- F3: Glucuronamide
- F4: Alaninamide

Amino Acids and Derivatives
- F5: D-Alanine
- F6: L-Alanine
- F7: L-Alanyl-glycine
- F8: L-Asparagine
- F9: L-Aspartic acid
- F10: L-Glutamic acid
- F11: Glycyl-L-aspartic acid
- F12: Glycyl-L-glutamic acid
- G1: L-Histidine
- G2: Hydroxy L-proline
- G3: L-Leucine
- G4: L-Ornithine
- G5: L-Phenylalanine
- G6: L-Proline
- G7: L-Pyroglutamic acid
- G8: D-Serine
- G9: L-Serine
- G10: L-Threonine
- G11: D,L-Carnitine
- G12: γ-Amino butyric acid

Aromatic Chemicals
- H1: Urocanic acid
- H2: Inosine
- H3: Uridine
- H4: Thymidine

Amines
- H5: Phenyl ethylamine
- H6: Putrescine
- H7: 2-Amino ethanol

Alcohols
- H8: 2,3-Butanediol
- H9: Glycerol
- H10 D,L-α-Glycerol phosphate

Phosphorylated Chemicals
- H11: Glucose-1-phosphate
- H12: Glucose-6-phosphate

Identification by using the Microlog 3.7N Software

Attempts to identify strains were done with the Microlog 3.7N data base alone. A similarity coefficient (SIM) given by the software provides an estimation of the accuracy of each identification. The software evaluates the quality of each identification as follows: $0.000 \leq SIM \leq 0.250$, no identification; $0.251 \leq SIM \leq 0.500$, poor identification; $0.501 \leq 0.750$, good identification; and $0.751 \leq SIM \leq 1.000$, excellent identification. When the SIM value of the best match is < 0.5, the program sums the SIM values of the top matches which consecutively belong to the same genus. When it is ≥ 0.5, then the software performs a genus identification.

Numerical analysis

Quantitative variables that had been collected by utilizing the Biolog system were handled using both nominal and ratio scales of ordination. All statistical evaluations were performed with SPSS® for Windows™, Professional Statistical Package, Release 6.1 (SPSS Inc.; Chicago, Illinois). The basis for the bulk of the calculations was a data matrix with 143 strains or operational taxonomic units (OTUs), and 95 characters collected from the Biolog-GN Microplate. Results of the Biolog profiles were coded firstly as binary responses (1 for positive and intermediate responses and 0 for negative responses). The goal was to uncover differences between isolates, samples, temperature and the presence or absence of pigmentation using hierarchical cluster analysis and discriminant analysis. The squared Euclidean distance coefficient was used to estimate pairwise dissimilarities between OTUs, followed by cluster analysis using UMPGA. Other methods used for

comparison or verification included single linkage (SLINK) and Ward's clustering methods.

Using binary data may entail a loss of information. The standardized z-score percent change in optical density values versus the A1 control well was therefore analysed using the squared Euclidean distance measure and UMPGA clustering procedure. Chi-square analysis was performed on these classifications to determine whether the results of one classification would predict that of the other.

A separate data matrix, coded as binary responses (1/0), consisted of twenty-five OTU yielding a positive response in the A1 control well. Cluster analysis by UMPGA and the squared Euclidean distance measure was employed on this matrix.

RESULTS

Two collections were made at the sediment-water interface which was at a depth of approximately 9 m from the surface. One collection was made on June 6 and the other on September 15, 1995. On both occasions the sediment-water interface appeared as a thin coating of loose flocculent material, quite distinct from the firmer, relatively compact sediment below. It would be expected to be composed primarily of particulate matter that settled down the water column. Microscopic examination of this sediment revealed diatom tests but most of the material was amorphous. The water temperature at depth was observed as 4.5 and 13°C for June and September, respectively. The salinity was recorded as 30.4‰ for each sampling date. All water samples were free of coliform bacteria.

Counts were highest for plates incubated at 15°C, as compared with those incubated at 5°C, for both sampling dates (Table 3). More bacteria were evident from the viable counts for the June collection than from the September collection. According to the total bacterial counts, estimated by the AODC method, approximately 1.1% of the September collection and 3.2% of the June collection was culturable on modified Lib X medium when the incubation temperature was 15°C. Approximately 70 to 80% of the bacteria that were recovered at 15°C were also recovered at 5°C.

A variety of colonial morphologies and pigmentations were observed on both sampling dates. Figures 3.0 and 3.1 show the various sizes, shapes and colours of colonies isolated from the 5 and 15°C incubated June samples. Figure 4.0 shows the

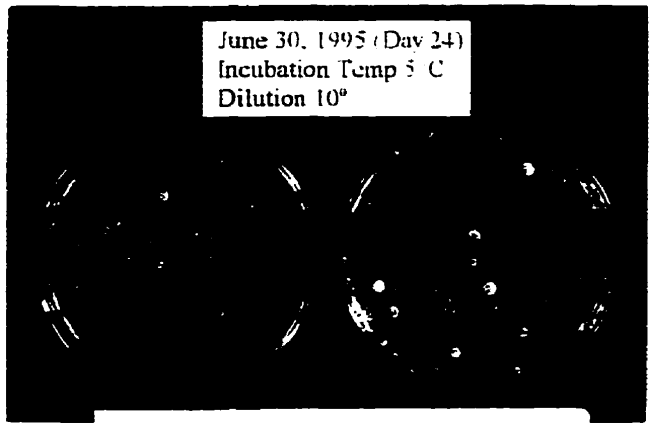
Table 3. Viable and acridine orange direct counts for samples collected from the sediment-water interface near Kellys Island, Conception Bay, Newfoundland, Canada.

Sampling Date		Viable Count at 5°C (L^{-1})	% of Direct Count	Viable Count at 15°C (L^{-1})	% of Direct Count	Direct Count (L^{-1})
06/06/1995	1	7.6×10^6	-	2.2×10^7	-	7.7×10^8
	2	5.4×10^6	-	2.4×10^7	-	6.7×10^8
Average:		6.5×10^6	0.9	2.3×10^7	3.2	7.2×10^8
09/15/1995	1	1.7×10^6	-	3.2×10^6	-	3.5×10^8
	2	1.5×10^6	-	1.5×10^7	-	1.3×10^9
Average:		1.6×10^6	0.2	9.0×10^6	1.1	8.3×10^8

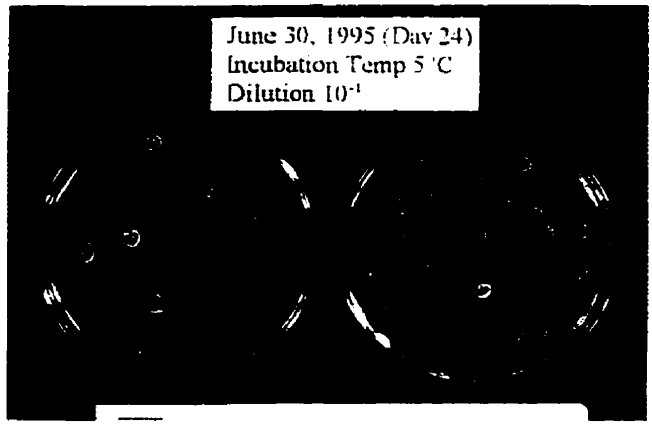
Note: Samples were collected at a depth of 9 metres. The water temperature at depth was 4.5°C for June 6, 1995 and 13°C for September 15, 1995. The salinity was 30.4‰ on both days.

Figure 3.0: Dilution series of the growth of bacterial cultures on modified Lib X medium (Bunch, 1979) for bacteria collected on June 6, 1995 and incubated for 24 days at 5°C. Seawater samples were collected from the sediment-water interface at a depth of 9 m. Note the different sizes, shapes and colors of the colonies. This selection of plates does not necessarily reflect the cumulative proportions of observed characteristics.

(a)


June 30, 1995 (Day 24)
Incubation Temp 5 °C
Dilution 10⁰

(b)


June 30, 1995 (Day 24)
Incubation Temp 5 °C
Dilution 10⁻¹

(c)

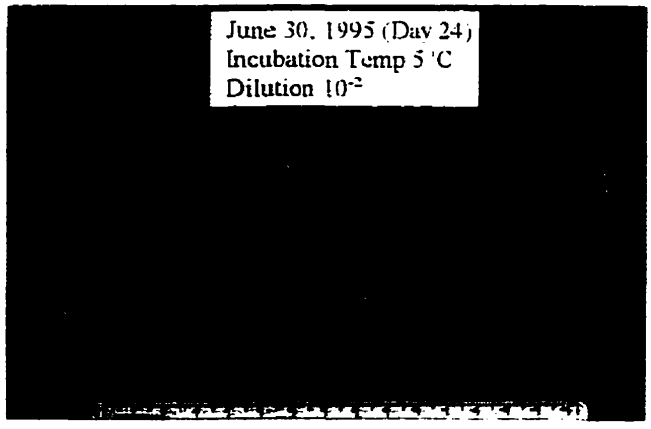
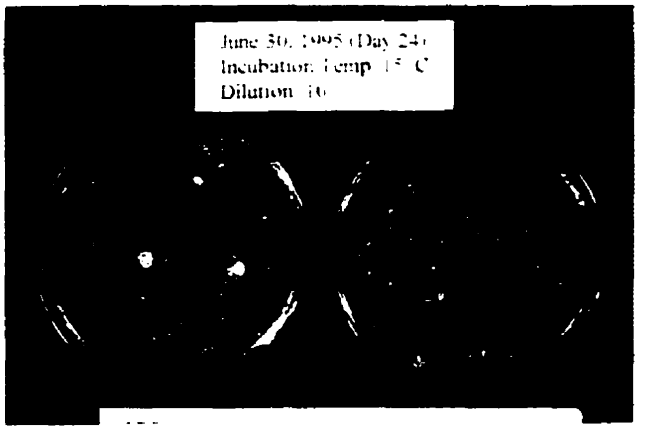
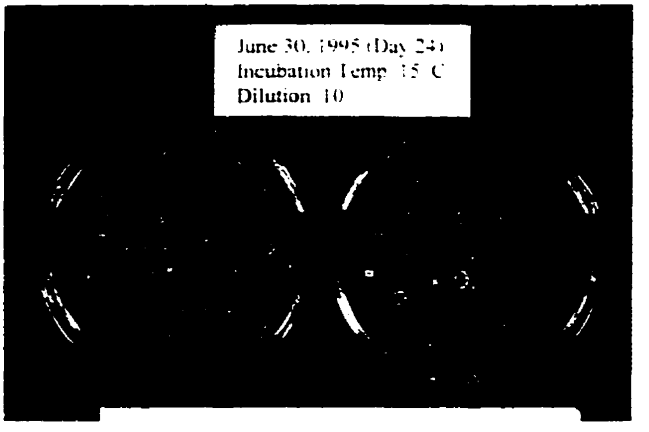

June 30, 1995 (Day 24)
Incubation Temp 5 °C
Dilution 10⁻²

Figure 3.1: Dilution series of the growth of bacterial cultures on modified Lib X medium (Bunch, 1979) for bacteria collected on June 6, 1995 and incubated for 24 days at 15°C. Seawater samples were collected from the sediment-water interface at a depth of 9 m. Note the different sizes, shapes and colors of the colonies. This selection of plates does not necessarily reflect the cumulative proportions of observed characteristics.

(a)


June 30, 1995 (Day 24)
Incubation Temp 15 °C
Dilution 10

(b)


June 30, 1995 (Day 24)
Incubation Temp 15 °C
Dilution 10

(c)

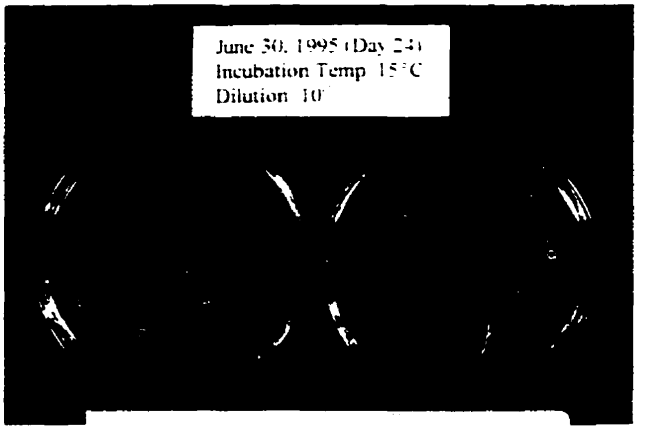
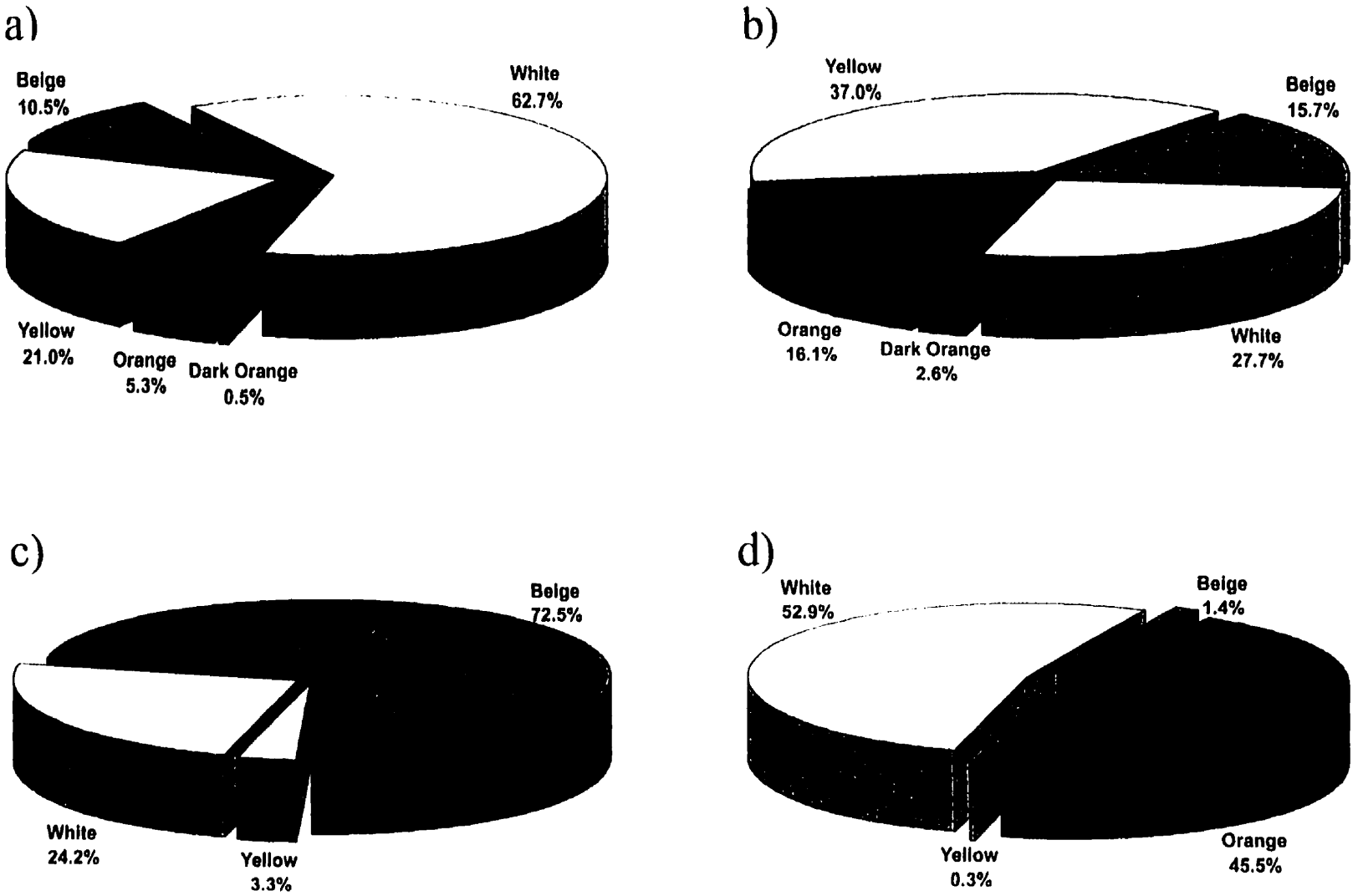

June 30, 1995 (Day 24)
Incubation Temp 15°C
Dilution 10

Figure 4. Cumulative spread plate color percentage counts of bacteria collected from the sediment-water interface off Kellys Island, Conception Bay, Newfoundland. (a) June 6, 1995; 5°C incubation; n = 6.4×10^4 (b) June 6,1995; 15°C incubation; n = 3.4×10^5 (c) September 15, 1995; 5°C incubation; n = 3.1×10^3 (d) September 15, 1995; 15°C incubation; n = 2.8×10^4.


a)
Beige
10.5%
White
62.7%
Yellow
21.0%
Orange
5.3%
Dark Orange
0.5%
b)
Yellow
37.0%
Beige
15.7%
Orange
16.1%
Dark Orange
2.6%
White
27.7%
c)
Beige
72.5%
White
24.2%
Yellow
3.3%
d)
White
52.9%
Beige
1.4%
Yellow
0.3%
Orange
45.5%

pooled average colony colourations observed in June and September at both incubation temperatures. Pigmented bacteria, defined as being neither white nor beige, made up a significant proportion of the bacterial flora of the sediment-water interface. Pigmented bacteria made up approximately 27% of the 5°C June isolates and over 55% of the 15°C isolates. For the September collection just over 3% of the 5°C and close to 46% of the 15°C isolates were pigmented.

The same 5 and 15°C agar plates, used for the enumeration of bacteria, were used for the isolation of two hundred and fifty-two (252) heterotrophic bacterial strains (Appendix A). Though a variety of morphologies were observed the majority of these cultures were circular, convex, entire, smooth and 2 to 4 mm in diameter. Of these initial isolates, one hundred and forty-one (141), or 56%, were viable when subcultured on Lib X medium. More specifically, 48% of the June collection were able to grow upon subculturing. Of those that could not be subcultured, 74% were pigmented. For the September collection, 74% were able to grow upon subculturing. Of those that could not be subcultured, 72% were pigmented. For the combined collection, the strains remaining were predominantly Gram-negative motile rods, ranging from 0.4 to 2.6 μm in length, oxidase (~89%) and catalase positive (~88%), oxidative (~64%), and requiring Na^+ for growth (~79%). The background concentration of Na^+ in the medium prepared without added NaCl was approximately 138 μM by flame emission spectrophotometry.

Biolog Identifications

A disadvantage of relying solely on the Biolog relative likelihood value to make an identification is that if a strain belongs to a taxon not included in the matrix, it could be mislabelled as a taxon in the matrix if the strain resembles that taxon much more closely than it does any other taxon in the matrix. Table 4 provides the identifications given by the Biolog-GN Microstation System for any of one-hundred and thirty-one (131) regional strains and thirty-seven (37) reference strains bearing an ID when tested. Of the reference strains studied, twelve were not part of the Biolog data base. The identification of some regional strains as pathogens or those associated with humans as hosts, i.e., members of the genera *Kingella*, CDC Groups, *Pasteurella*, *Klebsiella*, *Capnocytophaga*, *Xanthomonas*, illustrates the traditional difficulty identification systems have with wild-type environmental isolates. Additionally, modifications described from the standard protocol may have complicated attempts to compare the profiles generated with those of the Biolog data base.

Biolog results were used to calculate similarity matrices. When used in concert with ATCC reference strains, similarity clusters have been used to draw conclusions about the genus or group of an environmental strain based on its relative position in a group or cluster with other bacteria.

As a supplement to the Biolog substrate utilization profiles Table 5 provides additional differential morphological and physiological characteristics for the reference strains obtained from the ATCC. Of the thirty-seven strains examined, seven were

Table 4. Biolog Identifications and the associated similarity values for data collected at 24 hour intervals for environmental isolates and those from the American Type Culture Collection (ATCC).

Strain	BIOLOG Id (24 Hours)	SIM	BIOLOG Id (48 Hours)	SIM	BIOLOG Id (72 Hours)	SIM	BIOLOG Id (96 Hours)	SIM
3							*Kingella kingae*	0.540
7					*Kingella*	0.292		
9			*Acinetobacter johnsonii*/Genospecies 7	0.620	*Acinetobacter johnsonii*/Genospecies 7	0.596	*Acinetobacter johnsonii*/Genospecies 7	0.585
11					*Acinetobacter radioresistens*/Genospcs 12	0.617	*Acinetobacter radioresistens*/Genospcs 12	0.885
12							*Acinetobacter radioresistens*/Genospcs 12	0.509
13	CDC Group II-I	0.605	CDC Group II-I	0.637	CDC Group II-I	0.681	CDC Group II-I	0.560
18	*Kingella kingae*	0.797	*Kingella*	0.630	*Kingella*	0.497		
26	*Psychrobacter immobilis*	0.699	*Psychrobacter immobilis*	0.800	*Psychrobacter immobilis*	0.850	*Psychrobacter immobilis*	0.891
32							*Xanthomonas*	0.385
36	*Pasteurella anatipestifer*	0.585	*Pasteurella anatipestifer*	0.580	*Pasteurella anatipestifer*	0.550	*Pasteurella anatipestifer*	0.505
39	*Psychrobacter immobilis*	0.856	*Psychrobacter immobilis*	0.492	*Psychrobacter immobilis*	0.650	*Psychrobacter immobilis*	0.895
42			*Xanthomonas oryzae PV Oryzae B*	0.563	*Xanthomonas campestris PV Hederae D*	0.643	*Xanthomonas campestris PV Hederae D*	0.645
43	*Pasteurella multocida*	0.531	*Pasteurella multocida*	0.689	*Pasteurella multocida*	0.679	*Pasteurella multocida*	0.663
48	*Capnocytophaga canimorsus*	0.634	*Capnocytophaga canimorsus*	0.518				
55	*Acinetobacter radioresistens*/Genospcs 12	0.583	*Acinetobacter radioresistens*/Genospcs 12	0.625	*Acinetobacter radioresistens*/ Genospcs 12	0.734	*Acinetobacter radioresistens*/Genospcs 12	0.853
58	*Aeromonas salmonicida ss masoucida*	0.667	*Aeromonas salmonicida ss masoucida*	0.650	*Aeromonas salmonicida ss masoucida*	0.596		
66							*Capnocytophaga gingivalis*	0.713
70			*Acinetobacter*	0.489	*Acinetobacter radioresistens*/Genospcs 12	0.574	*Acinetobacter radioresistens*/Genospcs 12	0.580
72							*Xanthomonas oryzae PV Oryzae E*	0.590
76			*Acinetobacter johnsonii*/Genospecies 7	0.607				
78	*Psychrobacter immobilis*	0.968	*Psychrobacter immobilis*	0.949	*Psychrobacter immobilis*	0.841	*Psychrobacter immobilis*	0.674
81			*Acinetobacter*	0.295				
88	*Pasteurella multocida*	0.728	*Pasteurella*	0.500	*Pasteurella multocida*	0.551		
89							*Capnocytophaga canimorsus*	0.517
94					*Kingella kingae*	0.766	*Kingella kingae*	0.766
97			*Hydrogenophaga flava*	0.716	*Lampropedia hyalina*	0.536	*Lampropedia hyalina*	0.712
99	*Xanthomonas campestris PV Hederae D*	0.611	*Xanthomonas campestris PV Hederae D*	0.626	*Xanthomonas campestris PV Hederae D*	0.659	*Xanthomonas campestris PV Translucens*	0.536
101	*Vibrio*	0.376			*Photobacterium angustum*	0.599	*Photobacterium angustum*	0.584
103	*Pasteurella anatipestifer*	0.566					*Flavobacterium odoratum*	0.516
105	*Capnocytophaga canimorsus*	0.694	CDC Group II-E Subgroup A	0.670	CDC Group II-E Subgroup A	0.694	CDC Group II-E Subgroup A	0.716
106	*Aeromonas* DNA Group II	0.608	*Aeromonas* DNA Group II	0.512			*Actinobacillus seminis*	0.656
108					*Xanthomonas*	0.404	*Xanthomonas*	0.432
109	*Photobacterium phosphorium*	0.610					*Aeromonas* DNA Group II	0.566
138	*Kingella kingae*	0.636	*Kingella kingae*	0.636	*Kingella kingae*	0.525	*Kingella kingae*	0.617
140							*Capnocytophaga gingivalis*	0.579
143					*Shewanella putrefaciens D*	0.669	*Shewanella putrefaciens D*	0.691
155					*Acinetobacter radioresistens*/Genospcs 12	0.532		
158					*Xanthomonas oryzae PV Oryzae E*	0.502		
162	*Cytophaga lytica*	0.699	*Sphingobacterium mizutaii*	0.750	*Sphingobacterium mizutaii*	0.831	*Sphingobacterium mizutaii*	0.900
200					*Alcaligenes latus*	0.580		
201	*Pasteurella anatipestifer*	0.556	*Pasteurella anatipestifer*	0.532				
202	*Vibrio parahaemolyticus*	0.509	*Vibrio*	0.362	*Vibrio metschnikovii*	0.556	*Vibrio metschnikovii*	0.609
204			*Vibrio splendidus 2*	0.549	*Vibrio*	0.425	*Vibrio*	0.398
205							*Xanthomonas oryzae PV Oryzae E*	0.513
207	*Xanthomonas campestris PV Xanthosoma*	0.751	*Xanthomonas campestris PV Xanthosoma*	0.751	*Xanthomonas campestris PV Xanthosoma*	0.759	*Xanthomonas campestris PV Xanthosoma*	0.759
209	*Vibrio pelagius I*	0.758	*Vibrio*	0.472	*Vibrio anguillarum*	0.589	*Vibrio anguillarum*	0.706
210	*Psychrobacter immobilis*	0.885	*Psychrobacter immobilis*	0.757	*Psychrobacter immobilis*	0.525	*Acinetobacter* Genospecies 15	0.645
211	*Shewanella putrefaciens D*	0.526	*Shewanella putrefaciens D*	0.579	*Shewanella putrefaciens D*	0.579	*Shewanella putrefaciens D*	0.553
212	*Vibrio parahaemolyticus*	0.772	*Vibrio parahaemolyticus*	0.633	*Vibrio parahaemolyticus*	0.512	*Vibrio*	0.494
216	*Flavobacterium asteroaromaticum*	0.820						
218	*Xanthomonas campestris PV Xanthosoma*	0.613	*Xanthomonas campestris PV Xanthosoma*	0.613	*Xanthomonas campestris PV Xanthosoma*	0.693	*Xanthomonas campestris PV Xanthosoma*	0.672
219							*Pasteurella anatipestifer*	0.675
220	*Kingella kingae*	0.544			*Photobacterium phosphoreum*	0.699	*Photobacterium phosphoreum*	0.699
223							*Acinetobacter* Genospecies 9	0.526
227			*Shewanella putrefaciens A*	0.632				
228					*Capnocytophaga gingivalis*	0.616	*Capnocytophaga gingivalis*	0.704
231			CDC Group DF-3	0.632				
232	*Pasteurella anatipestifer*	0.536					*Flavobacterium gleum*	0.570
234	CDC Group II-I	0.707	CDC Group II-I	0.822	CDC Group II-I	0.754	CDC Group II-I	0.736
236							*Acinetobacter*	0.267

Continued →

Table 4. Continued.

Strain		BIOLOG Id (24 Hours)	SIM	BIOLOG Id (48 Hours)	SIM	BIOLOG Id (72 Hours)	SIM	BIOLOG Id (96 Hours)	SIM
	237	*Pasteurella anatipestifer*	0 643					*Vibrio splendidus 2*	0 501
	242			*Vibrio splendidus 2*	0 526				
	243							*Vibrio tubiashii*	0 553
	245							*Acinetobacter*	0 318
	250	*Aeromonas* DNA Group II	0 801			*Shewanella putrefaciens D*	0 581	*Shewanella putrefaciens D*	0 543
	251							*Vibrio pelagius I*	0 543
	257	*Weeksella zoohelcum*	0 788	*Weeksella zoohelcum*	0 544			CDC Group II-E Subgroup A	0 712
	258	*Aeromonas salmonicida SS Masoucida*	0 763	*Aeromonas salmonicida SS Masoucida*	0 737	*Aeromonas salmonicida SS Masoucida*	0 730	*Aeromonas salmonicida SS Masoucida*	0 730
	261			*Shewanella putrefaciens B*	0 801	*Shewanella putrefaciens*	0 432	*Shewanella putrefaciens*	0 383
	262	*Psychrobacter immobilis*	0 814	*Psychrobacter immobilis*	0 628				
	263	*Aeromonas* DNA Group II	0 806					CDC Group II-H	0 526
	265					*Vibrio vulnificus*	0 509	*Vibrio vulnificus*	0 579
	271	*Vibrio splendidus 2*	0 534	*Vibrio pelagius I*	0 550	*Vibrio pelagius I*	0 659		
	283							*Photobacterium phosphoreum*	0 732
	289	*Xanthomonas oryzae PV Oryzae E*	0 549	*Xanthomonas oryzae PV Oryzae E*	0 554	*Xanthomonas oryzae PV Oryzae E*	0 569		
Alcaligenes faecalis subsp homari	33127	*Alcaligenes faecalis SS Homari*	0 868	*Pseudomonas bathycetes*	0 803	*Pseudomonas stutzeri*	0 555	*Pseudomonas stutzeri*	0 551
* *Alteromonas halopianktis*	14393	*Deleya venusta*	0 948	*Deleya venusta*	0 745	*Deleya venusta*	0 663	*Deleya venusta*	0 600
* *Alteromonas macleodii*	27126					*Psychrobacter immobilis*	0 610		
* *Alteromonas rubra*	29570	*Pseudomonas carboxydohydrogena*	0 828			*Shewanella putrefaciens A*	0 523	*Shewanella putrefaciens A*	0 523
Chryseobacterium indoltheticum (Flavobacterium indoltheticum)	27950	CDC Group II-H	0 741	*Flavobacterium indologenes*	0 789	*Flavobacterium indologenes*	0 544	*Flavobacterium indologenes*	0 543
Cytophaga marinoflava	19326	*Sphingobacterium thalpophilum*	0 585	*Sphingobacterium thalpophilum*	0 526	*Sphingobacterium thalpophilum*	0 526		
* *Deleya aquamarina*	27128								
Deleya cupida	27124	*Deleya cupida*	0 577						
Deleya marina	25374								
Deleya pacifica	27122	*Deleya pacifica*	0 801	*Deleya pacifica*	0 673	*Deleya pacifica*	0 626	*Pseudomonas putida Type B1*	0 612
Deleya venusta	27125	*Deleya pacifica*	0 749	*Deleya pacifica*	0 595	*Deleya pacifica*	0 673	*Deleya pacifica*	0 584
* *Flavobacterium marinotypicum*	19260	*Flavobacterium esteraromaticum*	0 759	*Xanthomonas campestris PV Translucens*	0 693				
* *Flavobacterium oleanolidolex*	33414								
* *Marinomonas communis*	27118	*Pseudomonas putida Type A1*	0 894	*Pseudomonas putida Type A1*	0 924	*Pseudomonas putida Type A1*	0 825	*Pseudomonas putida Type A1*	0 796
* *Marinomonas vaga*	27119								
Photobacterium angustum	25915	*Photobacterium angustum*	0 773	*Photobacterium angustum*	0 769	*Photobacterium angustum*	0 775	*Photobacterium angustum*	0 822
Photobacterium leiognathi	25521	*Photobacterium leiognathi*	0 982	*Photobacterium leiognathi*	0 927	*Photobacterium leiognathi*	0 831	*Photobacterium leiognathi*	0 563
Photobacterium phosphoreum	11040	*Enterobacter agglomerans* Biogroup 2B	0 895	*Enterobacter agglomerans* Biogroup 2B	0 668	*Enterobacter agglomerans* Biogroup 2B	0 513	*Klebsiella*	0 367
Pseudomonas bathycetes	23597	*Pseudomonas bathycetes*	0 881	*Pseudomonas bathycetes*	0 600	*Pseudomonas stutzeri*	0 613	*Pseudomonas stutzeri*	0 704
Pseudomonas doudoroffii	27123	*Pseudomonas doudoroffii*	0 596	*Pseudomonas doudoroffii*	0 945	*Pseudomonas doudoroffii*	0 915	*Pseudomonas doudoroffii*	0 783
* *Pseudomonas elongata*	10144								
Pseudomonas nautica	27132								
* *Pseudomonas stanieri*	27130							*Acinetobacer Genospecies 15*	0 628
Serratia proteamaculans subsp proteamaculans	19323	*Serratia proteamaculans*	0 572	*Serratia proteamaculans*	0 665	*Serratia proteamaculans*	0 727	*Serratia proteamaculans*	0 727
Serratia rubidaea	27593	*Klebsiella*	0 492	*Serratia rubidaea*	0 519	*Serratia rubidaea*	0 576	*Serratia rubidaea*	0 600
* *Shewanella alga*	51192	*Shewanella putrefaciens C*	0 946	*Shewanella putrefaciens C*	0 740	*Shewanella putrefaciens C*	0 838	*Shewanella putrefaciens C*	0 905
Shewanella putrefaciens	8071	*Shewanella putrefaciens C*	0 569	*Shewanella putrefaciens C*	0 840	*Shewanella putrefaciens C*	0 848	*Shewanella putrefaciens C*	0 853
Vibrio alginolyticus	17749	*Acinetobacter calcoaceticus BV ALC*	0 797			*Pseudomonas*	0 491	*Pseudomonas*	0 381
Vibrio carchariae	35084	*Vibrio metschnikovii*	0 719			*Vibrio fluvialis I*	0 602	*Vibrio fluvialis I*	0 574
Vibrio cincinnatiensis	35012	*Vibrio cincinnatiensis*	0 658	*Vibrio cincinnatiensis*	0 721	*Vibrio cincinnatiensis*	0 785	*Vibrio cincinnatiensis*	0 785
Vibrio damsela	33539	*Vibrio damsela*	0 914	*Vibrio damsela*	0 814	*Vibrio damsela*	0 793	*Vibrio damsela*	0 805
Vibrio furnissii	35016								
Vibrio metschnikovii	7708								
Vibrio mimicus	33653	*Vibrio cincinnatiensis*	0 721	*Vibrio cincinnatiensis*	0 599				
* *Vibrio mytili*	51288	*Vibrio anguillarum*	0 569	*Aeromonas caviae* DNA Group 4	0 836	*Aeromonas caviae* DNA Group 4	0 651	*Aeromonas caviae* DNA Group 4	0 685
Vibrio vulnificus	27562	*Pseudomonas corrugata*	0 646	*Pseudomonas*	0 313	*Pseudomonas synxantha*	0 653	*Pseudomonas*	0 414

• Strains not included in the Biolog-GN Data Base (Release 3.7).

Table 5: Differential characteristics of strains obtained from the American Type Culture Collection (ATCC).

Strain	ATCC #	Pigment	Cell Shape	Length (µm)	Width (µm)	Gram	Catalase	Oxidase	Na+ Req.	O/F	Motility
Alteromonas espejana	29659	NP	Rod	1.8-3.0	0.7-1.5	-	+	+	+	O	M
Alteromonas haloplanktis	14393	NP	Rod	1.8-3.0	0.7-1.5	-	+	+	+	O	M
Alteromonas macleodii	27126	NP	Rod	1.8-3.0	0.7-1.5	-	+	+	+	O	M
Alteromonas rubra	29570	P	Rod	1.8-3.0	0.7-1.5	-	+	+	+	O	M
Chryseobacterium indoltheticum (*Flavobacterium indoltheticum*)	27950	P	Rod	1.0-3.0	0.5	-	+	+	-	O	NM
Cytophaga marinoflava	19326	P	Rod	1.0-3.0	0.5-0.6	-	+	+	+	O	G
Deleya aquamarina	27128	NP	Rod	1.5-3.0	0.8-1.1	-	+	+	+	O	M
Deleya aquamarina	33127	NP	Rod	1.5-3.0	0.8-1.1	-	+	+	+	O	M
Deleya cupida	27124	NP	Rod	1.5-3.0	0.8-1.1	-	+	-	+	O	M
Deleya marina	25374	NP	Rod	1.5-3.0	0.8-1.1	-	+	-	+	O	M
Deleya pacifica	27122	NP	Rod	1.5-3.0	0.8-1.1	-	+	+	+	O	M
Deleya venusta	27125	NP	Rod	1.5-3.0	0.8-1.1	-	+	+	+	O	M
Flavobacterium marinotypicum	19260	P	Rod	1.0-3.0	0.5	-	+	+	-	O	NM
Flavobacterium okeanokoites	33414	P	Rod	1.0-3.0	0.5	-	+	+	-	O	NM
Marinomonas communis	27118	NP	Rod	1.8-3.0	0.7-1.5	-	+	+	+	O	M
Marinomonas vaga	27119	NP	Rod	1.8-3.0	0.7-1.5	-	+	+	+	O	M
Photobacterium angustum	25915	NP	Rod	1.8-2.4	0.8-1.3	-	+	+	+	F	M
Photobacterium leiognathi	25521	NP	Rod	1.8-2.4	0.8-1.3	-	+	+	+	F	M
Photobacterium phosphoreum	11040	NP	Rod	1.8-2.4	0.8-1.3	-	+	-	+	F	M
Pseudomonas bathycetes	23597	NP	Rod	1.5-5.0	0.5-1.0	-	+	+	-	O	M
Pseudomonas doudoroffii	27123	NP	Rod	1.5-5.0	0.7-1.2	-	+	+	+	O	M
Pseudomonas elongata	10144	P	Rod	1.5-5.0	0.5-1.0	-	+	+	+	O	M
Pseudomonas nautica	27132	NP	Rod	1.5-5.0	0.3-0.5	-	+	+	+	O	M
Pseudomonas stanieri	27130	NP	Rod	1.5-5.0	0.6-0.8	-	+	+	+	O	M
Serratia proteamaculans subsp. *proteamaculans*	19323	NP	Rod	0.9-2.0	0.5-0.8	-	+	-	-	F	M
Serratia rubidaea	27593	P	Rod	0.9-2.0	0.5-0.8	-	+	-	-	F	M
Shewanella alga	51192	NP	Rod	1.5	0.8	-	+	+	-	O	M
Shewanella putrefaciens	8071	NP	Rod	1.5	0.8	-	+	+	-	O	M
Vibrio alginolyticus	17749	NP	Rod	1.4-2.6	0.5-0.8	-	+	+	+	F	M
Vibrio carchariae	35084	NP	Rod	1.4-2.6	0.5-0.8	-	+	+	+	F	M
Vibrio cincinnatiensis	35912	NP	Rod	1.4-2.6	0.5-0.8	-	+	+	+	F	M
Vibrio damsela	33539	NP	Rod	1.4-2.6	0.5-0.8	-	+	+	+	F	M
Vibrio furnissii	35016	NP	Rod	1.4-2.6	0.5-0.8	-	+	+	+	F	M
Vibrio metschnikovii	7708	NP	Rod	1.4-2.6	0.5-0.8	-	+	-	+	F	M
Vibrio mimicus	33653	NP	Rod	1.4-2.6	0.5-0.8	-	+	+	+	F	M
Vibrio mytili	51288	NP	Rod	1.4-2.6	0.5-0.8	-	+	+	+	F	M
Vibrio vulnificus	27562	NP	Rod	1.4-2.6	0.5-0.8	-	+	+	+	F	M

Symbols: NP, nonpigmented; P, pigmented; O, oxidative; F, fermentative; M, motile; NM, nonmotile; G, gliding motility

pigmented while the rest produce beige to white colonies. All were Gram-negative and catalase positive. Most were oxidase positive, had a Na^+ requirement, possessed an oxidative metabolism, and were motile.

Biolog Analysis

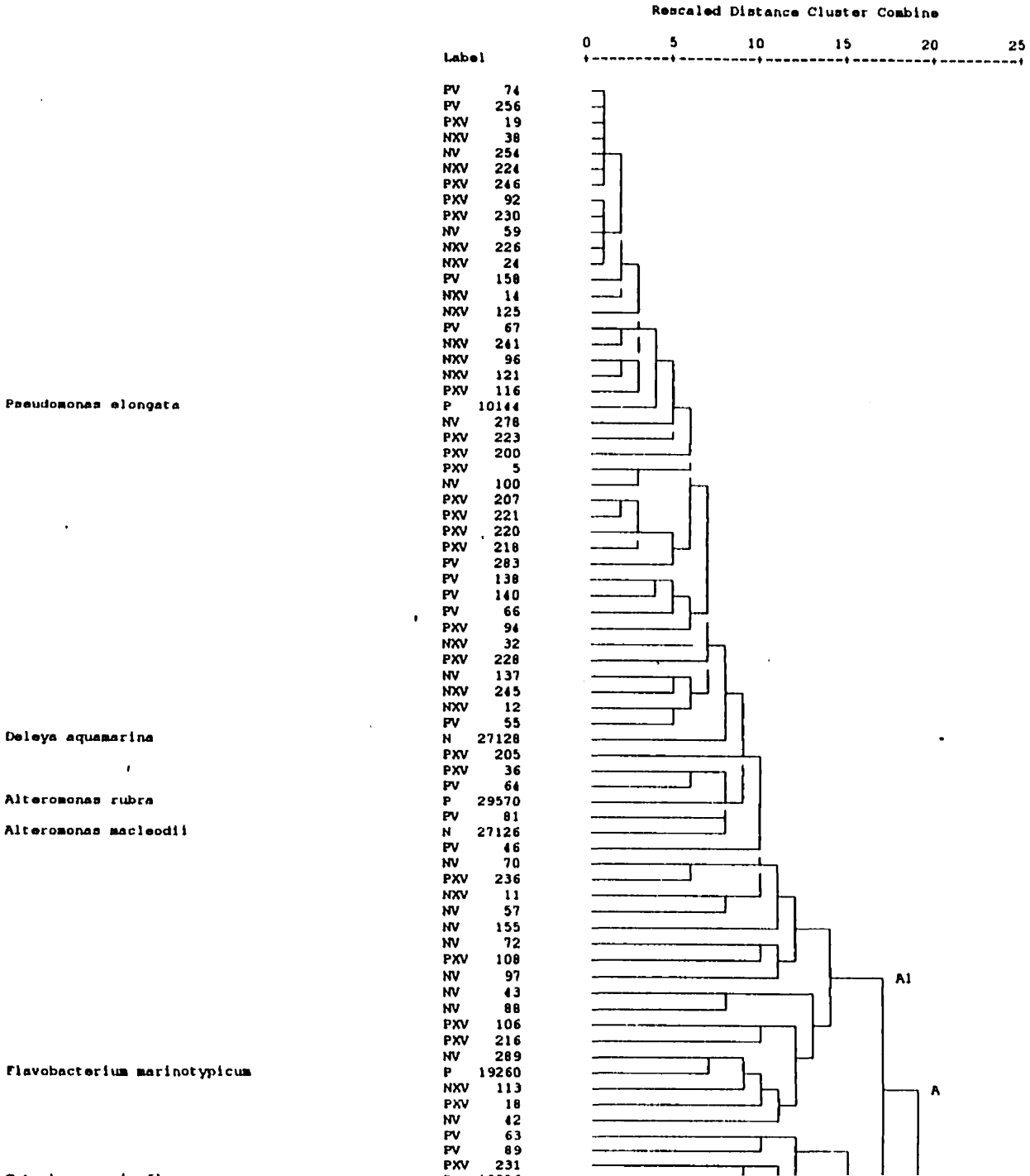
One-hundred and eight (108) regional strains and thirty-five (35) reference strains were successfully tested using the Biolog-GN Microplate. The data matrix used in the numerical analysis is given in Appendix B. Some strains would grow on Lib X medium but showed very little response in any of the Biolog wells. The matrix includes all 95 characteristics, which gave positive or variable reactions, recorded as 1, and negative reactions, recorded as 0. The results of both cluster and discriminant analysis are presented after 96 h incubation because this was the time when maximal substrate utilization and the highest activity levels were observed. Incubations were not done for longer than 96 hours because problems, such as drying effects, could be expected.

Determination of robustness of classification

Three cluster analysis programs were used. These have been outlined in the Materials and Methods. The OTU classifications which resulted from the three cluster analysis programs are given in dendrograms (Figures 5 to 7). It can be argued that, if each of the clustering methods give essentially the same tree for a given data matrix, then the clusters are well-defined in their attribute space and, in a sense, are "real". Conversely, if

Figure 5. Hierarchical classification showing the relationship of strains based on binomial data analysis of the Biolog GN substrate utilization patterns. The dendrogram was generated using the squared Euclidean distance measure and between-groups linkage (UMPGA) clustering method. The rescaled distance cluster combine units are arbitrary and are based on the sum of the squared presence of characters. Strains were designated: P, pigmented; N, non-pigmented; V, initial isolation temperature 5 °C and XV, initial isolation temperature 15 °C. The names of the reference cultures are given.

Dendrogram using Average Linkage (Between Groups)



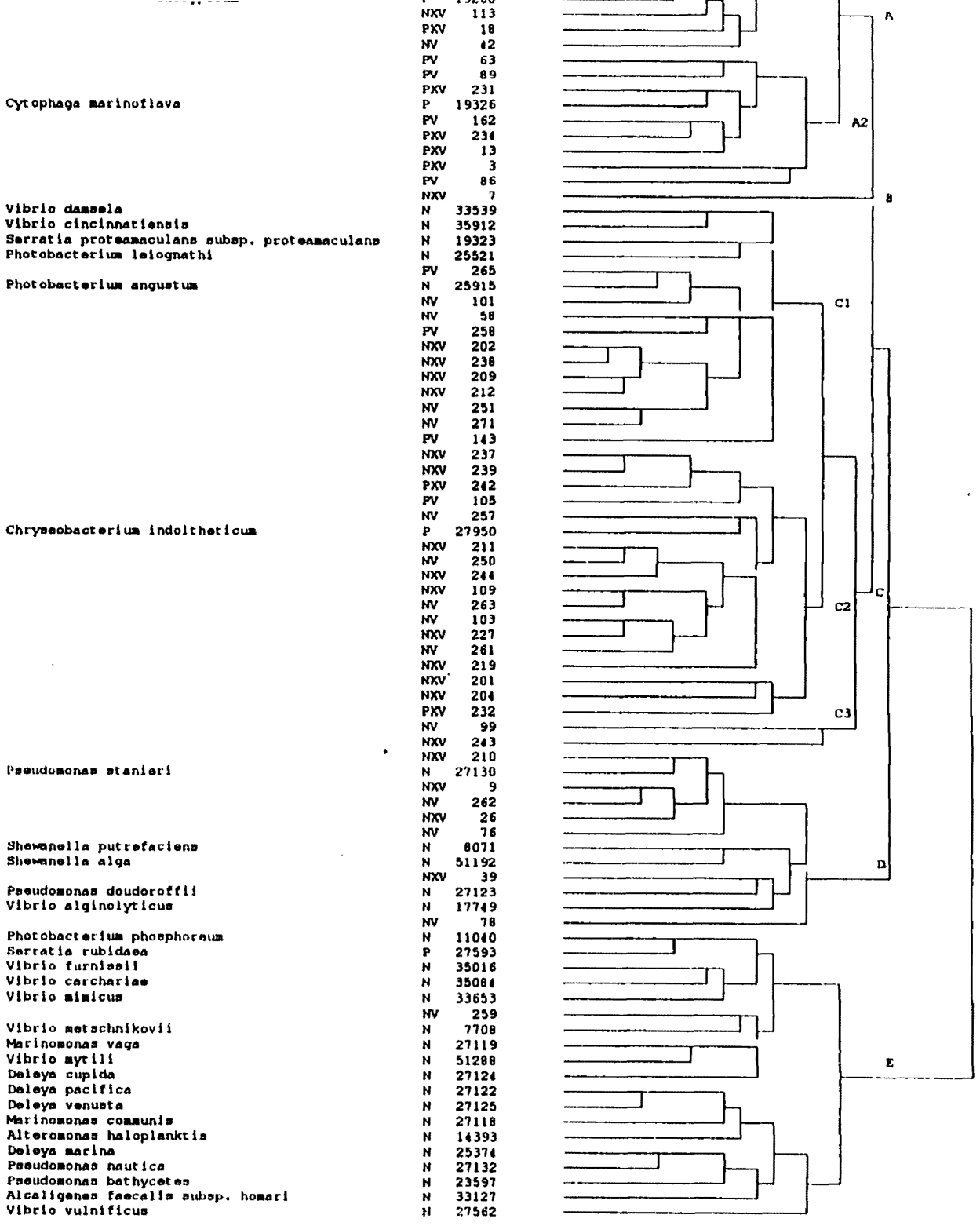
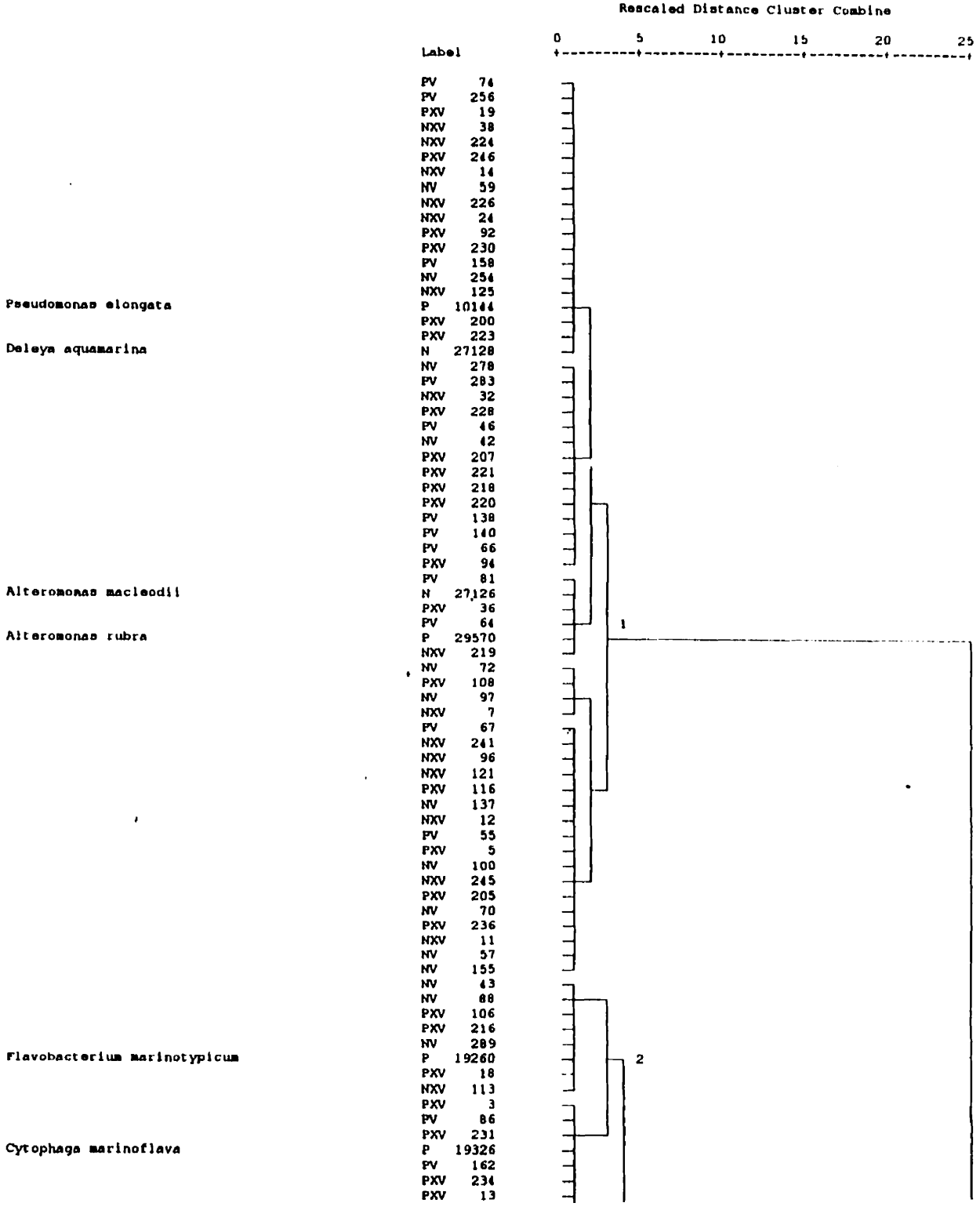

Cytophaga marinoflava
Vibrio damsela
Vibrio cincinnatiensis
Serratia proteamaculans subsp. proteamaculans
Photobacterium leiognathi
Photobacterium angustum
Chryseobacterium indoltheticum
Pseudomonas stanieri
Shewanella putrefaciens
Shewanella alga
Pseudomonas doudoroffii
Vibrio alginolyticus
Photobacterium phosphoreum
Serratia rubidaea
Vibrio furnissii
Vibrio carchariae
Vibrio mimicus
Vibrio metschnikovii
Marinomonas vaga
Vibrio mytili
Deleya cupida
Deleya pacifica
Deleya venusta
Marinomonas communis
Alteromonas haloplanktis
Deleya marina
Pseudomonas nautica
Pseudomonas bathycetes
Alcaligenes faecalis subsp. homari
Vibrio vulnificus
A
A2
B
C
C1
C2
C3
D
E

Figure 6. Hierarchical classification showing the relationship of strains based on binomial data analysis of the Biolog GN substrate utilization patterns. The dendrogram was generated using the squared Euclidean distance measure and Ward's clustering method. The rescaled distance cluster combine units are arbitrary and are based on the sum of the squared presence of characters. Strains were designated: P, pigmented; N, non-pigmented; V, initial isolation temperature 5°C and XV, initial isolation temperature 15°C. The names of the reference cultures are given.

Dendrogram using Ward Method



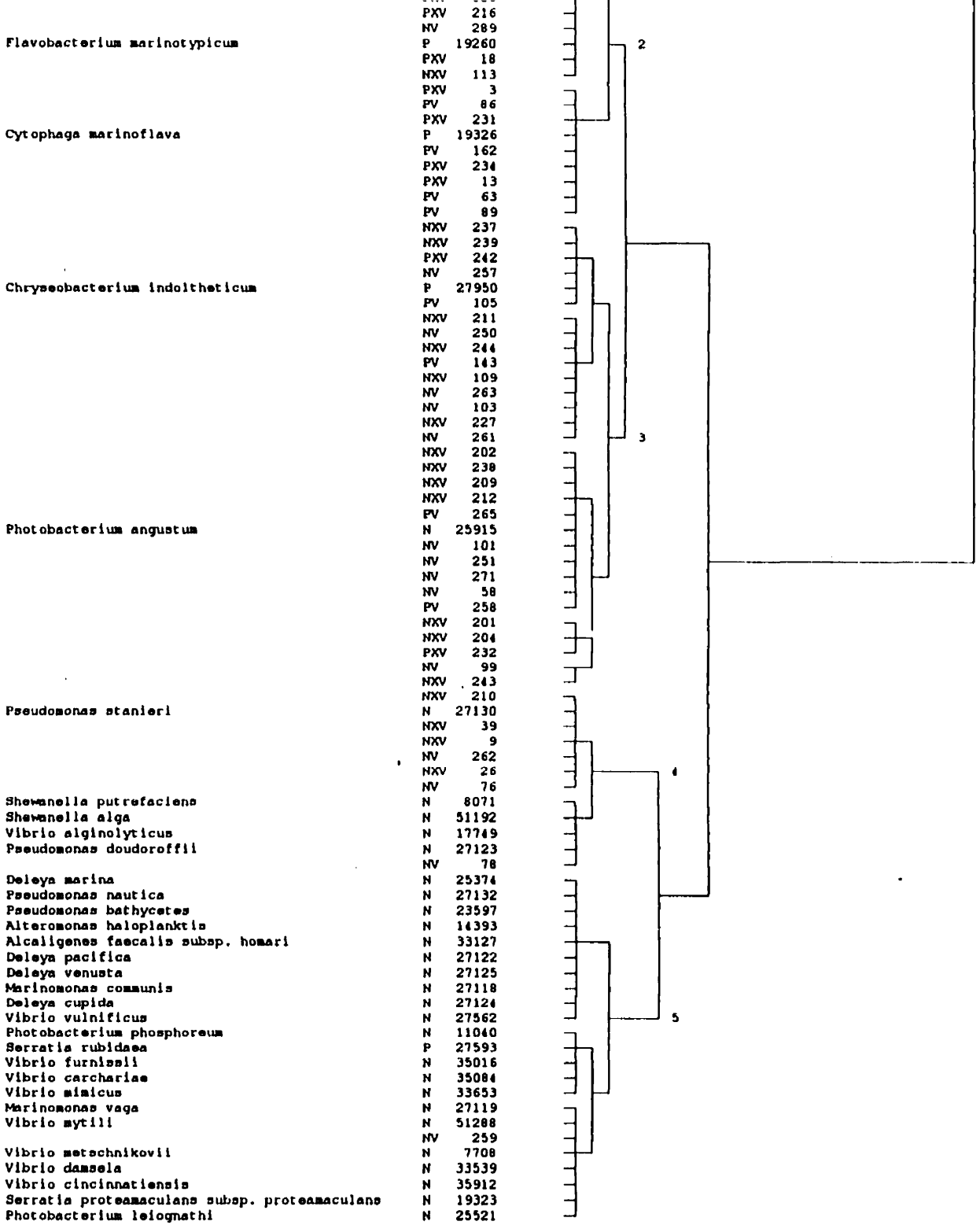
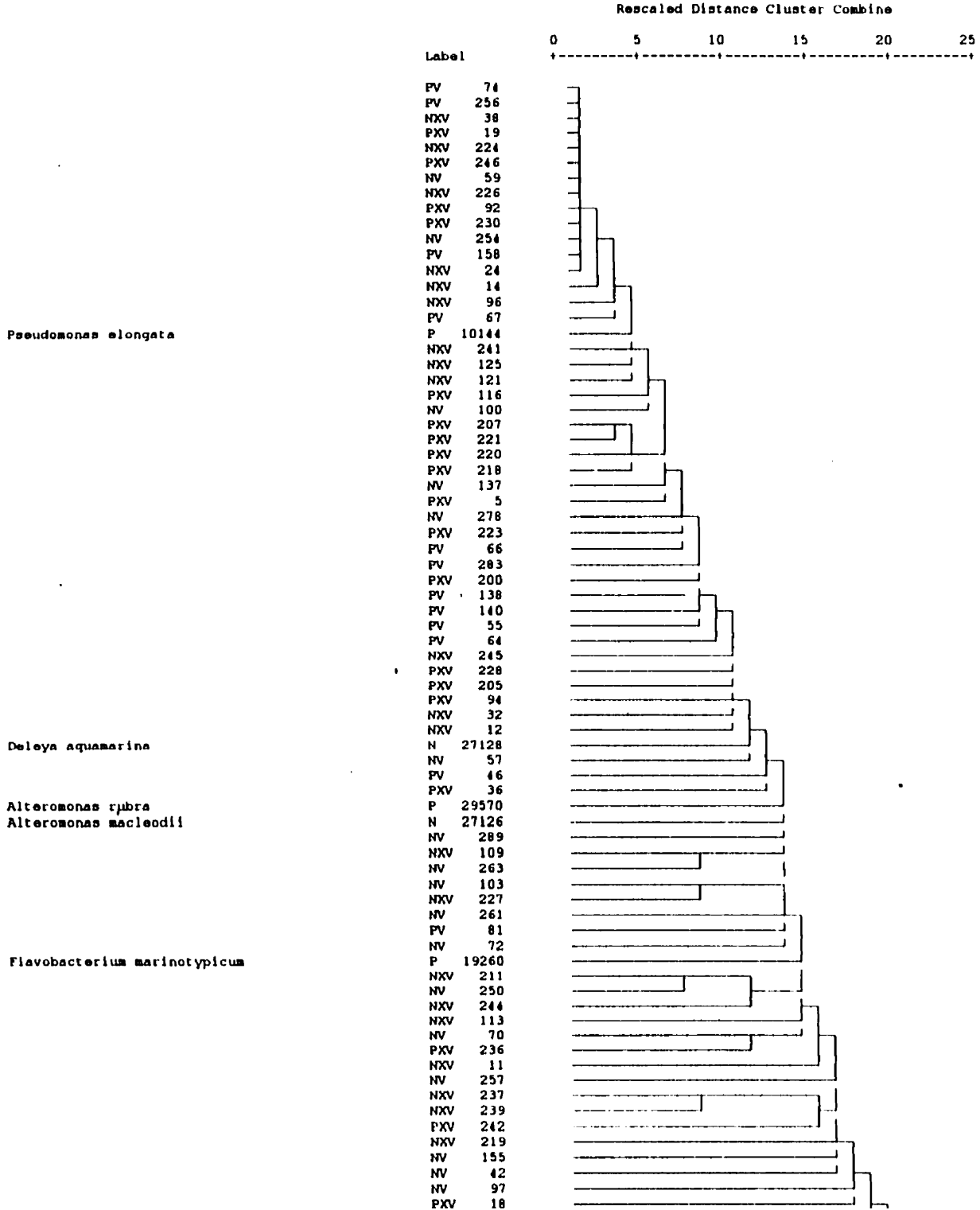
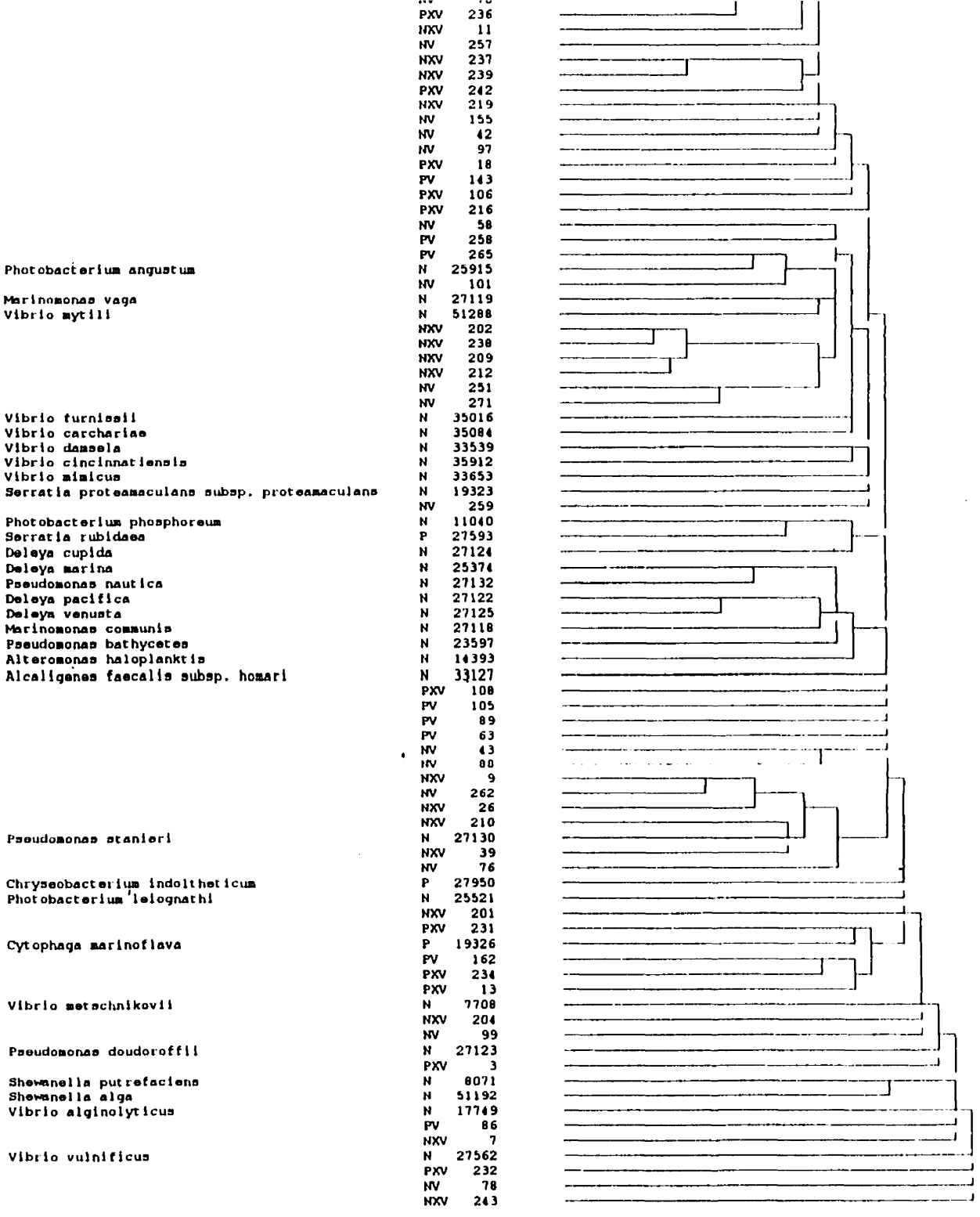

PXV 216
NV 289
Flavobacterium marinotypicum P 19260
PXV 18
NXV 113
PXV 3
PV 86
PXV 231
Cytophaga marinoflava P 19326
PV 162
PXV 234
PXV 13
PV 63
PV 89
NXV 237
NXV 239
PXV 242
NV 257
Chryseobacterium indoltheticum P 27950
PV 105
NXV 211
NV 250
NXV 244
PV 143
NXV 109
NV 263
NV 103
NXV 227
NV 261
NXV 202
NXV 238
NXV 209
NXV 212
PV 265
Photobacterium angustum N 25915
NV 101
NV 251
NV 271
NV 58
PV 258
NXV 201
NXV 204
PXV 232
NV 99
NXV 243
NXV 210
Pseudomonas stanieri N 27130
NXV 39
NXV 9
NV 262
NXV 26
NV 76
Shewanella putrefaciens N 8071
Shewanella alga N 51192
Vibrio alginolyticus N 17749
Pseudomonas doudoroffii N 27123
NV 78
Deleya marina N 25374
Pseudomonas nautica N 27132
Pseudomonas bathycetes N 23597
Alteromonas haloplanktis N 14393
Alcaligenes faecalis subsp. homari N 33127
Deleya pacifica N 27122
Deleya venusta N 27125
Marinomonas communis N 27118
Deleya cupida N 27124
Vibrio vulnificus N 27562
Photobacterium phosphoreum N 11040
Serratia rubidaea P 27593
Vibrio furnissii N 35016
Vibrio carchariae N 35084
Vibrio mimicus N 33653
Marinomonas vaga N 27119
Vibrio mytili N 51288
NV 259
Vibrio metschnikovii N 7708
Vibrio damsela N 33539
Vibrio cincinnatiensis N 35912
Serratia proteamaculans subsp. proteamaculans N 19323
Photobacterium leiognathi N 25521
2
3
4
5

Figure 7. Hierarchical classification showing the relationship of strains based on binomial data analysis of the Biolog GN substrate utilization patterns. The dendrogram was generated using the squared Euclidean distance measure and single linkage clustering method. The rescaled distance cluster combine units are arbitrary and are based on the sum of the squared presence of characters. Strains were designated: P, pigmented; N, non-pigmented; V, initial isolation temperature 5°C and XV, initial isolation temperature 15°C.
The names of the reference cultures are given.

Dendrogram using Single Linkage




PXV 236
NXV 11
NV 257
NXV 237
NXV 239
PXV 242
NXV 219
NV 155
NV 42
NV 97
PXV 18
PV 143
PXV 106
PXV 216
NV 58
PV 258
PV 265
Photobacterium angustum N 25915
NV 101
Marinomonas vaga N 27119
Vibrio mytili N 51288
NXV 202
NXV 238
NXV 209
NXV 212
NV 251
NV 271
Vibrio furnissii N 35016
Vibrio carchariae N 35084
Vibrio damsela N 33539
Vibrio cincinnatiensis N 35912
Vibrio mimicus N 33653
Serratia proteamaculans subsp. proteamaculans N 19323
NV 259
Photobacterium phosphoreum N 11040
Serratia rubidaea P 27593
Deleya cupida N 27124
Deleya marina N 25374
Pseudomonas nautica N 27132
Deleya pacifica N 27122
Deleya venusta N 27125
Marinomonas communis N 27118
Pseudomonas bathycetes N 23597
Alteromonas haloplanktis N 14393
Alcaligenes faecalis subsp. homari N 33127
PXV 108
PV 105
PV 89
PV 63
NV 43
NV 80
NXV 9
NV 262
NXV 26
NXV 210
Pseudomonas stanieri N 27130
NXV 39
NV 76
Chryseobacterium indoltheticum P 27950
Photobacterium 'lelognathi N 25521
NXV 201
PXV 231
Cytophaga marinoflava P 19326
PV 162
PXV 234
PXV 13
Vibrio metschnikovii N 7708
NXV 204
NV 99
Pseudomonas doudoroffii N 27123
PXV 3
Shewanella putrefaciens N 8071
Shewanella alga N 51192
Vibrio alginolyticus N 17749
PV 86
NXV 7
Vibrio vulnificus N 27562
PXV 232
NV 78
NXV 243

the three clustering methods give what are essentially different trees, the clusters are only weakly defined and perhaps are artifacts of the clustering method.

Dendrograms are strictly hierarchical because of the clustering methods used. The vertical scale gives the rescaled distance cluster combine at which OTU or clusters of OTU merge. The horizontal scale has no quantitative meaning because OTU are arranged to represent the clusters manifested by the similarity or distance measures. Dendrograms can be characterized as mobiles because the horizontal axis is considered free to rotate. Dendrograms should also be interpreted as representing phenetic similarity and not phylogenetic relationships (Dabinett, 1976).

The dendrograms produced by using UMPGA, shown in Figure 5, and Ward's, Figure 6, were compared with respect to the rank order of the arrangements of the clusters to see whether any consistent hierarchical clustering patterns would emerge. A summary of the distribution of the strains within the two clusters is given in Table 6. The table shows the number of strains that were common between the groups. Cluster A had 58 out of 60, or about 97%, of the same strains observed in cluster 1. Cluster B, containing just one isolate, was found in cluster 1. Similarly, cluster 3 had 31 out of 36 or ~86% of the same strains that were observed in cluster C. Clusters D and E were 100% similar to clusters 4 and 5. When this data was analyzed using the Chi-square test a value of 385.796 ($\chi^2_{0.01[16]}$) was produced. Therefore, apart from the values at which objects form clusters, the order in which objects merge is essentially the same in the two trees.

To determine whether or not the data may promote chaining in the tree, a cluster

Table 6: Number of strains observed in the clusters generated using the between-groups clustering method (UMPGA) (Figure 4) that occurred in the same clusters generated using Ward's method (Figure 5) from the Biolog-GN binomial data.

Clusters generated by Biolog's binomial data using Ward's method	Clusters Generated by Biolog's binomial data using UMPGA				
	A	B	C	D	E
1	58	1	1	0	0
2	17	0	0	0	0
3	0	0	31	0	0
4	0	0	0	12	0
5	0	0	4	0	19

analysis was performed using the single linkage (SLINK) or the nearest neighbour clustering method (Figure 7). Although partial chaining is observed in certain branches of the tree, it does not appear to be significant because there are no excessively long drawn out clusters occurring. Therefore, the data does not tend to promote chaining and successive OTU tend to initiate new clusters rather than incorporate themselves into existing clusters. As an additional test of the robustness of the classification, it was also observed that the rank order of the tree produced using SLINK is very similar to that seen previously using UMPGA and Ward's clustering methods.

Discriminant analysis was used to determine if it could place the OTU into their "known" classes as determined from the UMPGA clustering method. Figure 8 shows the separation of the groups of OTU on the first two discriminant functions, which account for 50.73 and 18.87%, respectively, of the among group variance (Table 7). Most groups required both functions to separate, with the possible exception of group D which separated from the other groups on function 1 alone. Despite the fact that the assumption of multivariate normality of the independent variables was not met for the prediction rule to be optimal, discriminant analysis grouped the clusters produced using the UMPGA clustering method into their known classes with a predicted group membership of 100%. This analysis also indicates that groups A2 and C2 may be closely associated.

Thus far, the focus has been on certain features that one might like the cluster analysis to have, such as agreement between various clustering methods and other multivariate analyses. These are referred to as measures of secondary validity. How well

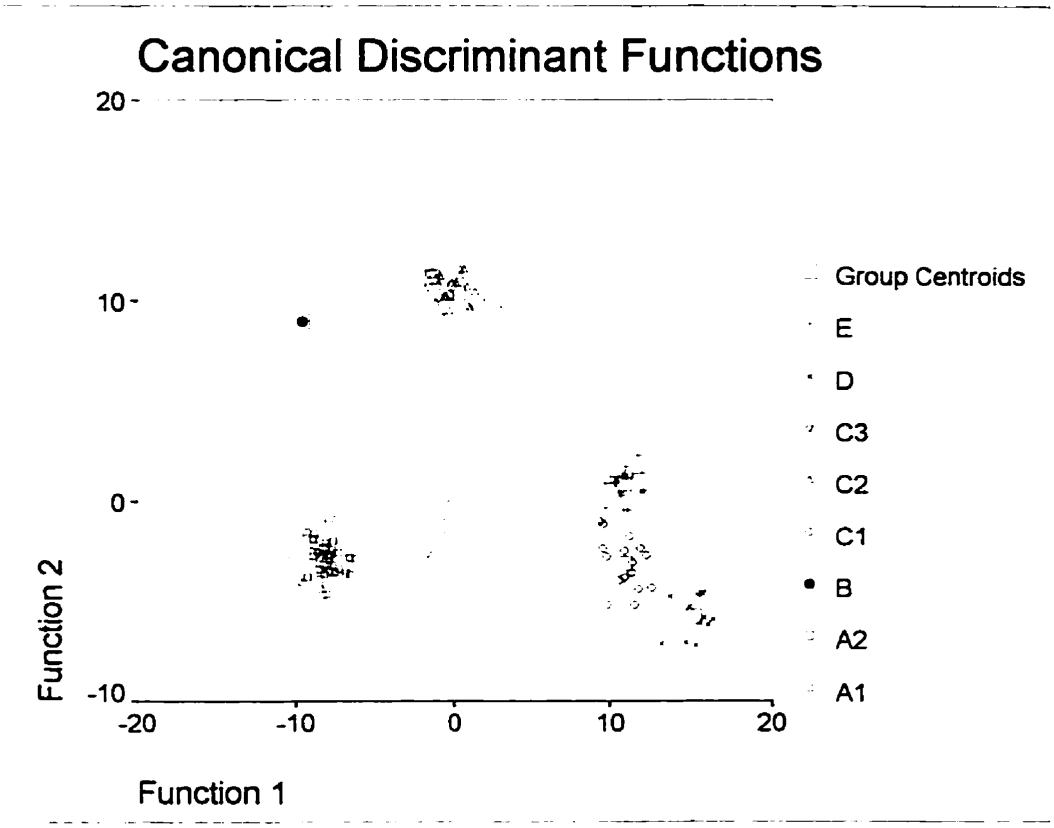

Canonical Discriminant Functions
20
10
0
-10
-20
-10
0
10
20
Function 2
Function 1
Group Centroids
E
D
C3
C2
C1
B
A2
A1

Table 7: Discriminant analysis of strains from the ATCC and the sediment-water interface of Conception Bay, Newfoundland grouped according to the UMPGA clustering method of the Biolog-GN binomial substrate utilization data.

Discriminant Function:	I	II
Percent of separation:	50.73	18.87
Cumulative percent of separation:	50.73	69.60

Pooled within-groups correlations between discriminating variables and canonical discriminant functions (variables ordered by size of correlation within function)

F1	0.32396	F11	0.15097
E12	0.23876	F12	0.14475
F10	0.13628	B10	0.11127
G6	0.13539	F4	0.08957
E4	0.12545	A4	0.06832
E6	0.12152		
F2	0.11774		
F6	0.10882		
F9	0.10612		
C12	0.09187		
D1	0.06506		
A7	0.03964		

a cluster analysis achieves its research goal and generates interesting and useful conclusions is a measure of its primary validity which will now become the focus.

Characteristics of the clusters

Table 8 gives the groups of OTU which clustered together using the UMPGA clustering method and the squared Euclidean distance measure. Five clusters designated A to E were evident at a rescaled distance cluster combine of 19. Groups A and C were further subdivided for increased detail. Except for clusters B and E all clusters contained strains from each sampling date, each incubation temperature, and from the ATCC. On the basis of the presence and distribution of reference strains, both clusters were probably represented by species and closely related groups. Of the 95 substrates contained in the Biolog panel, glycogen, tween 40, α-D-glucose, maltose, methyl pyruvate, itaconic acid, propionic acid, L-aspartic acid, L-glutamic acid and L-threonine were utilized to the greatest extent. Only tween 40 (polyoxyethylenesorbitan monopalmitate) was oxidized by strains in all clusters. Cluster A1 consisted of 66 of the 143 strains, or 46% of the strains examined. Strains from this cluster were considered nutritionally fastidious because of their relative inactivity using the Biolog-GN microplate and inability to grow on a range of routine laboratory media. Contained within this cluster were type strains: *Pseudomonas elongata* (10144), *Deleya aquamarina* (27128), *Alteromonas rubra* (29570), *Alteromonas macleodii* (27126) and *Flavobacterium marinotypicum* (19260). Cluster A2 showed greater substrate utilization, utilizing polymers (glycogen, tween 40),

Table 8. Differentiating characteristics of environmental and reference strains (ATCC) clustered according to the squared Euclidean correlation coefficient and the UMPGA clustering method of their binomial Biolog- GN substrate utilization profiles.

Cluster	A1	A2	B	C1	C2	C3	D	E
No. of strains	66	9	1	16	18	2	12	19
Polymers								
A2 (α-cyclodextrin)	-	44	-	38	56	-	58	68
A3 (dextrin)	24	78	-	+	83	+	-	+
A4 (glycogen)	53	+	+	+	+	+	42	+
A5 (tween 40)	+	+	+	+	+	+	+	+
A6 (tween 80)	29	-	-	+	72	+	+	+
Carbohydrates								
A7 (N-acetyl-D-galactosamine)	-	-	-	31	-	-	17	32
A8 (N-acetyl-D-glucosamine)	-	33	-	+	83	50	25	79
A9 (adonitol)	-	22	-	-	-	-	25	53
A10 (L-arabinose)	38	44	+	19	33	50	50	68
A11 (D-arabitol)	-	-	-	-	-	50	-	79
A12 (cellobiose)	17	78	-	69	28	+	-	53
B1 (i-erythritol)	-	-	-	13	17	-	33	68
B2 (D-fructose)	30	+	+	+	56	+	42	+
B3 (L-fucose)	21	67	+	25	39	+	25	63
B4 (D-galactose)	17	67	+	+	28	+	17	+
B5 (gentiobiose)	26	+	-	75	39	+	17	79
B6 (α-D-glucose)	46	+	-	+	+	+	-	+
B7 (m-inositol)	-	33	-	19	-	50	-	74
B8 (α-D-lactose)	-	78	+	56	17	-	-	42
B9 (lactulose)	-	78	+	-	22	50	-	37
B10 (maltose)	35	+	+	+	+	+	-	+
B11(D-mannitol)	20	22	-	69	-	+	-	79
B12 (D-mannose)	33	+	-	+	17	+	-	74
C1 (D-melibiose)	-	67	-	56	-	50	17	63
C2 (β-methyl D-glucoside)	-	+	+	31	39	50	33	+
C3 (D-psicose)	17	56	+	+	17	+	25	+
C4 (D-raffinose)	-	67	-	25	-	50	17	63
C5 (L-rhamnose)	15	+	+	19	22	50	50	53
C6 (D-sorbitol)	-	-	-	38	-	50	-	63
C7 (sucrose)	20	+	+	44	28	+	17	+
C8 (D-trehalose)	24	+	+	81	44	+	42	+
C9 (turanose)	-	78	-	38	17	+	17	+
C10 (xylitol)	-	22	-	-	-	-	25	42
Methyl esters								
C11 (methyl pyruvate)	26	22	+	81	+	+	+	+
C12 (mono-methyl-succinate)	15	56	-	63	22	50	+	+
Carboxylic acids								
D1 (acetic acid)	27	67	+	67	56	+	+	+
D2 (cis-aconitic acid)	-	-	+	75	50	-	+	+
D3 (citric acid)	-	-	+	50	28	-	67	+
D4 (formic acid)	-	-	-	25	-	50	33	68
D5 (D-galactonic acid lactone)	-	-	-	-	-	-	-	63
D6 (D-galacturonic acid)	17	33	-	-	17	-	17	79
D7 (D-gluconic acid)	14	33	-	81	-	50	17	+
D8 (D-glucosaminic acid)	-	-	-	13	-	-	25	63
D9 (D-glucuronic acid)	12	33	+	31	-	50	-	63
D10 (α-hydroxybutyric acid)	-	-	+	13	-	+	67	42
D11 (β-hydroxybutyric acid)	12	-	+	19	-	50	83	74
D12 (γ-hydroxybutyric acid)	-	-	-	-	-	50	-	26
E1 (p-hydroxy phenylacetic acid)	-	-	-	13	-	50	17	37
E2 (itaconic acid)	65	67	+	69	78	+	+	63

Continued →

Table 8. Continued.

Cluster	A1	A2	B	C1	C2	C3	D	E
No. of strains	66	9	1	16	18	2	12	19
E3 (α-keto butyric acid)	-	56	+	-	39	50	33	42
E4 (α-keto gluctaric acid)	-	-	+	63	33	50	+	+
E5 (α-keto valeric acid)	15	-	-	-	50	-	58	47
E6 (D,L-lactic acid)	-	44	+	81	39	+	+	+
E7 (malonic acid)	12	-	+	-	22	50	42	79
E8 (propionic acid)	39	78	+	69	56	+	+	+
E9 (quinic acid)	-	-	-	-	-	-	42	74
E10 (D-saccharic acid)	-	22	+	-	-	-	25	+
E11 (sebacic acid)	-	-	-	-	-	50	50	16
E12 (succinic acid)	-	-	-	+	28	-	+	+
Brominated chemicals								
F1 (bromo succinic acid)	-	-	-	+	-	-	+	+
Amines								
F2 (succinamic acid)	-	22	+	81	39	50	+	84
F3 (glucuronamide)	-	22	+	19	-	-	-	53
F4 (alaninamide)	-	67	+	44	78	+	58	74
Amino acids and derivatives								
F5 (D-alanine)	15	-	+	50	28	50	+	+
F6 (L-alanine)	17	33	-	88	+	+	+	+
F7 (L-alanyl-glycine)	17	56	-	88	+	+	50	+
F8 (L-asparagine)	-	22	+	+	+	+	+	+
F9 (L-aspartic acid)	17	67	-	+	83	+	83	+
F10 (L-glutamic acid)	20	+	-	+	+	50	+	+
F11 (glycyl-L-aspartic acid)	-	+	-	+	+	-	25	74
F12 (glycyl-L-glutamic acid)	14	+	-	+	+	50	58	+
G1 (L-histidine)	-	22	-	31	17	+	67	68
G2 (hydroxy L-proline)	-	-	-	-	-	50	25	42
G3 (L-leucine)	-	-	-	-	78	-	+	63
G4 (L-ornithine)	-	+	-	25	50	50	67	74
G5 (L-phenylalanine)	-	-	-	19	-	50	83	37
G6 (L-proline)	-	+	+	88	+	50	+	+
G7 (L-pyroglutamic acid)	-	-	+	-	-	+	50	74
G8 (D-serine)	-	-	-	25	-	-	33	53
G9 (L-serine)	15	56	+	+	+	+	+	+
G10 (L-threonine)	-	22	-	+	+	+	58	74
G11 (D,L-carnitine)	-	-	-	-	-	-	-	53
G12 (γ-amino butyric acid)	-	-	-	-	-	50	58	79
Aromatic chemicals								
H1 (urocanic acid)	-	-	-	38	39	+	25	58
H2 (inosine)	12	-	-	+	78	+	33	+
H3 (uridine)	15	22	-	+	83	+	17	84
H4 (thymidine)	23	-	+	+	61	+	25	68
Amides								
H5 (phenyl ethylamine)	-	-	-	-	-	-	17	26
H6 (putrescine)	32	-	+	19	44	50	58	47
H7 (2-amino ethanol)	-	-	-	-	-	50	-	26
Alcohols								
H8 (2,3-butanediol)	-	-	+	-	-	50	17	37
H9 (glycerol)	32	22	+	+	22	+	-	+
Phosphorylated chemicals								
H10 (D,L-α-glycerol phosphate)	-	-	-	56	17	-	-	47
H11 (glucose-1-phosphate)	-	33	-	56	17	-	-	42
H12 (glucose-6-phosphate)	-	-	-	63	17	-	-	32

Symbols: +, 89% or more of the strains are positive; -, 89% or more of the strains are negative. The percentage of positive responses falling within this range are given.

carbohydrates (D-fructose, gentiobiose, α-D-glucose, maltose, D-mannose, β-methyl-D-glucoside, L-rhamnose, sucrose, D-trehalose), and amino acids or derivatives (L-glutamic acid, glycyl-L-aspartic acid, glycyl-L-glutamic acid, L-ornithine, L-proline). This cluster, consisting of only pigmented organisms, contained *Cytophaga marinoflava* (19326). Cluster B, having just one strain, utilized substrates from all categories except brominated chemicals and phosphorylated chemicals. Cluster C1 contained 16 strains, including: *Vibrio damsela* (33539), *V. cincinnatiensis* (35912), *Serratia proteamaculans* subsp. *proteamaculans* (19323), *Photobacterium leiognathi* (25521) and *P. angustum* (25915). Cluster C1 showed positive utilization for all categories except for either of the methyl esters, amines, amides or phosphorylated chemicals. Cluster C2 contained 18 strains and included: *Chryseobacterium indoltheticum* (27950), which was formerly *Flavobacterium indoltheticum*. Cluster C2 did not show any positive utilization at the 89% level for any of the carboxylic acids, brominated chemicals, amines, aromatic chemicals, amides, alcohols or phosphorylated chemicals. Cluster C3, having just two OTU, showed positive utilization from each of the broader categories except for the brominated chemicals, amides and phosphorylated chemicals. Cluster D contained 12 strains, including *Pseudomonas stanieri* (27130), *P. doudoroffii* (27123), *Shewanella putrefaciens* (8071), *S. alga* (51192) and *V. alginolyticus* (17749). These strains utilized substrates from each category except for carbohydrates, aromatic chemicals, amides, alcohols, and phosphorylated chemicals. Cluster E, contained 19 strains. Of these 18 were reference strains, from the genera *Vibrio*, *Marinomonas*, *Deleya*, *Alteromonas*, *Pseudomonas* and

Alcaligenes, and one regional strain collected in September. Strains in cluster E utilized all categories of substrates except for the amines, amides and phosphorylated chemicals. It could be distinguished from cluster C1, by positively utilizing D-saccharic acid, and was distinguished from cluster C2 by being positive for both bromo succinic acid and D-saccharic acid.

The clusters did not possess any unique single features permitting differentiation from all other groups. Nevertheless, the number of characters needed to be used to distinguish between each of the delineated clusters is presented in Figure 9. From this diagram, it is apparent that clusters A2 and C2 could not be distinguished from each other on the basis of substrate utilization patterns.

Table 9 lists the morphological and physiological features recorded for each of the environmental isolates clustered by the UMPGA clustering method and the binomial Biolog-GN substrate utilization profiles. Most of the strains were rod shaped ranging in length from 0.4 - 1.4 μm forming colonies of between 1 to less than 5 mm in diameter. Table 10 provides a closer examination of whether or not the clusters correlated to sampling date, isolation temperature, and/or colony pigmentation. Considering the June collection, 46 out of 59, or 78% of the isolates were found in cluster A. The September collection was more evenly distributed with 23 out of 49, or 47%, found in cluster C and 21, or 43%, being found in cluster A. There was no significant difference detected for the distribution of strains observed according to the initial incubation temperature of isolation. If one were to consider the dispersion of pigmented and non-pigmented bacteria from the

		A		B	C			D	E
		A1	A2		C1	C2	C3		
A	A1	0							
	A2	4	0						
B		17	18	0					
C	C1	6	5	20	0				
	C2	4	0	14	1	0			
	C3	9	6	20	4	4	0		
D		9	10	12	6	3	11	0	
E		11	8	14	1	2	5	4	0

Figure 9: Number of tests differentiating the five clusters, generated by the squared Euclidean distance measure and the between-groups linkage (UMPGA) clustering method, defined by examination of the Biolog-GN substrate utilization pattern.

Table 9. Morphological and physiological features of environmental isolates found in each cluster produced using the squared Euclidean distance measure and the between-groups linkage (UMPGA) clustering method.

Characteristics of environmental isolates	Cluster							
	A		B	C			D	E
	A1	A2		C1	C2	C3		
	61	8	1	11	17	2	7	1
Cell Morphology								
Rod	59	8	1	10	17	2	6	1
Cocci	2	0	0	1	0	0	1	0
Cell Length (μm)								
0.5 - 0.9	28	2	0	3	3	0	1	1
1.0 - 1.4	21	3	1	7	6	2	5	0
1.5 - 2.5	9	2	0	1	7	0	1	0
2.6 - 4.0	3	1	0	0	1	0	0	0
Colony Morphology								
Shape								
Circular	54	5	0	9	10	2	7	0
Irregular	7	3	1	2	7	0	0	1
Elevation								
Raised	16	1	0	5	5	0	2	1
Convex	30	3	0	1	4	1	2	0
Flat	5	3	0	5	7	0	2	0
Umbonate	7	1	1	0	1	0	1	0
Pulvinate	2	0	0	0	0	1	0	0
Umbilicate	1	0	0	0	0	0	0	0
Margin								
Entire	52	4	0	6	8	1	4	1
Undulate	7	1	1	1	7	0	1	0
Lobate	2	3	0	4	2	1	2	0
Surface								
Smooth	46	4	0	5	8	1	3	1
Rough	15	4	1	6	8	1	4	0
Mucoid	0	0	0	0	1	0	0	0

Continued →

Table 9: Continued.

Characteristics of environmental isolates	Cluster							
	A		B	C			D	E
	A1	A2		C1	C2	C3		
	61	8	1	11	17	2	7	1
Colony Size (mm)								
1 < 5	45	4	1	1	1	2	2	0
5 < 10	14	1	0	3	10	0	3	1
10 < 26	2	3	0	7	6	0	2	0
Colony Pigmentation								
Yellow	19	6	0	2	3	1	0	0
Orange	12	2	0	1	0	0	0	0
White	10	0	0	1	0	0	5	1
Beige	20	0	1	7	14	1	2	0
Catalase Positive	57	8	1	9	14	2	7	0
Oxidase Positive	53	7	1	9	17	1	7	1
Na^+ Requirement	51	6	1	10	14	1	3	1
Strictly respiratory	45	5	1	0	7	2	5	1
Facultatively anaerobic	16	3	0	11	10	0	2	0
Motile	56	6	1	11	17	2	7	1

Table 10. Total numbers according to cluster membership of pigmented and non-pigmented strains isolated in June and September, 1995, and total numbers of 5°C and 15°C isolates found in each cluster determined by UMPGA and the squared Euclidean distance measure using the Biolog-GN substrate profile.

Cluster	June			September			Isolation Temp. (°C)	
	P(27)	NP(32)	Total(59)	P (20)	NP(29)	Total(49)	5 (48)	15 (60)
A1(61)	19	21	40	14	7	21	26	35
A2 (8)	6	0	6	2	0	2	4	4
B (1)	0	1	1	0	0	0	0	1
C (30)	2	5	7	4	19	23	14	16
D (7)	0	5	5	0	2	2	3	4
E (1)	0	0	0	0	1	1	1	0

Symbols: P, pigmented; NP, non-pigmented; overall totals provided in brankets.

June collection, no clear separation was observed; essentially an equal representation of pigmented and non-pigmented bacteria from June were found in each cluster. For the September collection however the pigmented bacteria tended to cluster in A while the non-pigmented isolates clustered in C.

Figure 10 provides a graphical representation of the distribution of colony coloration found within each cluster. Figure 11 provides a graphical representation of the distribution of pigmented and non-pigmented strains collected in June and September, 1995 as well as the distribution of those from the ATCC. The pigmented OTU are primarily grouped in clusters A1 and A2 which were characterized as utilizing the least number of substrates in the Biolog-GN microplate.

Figure 12 provides the canonical discriminant function analysis of the substrate utilization patterns collected from OTU grouped according to origin or date of isolation and pigmentation. All groups were separated on the first two discriminant functions, which accounted for 54.42 and 15.51%, respectively, of the among group variance (Table 11). On the axis of function 1, non-pigmented OTU from the ATCC yielded the highest score and were separated from the other groups primarily along this axis. The pigmented strains from the ATCC had the highest score for function 2 and separated from the environmental strains along this axis. The environmental isolates show some overlap but are chiefly separated by function 2. According to their group centroids, both pigmented and non-pigmented September strains fall positively along function 2, while the June isolates fall along the negative extreme. OTU from the ATCC which were pigmented

Figure 10. Hierarchical classification generated from binomial data of the Biolog GN substrate utilization profiles showing the distribution of bacterial pigmentation in each cluster at a rescaled distance cluster combine of 19. The base of each triangle is in proportion to the number of strains.

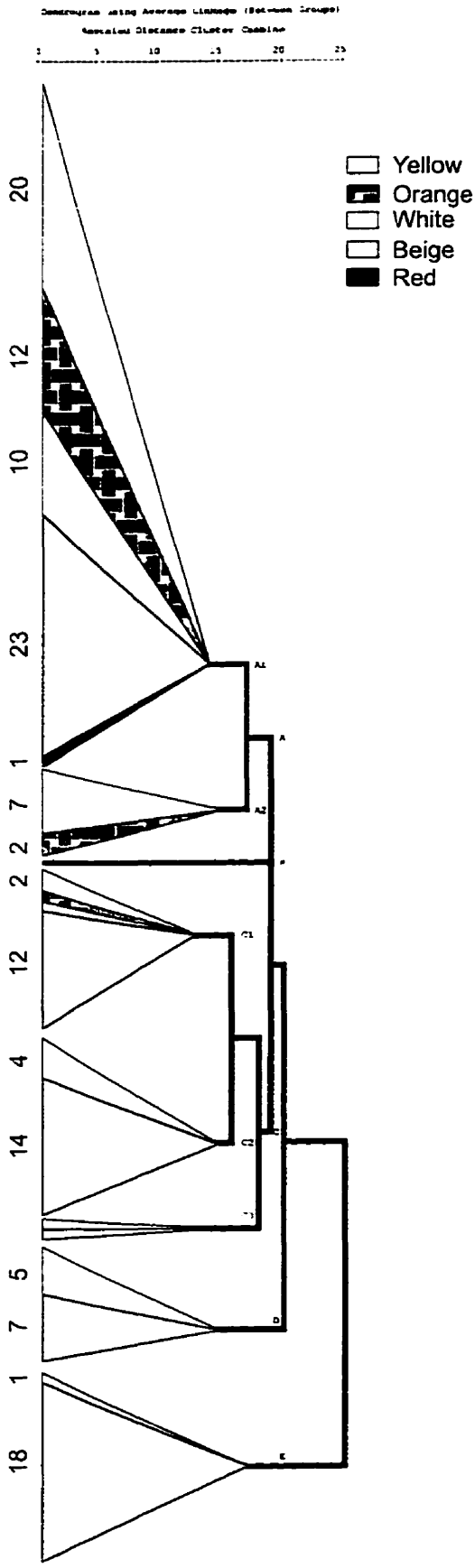

Yellow
Orange
White
Beige
Red
20
12
10
23
1
7
2
2
12
4
14
5
7
1
18

Figure 11. Hierarchical classification generated from binomial data of the Biolog-GN substrate utilization profiles showing the distribution of pigmented and non-pigmented bacteria per sampling date and origin at a rescaled distance cluster combine of 19. The base of each triangle is in proportion to the number of strains which is provided.

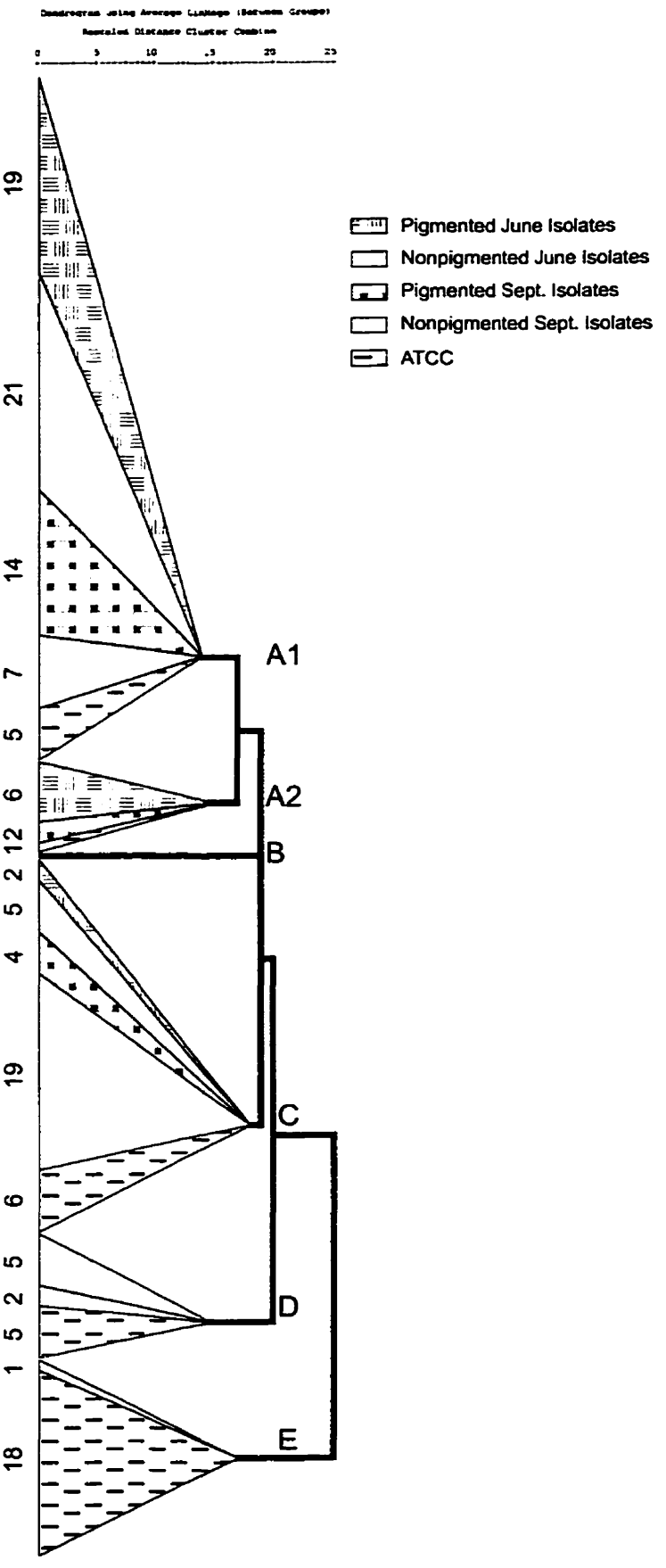

Pigmented June Isolates
Nonpigmented June Isolates
Pigmented Sept. Isolates
Nonpigmented Sept. Isolates
ATCC
A1
A2
B
C
D
E

Figure 12. Canonical discriminant functions calculated from the Biolog-GN substrate utilization profiles for bacteria collected from the sediment-water interface in Conception Bay, Newfoundland and those obtained from the ATCC. The data were grouped according to origin or date of isolation and pigmentation.

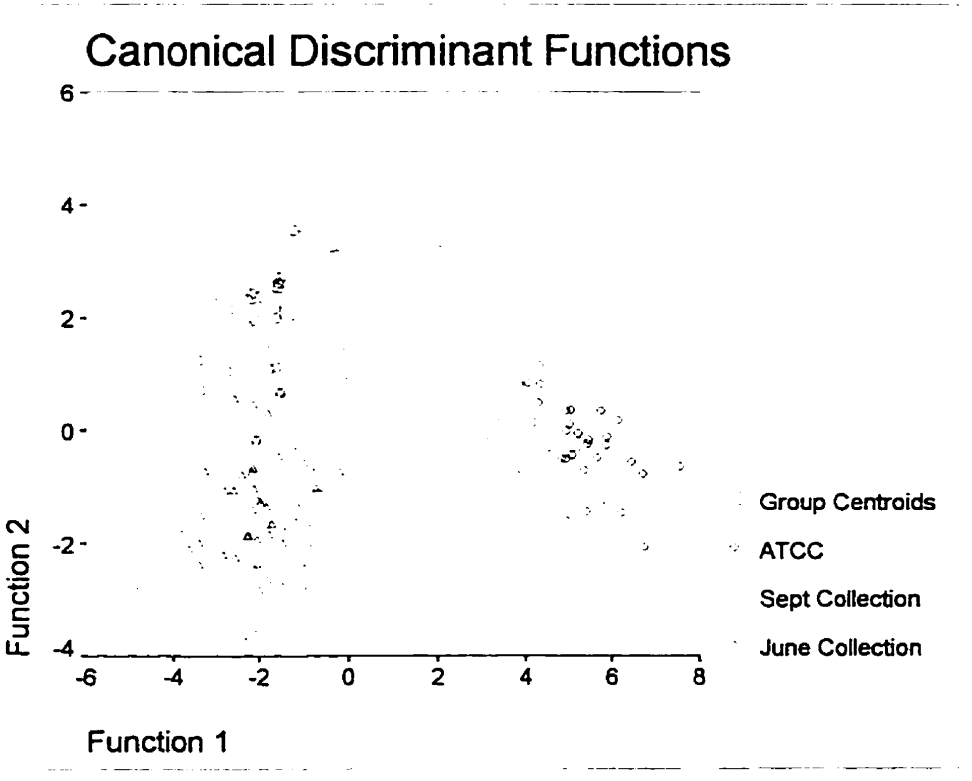

Canonical Discriminant Functions
6
4
2
0
-2
-4
-6
-4
-2
0
2
4
6
8
Function 2
Function 1
Group Centroids
ATCC
Sept Collection
June Collection

Table 11: Discriminant analysis of pigmented and non-pigmented strains from the ATCC and the sediment-water interface of Conception Bay, Newfoundland collected on June 6 and September 15, 1995.

Discriminant Function:	I	II
Percent of separation:	54.42	15.51
Cumulative percent of separation:	54.42	69.93

Pooled within-groups correlations between discriminating variables and canonical discriminant functions (variables ordered by size of correlation within function)

F1	0.27188	A3	0.14362
D3	0.24673	A12	0.11054
G8	0.23281	H12	0.10562
E4	0.22903	B8	0.05713
E12	0.21614		
G12	0.20223		
E10	0.19237		
D11	0.18519		
D7	0.18467		
E9	0.18223		
D8	0.16739		
C12	0.16328		
B7	0.15908		
D4	0.15796		
D5	0.15713		
A11	0.15621		
C9	0.15521		
H2	0.15184		
C4	0.14933		
F2	0.14898		

more closely resembled the communities of both the pigmented and non-pigmented environmental isolates, at least for the variables that are closely related to function 1. Conversely, the OTU from the ATCC which were non-pigmented more closely resembled the environmental isolates, at least for the variables that are closely related to function 2.

Table 12 shows the Biolog-GN percent substrate utilization profiles for pigmented and non-pigmented June and September isolates and reference strains. As seen, even though the discriminant analysis was able to separate the groups, the differences between the environmental isolates, whether pigmented or not, are marginal at best. The biggest difference between the June and September was that a greater percentage of the September isolates utilized dextrin, cellobiose, glucose-6-phosphate and α-D-lactose. A greater percentage of pigmented strains utilized D-mannose for both sampling dates while a greater percentage of non-pigmented strains utilized methyl pyruvate, cis-aconite acid, itaconic acid, α-ketogluctaric acid, D,L-lactic acid, D-alanine, L-asparagine and thymine.

Figure 13 provides the canonical discriminant function analysis for the OTU grouped according to origin (ATCC) and incubation temperature. All groups were separated on the first two discriminant functions, which account for 79.54 and 20.46%, respectively, of the among group variance (Table 13). The ATCC separated from the other groups primarily along function 1, yielding the highest score. Isolates incubated at 5 and 15°C, after sampling, were chiefly separated along function 2. The 15°C isolates fell positively, while the 5°C isolates fell negatively, along this function. Table 14 provides the overall Biolog-GN substrate utilization profiles for these groups. Once again, even

Table 12. Biolog-GN substrate utilization profiles for pigmented (P) and nonpigmented (NP) strains collected from the sediment-water interface in Conception Bay, Newfoundland on June 6 and September 15, 1995 as well as profiles for strains obtained from the ATCC.

Group	June		September		ATCC	
Pigmented/Nonpigmented	P	NP	P	NP	P	NP
No. of strains	27	31	20	30	4	31
Polymers						
A2 (α-cyclodextrin)	19	19	40	21	50	65
A3 (dextrin)	37	28	50	66	+	74
A4 (glycogen)	67	75	55	79	+	71
A5 (tween 40)	+	+	+	+	+	+
A6 (tween 80)	15	38	60	76	50	87
Carbohydrates						
A7 (N-acetyl-D-galactosamine)	-	-	-	-	25	32
A8 (N-acetyl-D-glucosamine)	15	28	35	62	-	68
A9 (adonitol)	-	16	-	-	-	35
A10 (L-arabinose)	22	53	30	28	75	61
A11 (D-arabitol)	-	13	-	-	-	52
A12 (cellobiose)	22	19	40	45	50	35
B1 (i-erythritol)	15	-	15	-	-	55
B2 (D-fructose)	48	56	30	55	75	81
B3 (L-fucose)	33	31	25	28	25	52
B4 (D-galactose)	41	25	30	41	25	71
B5 (gentiobiose)	44	25	50	34	75	65
B6 (α-D-glucose)	63	41	70	72	75	81
B7 (m-inositol)	-	-	-	-	-	52
B8 (α-D-lactose)	19	16	30	24	25	23
B9 (lactulose)	19	-	15	17	25	19
B10 (maltose)	59	31	60	72	+	71
B11(D-mannitol)	22	19	20	38	25	52
B12 (D-mannose)	59	22	55	28	75	61
C1 (D-melibiose)	22	16	25	24	25	48
C2 (β-methyl D-glucoside)	26	25	30	24	50	68
C3 (D-psicose)	26	31	15	41	25	77
C4 (D-raffinose)	-	-	-	-	25	55
C5 (L-rhamnose)	26	28	30	17	50	45
C6 (D-sorbitol)	-	-	-	17	-	45
C7 (sucrose)	26	31	45	24	75	65
C8 (D-trehalose)	37	41	55	41	50	77
C9 (turanose)	22	-	20	21	75	71
C10 (xylitol)	-	-	-	-	-	32
Methyl esters						
C11 (methyl pyruvate)	22	53	25	83	50	+
C12 (mono-methyl-succinate)	33	41	20	21	25	87
Carboxylic acids						
D1 (acetic acid)	37	31	50	62	50	87
D2 (cis-aconitic acid)	-	34	-	55	-	84
D3 (citric acid)	-	13	-	34	-	84
D4 (formic acid)	-	-	-	21	-	55
D5 (D-galactonic acid lactone)	-	-	-	-	-	35
D6 (D-galacturonic acid)	15	25	-	14	50	48
D7 (D-gluconic acid)	15	16	20	28	50	81
D8 (D-glucosaminic acid)	-	-	-	-	25	55
D9 (D-glucuronic acid)	-	22	-	24	25	42
D10 (α-hydroxybutyric acid)	-	19	-	-	50	42
D11 (β-hydroxybutyric acid)	15	25	-	14	-	68
D12 (γ-hydroxybutyric acid)	-	-	-	-	-	19
E1 (D-hydroxy phenylacetic acid)	-	19	-	-	25	29
E2 (itaconic acid)	59	88	45	69	+	74

Continued →

Table 12. Continued

Group	June		September		ATCC	
Pigmented/Nonpigmented	P	NP	P	NP	P	NP
No. of strains	27	31	20	30	4	31
E3 (α-keto butyric acid)	26	-	15	17	25	35
E4 (α-keto gluctaric acid)	-	25	15	41	-	+
E5 (α-keto valeric acid)	22	19	15	28	25	42
E6 (D,L-lactic acid)	19	34	15	52	-	+
E7 (malonic acid)	-	34	-	14	-	58
E8 (propionic acid)	48	50	40	62	75	+
E9 (quinic acid)	-	-	-	-	50	58
E10 (D-saccharic acid)	-	-	-	-	-	61
E11 (sebacic acid)	-	16	-	-	-	23
E12 (succinic acid)	-	25	25	41	-	+
Brominated chemicals						
F1 (bromo succinic acid)	-	22	15	28	-	+
Amines						
F2 (succinamic acid)	15	31	25	45	-	77
F3 (glucuronamide)	-	19	-	-	-	29
F4 (alaninamide)	37	25	20	52	25	61
Amino acids and derivatives						
F5 (D-alanine)	-	47	15	41	-	74
F6 (L-alanine)	30	38	35	76	50	81
F7 (L-alanyl-glycine)	37	19	40	72	75	84
F8 (L-asparagine)	19	41	25	72	25	+
F9 (L-aspartic acid)	48	34	30	66	25	+
F10 (L-glutamic acid)	56	38	35	79	50	+
F11 (glycyl-L-aspartic acid)	44	16	30	66	75	68
F12 (glycyl-L-glutamic acid)	52	22	30	72	75	87
G1 (L-histidine)	-	22	-	31	25	55
G2 (hydroxy L-proline)	-	-	-	-	25	32
G3 (L-leucine)	15	19	-	38	25	58
G4 (L-ornithine)	30	13	20	38	50	55
G5 (L-phenylalanine)	-	16	-	-	25	45
G6 (L-proline)	37	31	35	72	50	+
G7 (L-pyroglutamic acid)	-	16	-	14	-	52
G8 (D-serine)	-	-	-	-	-	55
G9 (L-serine)	33	41	25	76	75	+
G10 (L-threonine)	22	22	15	66	50	71
G11 (D,L-carnitine)	-	-	-	-	-	32
G12 (γ-amino butyric acid)	-	16	-	-	-	61
Aromatic chemicals						
H1 (urocanic acid)	-	-	-	38	-	45
H2 (inosine)	15	22	30	62	50	84
H3 (uridine)	37	22	25	62	25	71
H4 (thymidine)	15	50	20	59	25	61
Amides						
H5 (phenyl ethylamine)	-	-	-	-	-	23
H6 (putrescine)	-	53	25	31	25	48
H7 (2-amino ethanol)	-	-	-	-	-	16
Alcohols						
H8 (2,3-butanediol)	-	13	-	-	25	35
H9 (glycerol)	22	47	30	41	50	77
Phosphorylated chemicals						
H10 (D,L-α-glycerol phosphate)	-	-	-	21	-	39
H11 (glucose-1-phosphate)	-	-	15	17	25	35
H12 (glucose-6-phosphate)	-	-	15	17	25	39

Symbols +, 89% or more of the strains are positive, -, 89% or more of the strains are negative. The percentage of positive responses falling within this range are given.

Figure 13. Canonical discriminant functions calculated from the Biolog-GN substrate utilization profiles for bacteria collected from the sediment-water interface in Conception Bay, Newfoundland and those obtained from the ATCC. The data were grouped according to origin and initial incubation temperature for growth after collection.

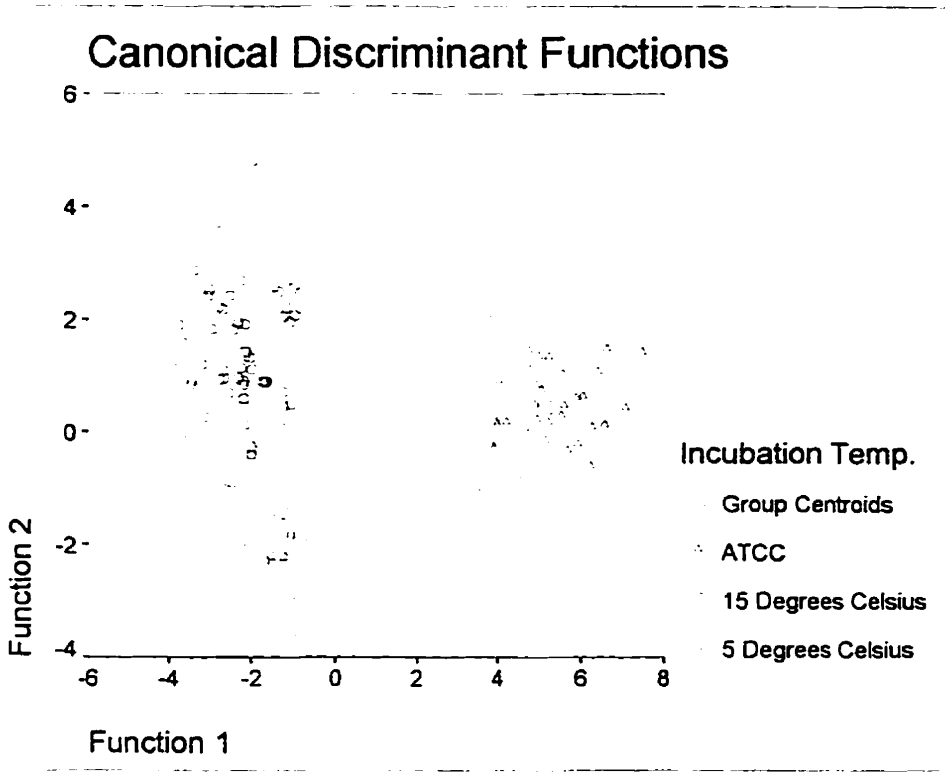

Canonical Discriminant Functions
6
4
2
0
-2
-4
-6
-4
-2
0
2
4
6
8
Function 2
Function 1
Incubation Temp.
Group Centroids
ATCC
15 Degrees Celsius
5 Degrees Celsius

Table 13: Discriminant analysis of strains from the ATCC and the sediment-water interface of Conception Bay, Newfoundland incubated at 5 and 15°C before initial subculture.

Discriminant Function:	I	II
Percent of separation:	79.54	20.46
Cumulative percent of separation:	79.54	100

Pooled within-groups correlations between discriminating variables and canonical discriminant functions (variables ordered by size of correlation within function)

F1	0.24473	D1	0.11303
D3	0.21841	H6	0.10563
E9	0.21776	C5	0.09163
G8	0.21580	E2	0.08893
D8	0.20047	F3	-0.07672
D7	0.20024	E3	0.06341
E4	0.19705	A5	0.05961
G12	0.19415	A4	-0.04715
E10	0.19415	B8	-0.04316
C9	0.19000	B9	0.03822
E12	0.18692		
C4	0.16868		
B7	0.16542		
D11	0.16328		
A11	0.16105		
C12	0.16063		
E6	0.15084		
D5	0.15061		
D4	0.15056		
G5	0.14966		
H2	0.14817		

Table 14. Biolog-GN substrate utilization profiles for strains isolated from the sediment-water interface of Conception Bay, Newfoundland on June 6 and September 15, 1995 and incubated at 5 and 15°C.

Group	5°C	15°C	ATCC
No. of strains	48	60	35
Polymers			
A2 (α-cyclodextrin)	32	16	63
A3 (dextrin)	47	43	77
A4 (glycogen)	74	67	74
A5 (tween 40)	+	+	+
A6 (tween 80)	43	49	83
Carbohydrates			
A7 (N-acetyl-D-galactosamine)	-	-	31
A8 (N-acetyl-D-glucosamine)	38	33	60
A9 (adonitol)	-	-	31
A10 (L-arabinose)	38	31	63
A11 (D-arabitol)	-	-	46
A12 (cellobiose)	32	30	37
B1 (i-erythritol)	13	-	49
B2 (D-fructose)	60	41	80
B3 (L-fucose)	28	31	49
B4 (D-galactose)	36	33	66
B5 (gentiobiose)	45	31	66
B6 (α-D-glucose)	64	57	80
B7 (m-inositol)	-	-	46
B8 (α-D-lactose)	26	18	23
B9 (lactulose)	13	16	20
B10 (maltose)	57	52	74
B11(D-mannitol)	30	21	49
B12 (D-mannose)	40	38	63
C1 (D-melibiose)	17	21	46
C2 (β-methyl D-glucoside)	21	30	66
C3 (D-psicose)	36	25	71
C4 (D-raffinose)	-	-	51
C5 (L-rhamnose)	17	31	46
C6 (D-sorbitol)	-	-	40
C7 (sucrose)	36	26	66
C8 (D-trehalose)	38	46	74
C9 (turanose)	19	16	71
C10 (xylitol)	-	-	29
Methyl esters			
C11 (methyl pyruvate)	49	48	+
C12 (mono-methyl-succinate)	32	28	80
Carboxylic acids			
D1 (acetic acid)	36	51	83
D2 (cis-aconitic acid)	32	26	74
D3 (citric acid)	13	16	74
D4 (formic acid)	-	13	49
D5 (D-galactonic acid lactone)	-	-	31
D6 (D-galacturonic acid)	23	-	49
D7 (D-gluconic acid)	19	20	77
D8 (D-glucosaminic acid)	-	-	51
D9 (D-glucuronic acid)	17	18	40
D10 (α-hydroxybutyric acid)	-	-	43
D11 (β-hydroxybutyric acid)	15	15	60
D12 (γ-hydroxybutyric acid)	-	-	17
E1 (D-hydroxy phenylacetic acid)	-	-	29
E2 (itaconic acid)	60	74	77
E3 (α-keto butyric acid)	13	18	34
E4 (α-keto gluctaric acid)	23	21	80
E5 (α-keto valeric acid)	21	21	40
E6 (D,L-lactic acid)	30	33	80
E7 (malonic acid)	17	15	51
E8 (propionic acid)	51	51	+
E9 (quinic acid)	-	-	57
E10 (D-saccharic acid)	-	-	54
E11 (sebacic acid)	-	-	20
E12 (succinic acid)	23	25	80
Brominated chemicals			
F1 (bromo succinic acid)	21	15	83
Amines			
F2 (succinamic acid)	28	31	69
F3 (glucuronamide)	19	-	26
F4 (alaninamide)	32	36	57
Amino acids and derivatives			
F5 (D-alanine)	26	31	66
F6 (L-alanine)	51	41	77
F7 (L-alanyl-glycine)	47	38	83
F8 (L-asparagine)	40	41	83
F9 (L-aspartic acid)	55	38	83
F10 (L-glutamic acid)	62	46	+
F11 (glycyl-L-aspartic acid)	45	34	69
F12 (glycyl-L-glutamic acid)	53	38	86
G1 (L-histidine)	17	20	51
G2 (hydroxy L-proline)	-	-	31
G3 (L-leucine)	23	20	54
G4 (L-ornithine)	26	25	54
G5 (L-phenylalanine)	-	-	43
G6 (L-proline)	38	49	86
G7 (L-pyroglutamic acid)	13	-	46
G8 (D-serine)	-	-	49
G9 (L-serine)	53	39	+
G10 (L-threonine)	38	28	69
G11 (D,L-carnitine)	-	-	29
G12 (γ-amino butyric acid)	-	-	54
Aromatic chemicals			
H1 (urocanic acid)	17	13	40
H2 (inosine)	34	31	80
H3 (uridine)	40	34	66
H4 (thymidine)	40	36	57
Amides			
H5 (phenyl ethylamine)	-	-	20
H6 (putrescine)	21	39	46
H7 (2-amino ethanol)	-	-	14
Alcohols			
H8 (2,3-butanediol)	-	-	34
H9 (glycerol)	36	36	74
Phosphorylated chemicals			
H10 (D,L-α-glycerol phosphate)	-	-	34
H11 (glucose-1-phosphate)	13	-	34
H12 (glucose-6-phosphate)	-	-	29

Symbols: +, 89% or more of the strains are positive; -, 89% or more of the strains are negative. The percentage of positive responses falling within this range are given.

though the discriminant analysis was able to separate the environmental isolates, whether incubated at 5 or 15°C, the differences according to the percent substrate utilization profiles were negligible. The biggest difference between 5 and 15°C strains was that a greater percentage of the 15°C strains utilized acetic acid, putrescine, L-rhamnose, and itaconic acid while a greater percentage of the 5°C isolates utilized glucuronamide.

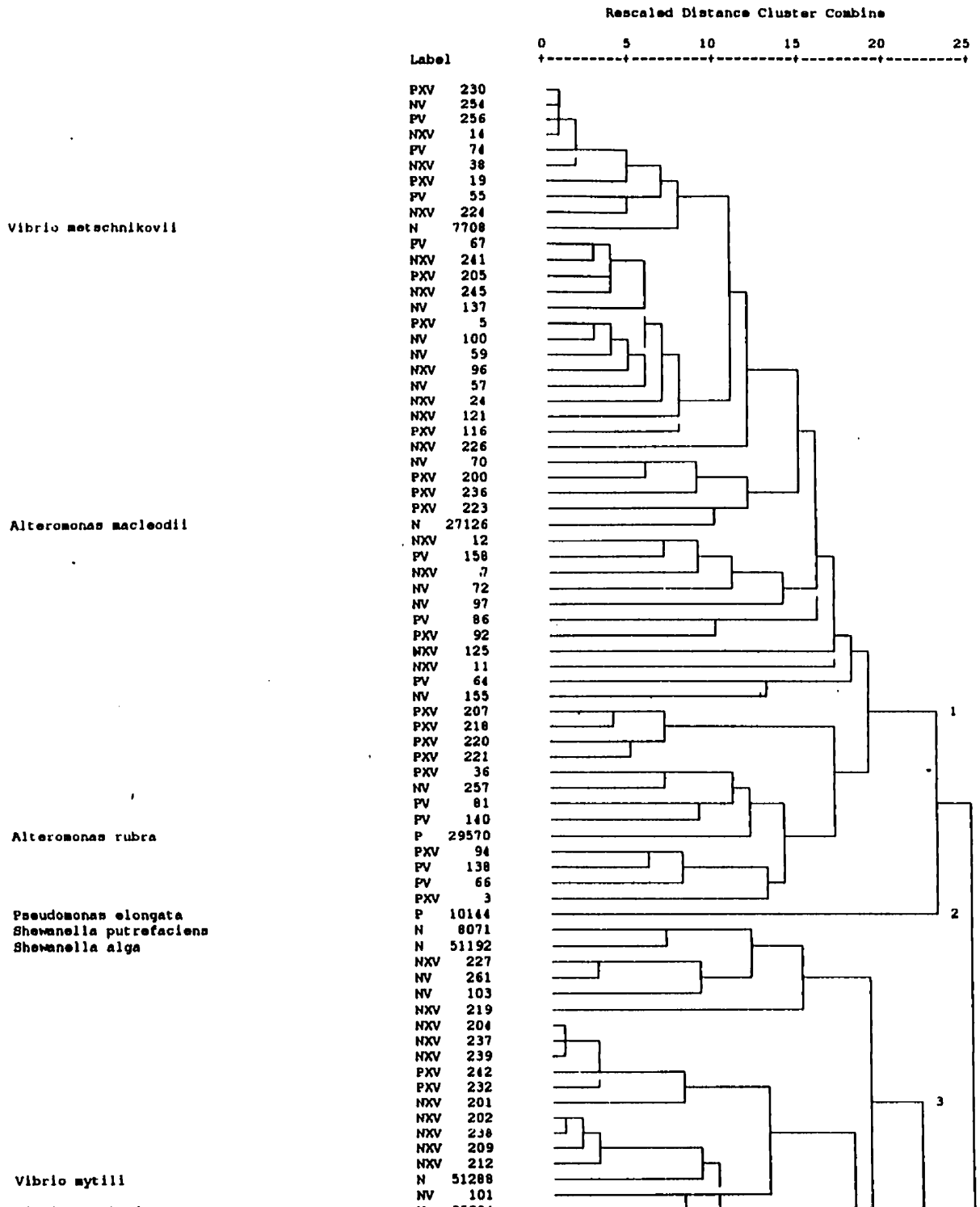
Levels of Activity

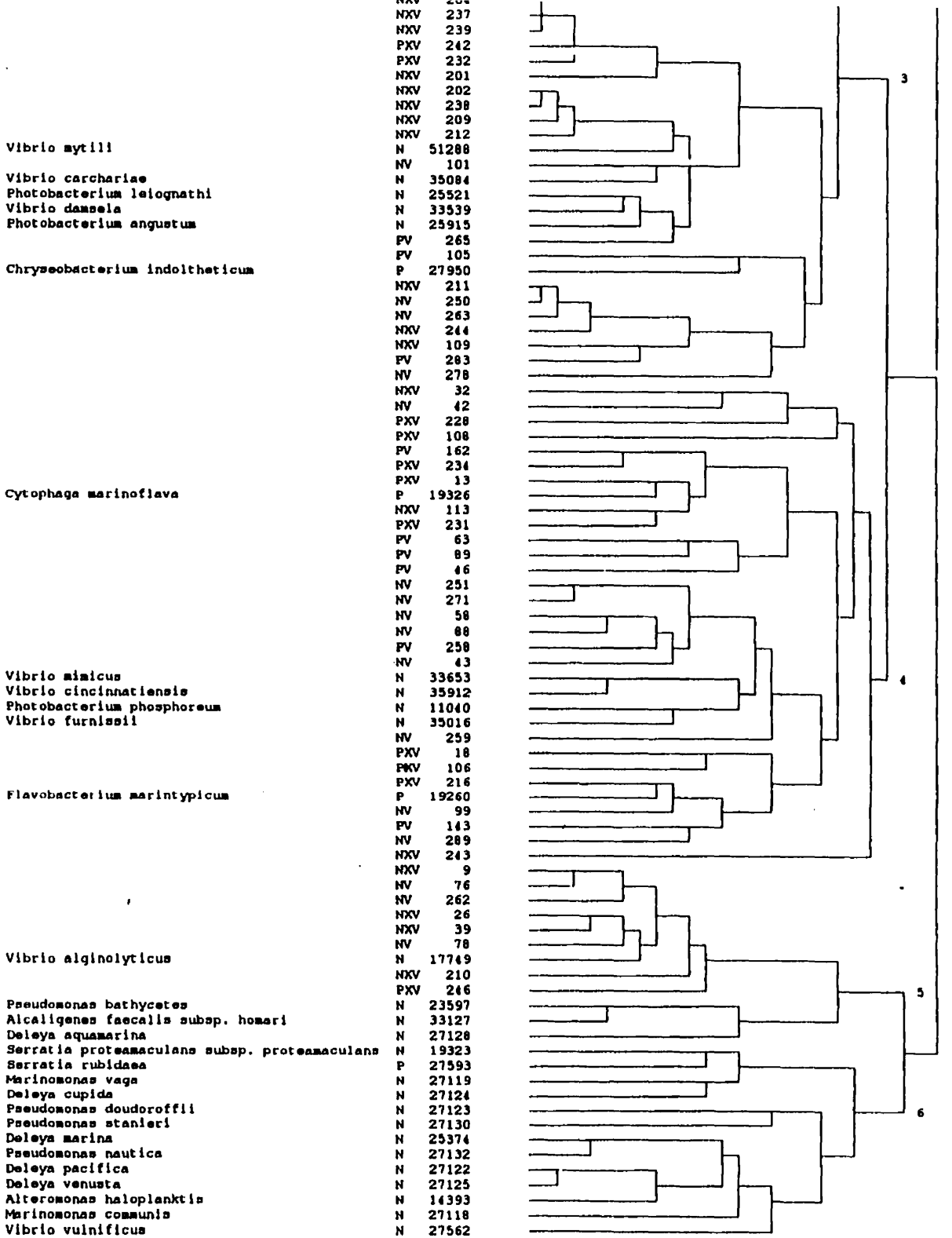
Cluster analysis, based on the presence or absence of utilized substrates, revealed consistent relationships among strains regardless of the measurement used. Such an approach, however, entails a loss of information. Biolog-GN metabolic profiles, showing the levels of activity or the extent of color formation for each substrate obtained for successfully tested cultures, are shown in Appendix C. Using the actual percent change in optical density values gathered from each OTU, raises a difficulty. This is that the range of values on certain attributes are much greater than the range of others. As a result, certain attributes carry greater weight in determining the similarity among objects. Looking at the data, some attributes are more abundant than others. Standardization reduces the influence of extreme values. If not standardized, they would overshadow the rare elements and possibly reduce the uniqueness among the data profiles.

Figure 14 provides the hierarchical classification, based on the standardized z-scores of the percent change in optical density versus the A1 control well for each OTU as recorded by the Biolog Microplate reader. Six clusters were identified at a rescaled

Figure 14. Hierarchical classification, based on standardized data analysis of the average change in optical density values, for strains examined using the Biolog-GN Microstation system. The dendrogram was generated using the squared Euclidean distance measure and between-groups linkage (UMPGA) clustering method. The rescaled distance cluster combine units are arbitrary and are based on the sum of the squared presence of characters. Strains were designated: P, pigmented; N, non-pigmented; V, incubation temperature of 5 °C and XV, incubation temperature of 15 °C. The names of reference cultures are given in the left-side column.

Dendrogram using Average Linkage (Between Groups)




NXV 237
NXV 239
PXV 242
PXV 232
NXV 201
NXV 202
NXV 238
NXV 209
NXV 212
Vibrio mytili N 51288
NV 101
Vibrio carchariae N 35084
Photobacterium leiognathi N 25521
Vibrio damsela N 33539
Photobacterium angustum N 25915
PV 265
PV 105
Chryseobacterium indoltheticum P 27950
NXV 211
NV 250
NV 263
NXV 244
NXV 109
PV 283
NV 278
NXV 32
NV 42
PXV 228
PXV 108
PV 162
PXV 234
PXV 13
Cytophaga marinoflava P 19326
NXV 113
PXV 231
PV 63
PV 89
PV 46
NV 251
NV 271
NV 58
NV 88
PV 258
NV 43
Vibrio mimicus N 33653
Vibrio cincinnatiensis N 35912
Photobacterium phosphoreum N 11040
Vibrio furnissii N 35016
NV 259
PXV 18
PXV 106
PXV 216
Flavobacterium marintypicum P 19260
NV 99
PV 143
NV 289
NXV 243
NXV 9
NV 76
NV 262
NXV 26
NXV 39
NV 78
Vibrio alginolyticus N 17749
NXV 210
PXV 246
Pseudomonas bathycetes N 23597
Alcaligenes faecalis subsp. homari N 33127
Deleya aquamarina N 27128
Serratia proteamaculans subsp. proteamaculans N 19323
Serratia rubidaea P 27593
Marinomonas vaga N 27119
Deleya cupida N 27124
Pseudomonas doudoroffii N 27123
Pseudomonas stanieri N 27130
Deleya marina N 25374
Pseudomonas nautica N 27132
Deleya pacifica N 27122
Deleya venusta N 27125
Alteromonas haloplanktis N 14393
Marinomonas communis N 27118
Vibrio vulnificus N 27562
3
4
5
6

distance cluster combine of 23 and were compared with clusters cut at a rescaled distance cluster combine of 18 for Figure 5.

A summary of the distribution of the strains within the two clusters is given in Table 15. The table shows the number of strains that were common between the groups. Cluster 1 had 50 out of 75 or about 67% of the same strains that were observed in cluster A. Similarly, cluster 3 had 27 out of 34 or about 79% of the same strains that were observed in cluster C. Cluster 4 had 20 out of 75, or about 27% of the same strains that were in cluster A. Cluster 5 had 8 out of 12, or about 67% of the same strains that were observed in cluster E. Cluster 6 contained 9 out of 19, or about 47%, of the same strains that were observed in cluster F. When this data was analyzed using the Chi-square test a value of 140.19 ($\chi^2_{0.01[25]}$) was produced. Therefore, apart from the values at which objects form clusters, the order in which objects merge is essentially the same in the two trees.

Table 16 provides the average percent change in optical density for the OTU grouped. Cluster 1, having 53 out of 143 strains, or 37% of the strains examined, consisted of strains characterized as having low activity for all substrates except tween 40. Contained within this cluster were the type strains *Vibrio metschnikovii* (7708) and *Alteromonas macleodii* (27126). Cluster 2 consisted of one type strain, *Pseudomonas elongata* (10144), which has a low level of activity for most substrates with the highest activity level expressed for itaconic acid. Cluster 3 has 33 strains, including: *Shewanella putrefaciens* (8071), *S. alga* (51192), *V. mytili* (51288), *V. carchariae* (35084),

Table 15: Number of strains observed in the clusters generated using the between-groups linkage (UMPGA) clustering method from the Biolog-GN binomial data (Figure 5) compared with the clusters generated using the corresponding percent change in optical density data (Figure 13).

Clusters generated by Biolog using UMPGA and the percent change in optical density values	Clusters Generated by Biolog using UMPGA with binomial data					
	A	B	C	D	E	F
1	50	1	1	0	0	1
2	1	0	0	0	0	0
3	2	0	27	0	2	2
4	20	0	5	2	0	4
5	2	0	0	0	8	3
6	0	0	1	0	2	9

Table 16. Biolog-GN average percent change in optical density versus the A1 control well values for strains, both environmental and from the ATCC, clustered according to their individual standardized z-scores. Environmental strains were collected from the sediment-water interface in Conceptio Bay, Newfoundland on June 6 and September 15, 1995.

Cluster	1	2	3	4	5	6
No. of strains	53	1	33	31	13	12
Polymers						
A2 (α-cyclodextrin)	16	24	129	69	31	36
A3 (dextrin)	20	0	504	257	51	166
A4 (glycogen)	39	23	408	176	45	96
A5 (tween 40)	149	6	301	153	264	343
A6 (tween 80)	21	16	251	107	441	370
Carbohydrates						
A7 (N-acetyl-D-galactosamine)	7	0	124	63	10	108
A8 (N-acetyl-D-glucosamine)	7	7	562	177	8	353
A9 (adonitol)	9	0	7	24	11	217
A10 (L-arabinose)	27	24	75	123	27	315
A11 (D-arabitol)	7	5	4	29	11	283
A12 (cellobiose)	13	19	272	198	2	137
B1 (i-erythritol)	9	5	8	9	14	231
B2 (D-fructose)	21	0	235	263	35	610
B3 (L-fucose)	15	8	18	34	14	118
B4 (D-galactose)	11	0	272	176	8	394
B5 (gentiobiose)	19	32	121	194	16	165
B6 (α-D-glucose)	27	0	374	298	39	672
B7 (m-inositol)	7	0	5	47	10	403
B8 (α-D-lactose)	10	0	100	121	10	117
B9 (lactulose)	12	5	31	55	17	88
B10 (maltose)	26	1	524	261	42	465
B11(D-mannitol)	11	0	125	232	8	424
B12 (D-mannose)	19	0	171	222	6	292
C1 (D-melibiose)	8	2	56	90	11	201
C2 (β-methyl D-glucoside)	10	0	104	142	21	175
C3 (D-psicose)	15	0	74	64	22	66
C4 (D-raffinose)	11	0	19	66	15	182
C5 (L-rhamnose)	12	22	20	62	20	46
C6 (D-sorbitol)	8	0	17	75	6	263
C7 (sucrose)	15	0	67	230	48	511
C8 (D-trehalose)	16	25	240	233	36	474
C9 (turanose)	9	1	37	99	44	431
C10 (xylitol)	8	0	7	21	10	63
Methyl esters						
C11 (methyl pyruvate)	16	13	412	122	174	248
C12 (mono-methyl-succinate)	18	4	68	47	163	140
Carboxylic acids						
D1 (acetic acid)	40	3	110	46	142	114
D2 (cis-aconitic acid)	10	0	94	79	136	620
D3 (citric acid)	10	0	53	62	80	457
D4 (formic acid)	8	0	52	22	14	234
D5 (D-galactonic acid lactone)	8	0	8	26	10	164
D6 (D-galacturonic acid)	14	0	34	81	15	214
D7 (D-gluconic acid)	10	12	214	128	32	430
D8 (D-glucosaminic acid)	10	31	11	13	22	100
D9 (D-glucuronic acid)	12	0	53	58	12	169
D10 (α-hydroxybutyric acid)	9	14	44	14	47	32
D11 (β-hydroxybutyric acid)	12	0	27	40	145	406
D12 (γ-hydroxybutyric acid)	8	0	4	7	51	61
E1 (D-hydroxy phenylacetic acid)	10	0	5	36	14	338

Continued →

Table 16. Continued

Cluster	1	2	3	4	5	6
No. of strains	53	1	33	31	13	12
E2 (itaconic acid)	57	60	73	44	71	107
E3 (α-keto butyric acid)	10	0	80	21	16	36
E4 (α-keto gluctaric acid)	15	0	150	57	130	480
E5 (α-keto valeric acid)	11	0	27	8	51	53
E6 (D,L-lactic acid)	15	1	336	91	205	431
E7 (malonic acid)	13	1	22	23	20	82
E8 (propionic acid)	38	31	97	48	97	142
E9 (quinic acid)	11	16	10	11	13	250
E10 (D-saccharic acid)	9	0	19	36	17	233
E11 (sebacic acid)	5	23	1	6	28	16
E12 (succinic acid)	12	4	177	70	145	204
Brominated chemicals						
F1 (bromo succinic acid)	8	0	69	30	110	157
Amines						
F2 (succinamic acid)	11	0	50	26	61	157
F3 (glucuronamide)	11	0	15	14	6	44
F4 (alaninamide)	14	0	57	28	54	65
Amino acids and derivatives						
F5 (D-alanine)	11	0	140	21	120	534
F6 (L-alanine)	18	0	466	53	194	592
F7 (L-alanyl-glycine)	22	0	432	57	54	395
F8 (L-asparagine)	9	0	492	110	88	680
F9 (L-aspartic acid)	20	0	373	102	61	363
F10 (L-glutamic acid)	18	0	408	142	252	789
F11 (glycyl-L-aspartic acid)	19	2	454	57	11	114
F12 (glycyl-L-glutamic acid)	25	0	451	81	73	330
G1 (L-histidine)	14	4	79	20	67	367
G2 (hydroxy L-proline)	5	0	6	8	25	339
G3 (L-leucine)	6	0	84	11	155	233
G4 (L-ornithine)	13	0	64	30	44	214
G5 (L-phenylalanine)	7	0	25	9	29	221
G6 (L-proline)	17	0	285	86	169	850
G7 (L-pyroglutamic acid)	10	2	13	18	98	283
G8 (D-serine)	4	4	14	32	19	121
G9 (L-serine)	16	0	618	100	179	609
G10 (L-threonine)	9	0	410	25	44	86
G11 (D,L-carnitine)	8	1	6	5	9	108
G12 (γ-amino butyric acid)	7	0	6	13	85	434
Aromatic chemicals						
H1 (urocanic acid)	6	0	27	16	60	409
H2 (inosine)	16	28	511	169	16	340
H3 (uridine)	14	7	376	76	5	192
H4 (thymidine)	14	0	180	61	13	74
Amides						
H5 (phenyl ethylamine)	5	0	6	3	7	244
H6 (putrescine)	21	0	25	25	35	323
H7 (2-amino ethanol)	5	0	3	3	16	79
Alcohols						
H8 (2,3-butanediol)	14	21	11	10	17	18
H9 (glycerol)	19	0	264	167	39	434
Phosphorylated chemicals						
H10 (D,L-α-glycerol phosphate)	6	0	75	14	5	109
H11 (glucose-1-phosphate)	9	0	160	32	3	49
H12 (glucose-6-phosphate)	7	0	155	25	5	44

Photobacterium leiognathi (25521), *V. damsela* (33539), *P. angustum* (25915) and *Chryseobacterium indoltheticum* (27950). Strains within this cluster had the lowest utilization patterns for bromo succinate and both the amines and amides. Cluster 4 has 31 strains, including: *Cytophaga marinoflava* (19326), *V. mimicus* (33653), *V. cincinnatiensis* (35912), *Photobacterium phosphoreum* (11040), *V. furnissii* (35016) and *Flavobacterium marinotypicum* (19260). Strains within this cluster showed the lowest utilization profiles for bromo succinate, amines, amides, and phosphorylated chemicals. Cluster 5 has 13 strains, including *V. alginolyticus* (17749), *Pseudomonas bathycetes* (23597), *Alcaligenes faecalis* subsp. *homari* (33127) and *Deleya aquamarina* (27128). Strains within this cluster had the lowest utilization profiles for all the carbohydrates, amides, alcohols and phosphorylated chemicals. Cluster 6 consisted of the remaining type clusters included in this study and were characterized as having high utilization profiles for all substrate categories.

Table 17 lists the morphological and physiological features recorded for each of the environmental isolates clustered by the UMPGA clustering method using the standardized Biolog-GN substrate utilization profiles. Cluster 1 contained 44 isolates, or 88%, ranging in length from 0.5-1.4 μm. Cluster 3 contained 19 isolates, or 79%, ranging in length from 1 to 2.5 μm. Cells in cluster 4 were more evenly distributed from 0.5 to 4.0 μm in length while cells in cluster 5 were chiefly between 1 to 1.4 μm in length with 6 isolates, or 75%, occurring within this range. Strains within cluster 1 formed clusters chiefly ranging in diameter from 1 to less than 5 mm (78%). Strains in cluster 2 formed

Table 17. Morphological and physiological features of environmental isolates found in each cluster produced using the squared Euclidean distance measure of the standardized percent change in optical density Biolog-GN values and the between-groups linkage (UMPGA) clustering method.

Characteristics of environmental isolates	**Cluster**			
	1	**3**	**4**	**5**
	50	24	26	8
Cell Morphology				
Rod	49	24	24	7
Cocci	1	0	2	1
Cell Length (μm)				
0.5 - 0.9	24	4	9	1
1.0 - 1.4	20	12	7	6
1.5 - 2.5	4	7	7	1
2.6 - 4.0	2	1	3	0
Colony Morphology				
Shape				
Circular	46	16	17	8
Irregular	4	8	9	0
Elevation				
Raised	13	8	7	2
Convex	25	4	10	2
Flat	4	10	5	3
Umbonate	6	1	3	1
Pulvinate	2	0	1	0
Umbilicate	0	1	0	0
Margin				
Entire	42	11	17	5
Undulate	7	7	3	1
Lobate	1	6	6	2
Surface				
Smooth	38	9	18	3
Rough	12	14	8	5
Mucoid	0	1	0	0

Continued→

Table 17: Continued.

Characteristics of environmental isolates	Cluster			
	1	3	4	5
	50	24	26	8
Colony Size (mm)				
1 < 5	39	1	11	3
5 < 10	8	14	8	3
10 < 26	3	9	7	2
Colony Pigmentation				
Yellow	16	4	11	0
Orange	9	1	4	1
White	6	1	5	5
Beige	19	18	6	2
Catalase Positive	49	20	21	8
Oxidase Positive	46	24	20	8
Na^+ Requirement	47	21	16	4
Strictly respiratory	42	6	12	6
Facultatively anaerobic	8	18	14	2
Motile	45	24	24	8

larger colonies with only 1 strain, or 4%, forming colonies less than 5 mm in diameter. With regards to colony pigmentation, clusters 3 and 5 were represented by 79% and 88% non-pigmented strains, respectively. Of further interest is the fact that all clusters were made up of Na^+ requiring and non Na^+ requiring, oxidative and fermentative and motile and nonmotile strains (except for cluster 5 which was made up entirely of motile isolates).

Table 18 provides a comparison of the Biolog-GN average percent change in optical density values for pigmented and non-pigmented strains from the June and September collection and for those obtained from the ATCC. In general the June strains had the lowest activity levels. The pigmented September strains showed increased activity levels for certain substrates but the non-pigmented September strains showed the highest activity levels for strains isolated from Newfoundland coastal waters. The pigmented and non-pigmented ATCC strains had the highest overall activity levels.

Table 19 provides a comparison of the Biolog average percent change in O.D. values for strains isolated at 5 and 15°C as well as for those of the ATCC. Though the profiles were similar between isolation temperatures, the 15°C isolates showed greater activity for the amino acids and derivatives than the 5°C isolates.

Biolog A1 Control Well Positive Results

Twenty-three of the regional strains and two of the tested reference strains [*Alteromonas espejiana* (29659) and *Flavobacterium okeanokoites* (33414)] consistently gave positive results in the A1 control well of the Biolog-GN Microplate. These were

Table 18. Biolog-GN average percent change in O.D. values for pigmented (P) and non-pigmented (NP) Bay, Newfoundland on June 6 and strains collected from the sediment-water interface in Conception September 15, 1995 as well as profiles for strains obtained from the ATCC.

Group	June		September		ATCC	
Pigmented/Nonpigmented	P	NP	P	NP	P	NP
No. of strains	27	31	20	30	4	31
Polymers						
A2 (α-cyclodextrin)	30	26	31	98	133	73
A3 (dextrin)	80	84	184	359	357	242
A4 (glycogen)	76	92	119	273	186	222
A5 (tween 40)	103	158	166	286	195	328
A6 (tween 80)	26	106	74	249	162	311
Carbohydrates						
A7 (N-acetyl-D-galactosamine)	11	27	5	7	204	179
A8 (N-acetyl-D-glucosamine)	19	61	149	391	102	391
A9 (adonitol)	9	15	8	5	117	93
A10 (L-arabinose)	21	36	25	21	303	261
A11 (D-arabitol)	7	12	6	3	117	131
A12 (cellobiose)	42	43	81	260	286	146
B1 (i-erythritol)	9	10	6	7	121	89
B2 (D-fructose)	51	82	88	169	215	465
B3 (L-fucose)	26	18	12	16	108	52
B4 (D-galactose)	44	52	69	170	204	335
B5 (gentiobiose)	53	68	76	100	335	117
B6 (α-D-glucose)	92	79	142	261	333	505
B7 (m-inositol)	8	7	7	6	106	207
B8 (α-D-lactose)	47	28	37	112	152	74
B9 (lactulose)	34	17	19	23	87	60
B10 (maltose)	89	84	194	391	343	365
B11(D-mannitol)	48	57	41	160	81	293
B12 (D-mannose)	55	45	95	130	328	237
C1 (D-melibiose)	32	11	20	70	265	90
C2 (β-methyl D-glucoside)	31	33	75	34	211	182
C3 (D-psicose)	24	24	14	52	53	98
C4 (D-raffinose)	19	12	16	11	241	97
C5 (L-rhamnose)	20	14	20	13	157	50
C6 (D-sorbitol)	13	13	8	18	7	185
C7 (sucrose)	65	33	69	38	266	362
C8 (D-trehalose)	41	83	133	166	250	340
C9 (turanose)	26	10	34	21	257	243
C10 (xylitol)	7	10	23	6	6	38
Methyl esters						
C11 (methyl pyruvate)	39	58	43	332	234	290
C12 (mono-methyl-succinate)	29	47	23	33	47	154
Carboxylic acids						
D1 (acetic acid)	45	49	45	94	43	123
D2 (cis-aconitic acid)	12	38	9	51	87	416
D3 (citric acid)	11	19	6	27	67	307
D4 (formic acid)	6	10	4	27	26	155
D5 (D-galactonic acid lactone)	5	11	4	7	2	104
D6 (D-galacturonic acid)	13	17	7	11	269	152
D7 (D-gluconic acid)	16	37	32	153	104	351
D8 (D-glucosaminic acid)	12	7	6	8	23	64
D9 (D-glucuronic acid)	16	20	20	29	140	117
D10 (α-hydroxybutyric acid)	9	17	8	6	25	69
D11 (β-hydroxybutyric acid)	13	36	4	19	4	264
D12 (γ-hydroxybutyric acid)	8	10	3	6	4	49
E1 (D-hydroxy phenylacetic acid)	5	15	29	5	179	137

Continued →

Table 18. Continued.

Group	June		Sept		ATCC	
Pigmented/Nonpigmented	P	NP	P	NP	P	NP
No. of strains	27	31	20	30	4	31
E2 (itaconic acid)	42	83	52	61	51	75
E3 (α-keto butyric acid)	23	12	14	22	67	70
E4 (α-keto gluctaric acid)	20	35	12	131	34	320
E5 (α-keto valeric acid)	15	14	7	13	46	47
E6 (D,L-lactic acid)	41	51	39	207	57	437
E7 (malonic acid)	11	19	7	11	20	67
E8 (propionic acid)	34	45	35	72	33	150
E9 (quinic acid)	11	8	5	9	93	109
E10 (D-saccharic acid)	8	10	4	8	43	151
E11 (sebacic acid)	6	9	2	6	4	11
E12 (succinic acid)	17	49	41	121	31	222
Brominated chemicals						
F1 (bromo succinic acid)	5	25	12	37	13	162
Amines						
F2 (succinamic acid)	14	24	19	38	7	107
F3 (glucuronamide)	11	14	8	13	28	23
F4 (alaninamide)	28	15	21	46	9	64
Amino acids and derivatives						
F5 (D-alanine)	7	35	12	137	83	280
F6 (L-alanine)	34	60	74	394	134	382
F7 (L-alanyl-glycine)	33	39	66	345	110	291
F8 (L-asparagine)	14	65	120	306	136	522
F9 (L-aspartic acid)	38	61	86	253	68	320
F10 (L-glutamic acid)	45	71	106	337	285	510
F11 (glycyl-L-aspartic acid)	43	45	72	286	181	193
F12 (glycyl-L-glutamic acid)	56	43	69	341	221	279
G1 (L-histidine)	15	24	9	61	100	198
G2 (hydroxy L-proline)	3	8	3	9	12	161
G3 (L-leucine)	11	42	11	63	45	150
G4 (L-ornithine)	28	19	28	47	76	114
G5 (L-phenylalanine)	7	14	4	13	117	100
G6 (L-proline)	36	51	78	224	248	475
G7 (L-pyroglutamic acid)	13	23	8	22	115	130
G8 (D-serine)	2	9	3	6	3	99
G9 (L-serine)	44	82	71	449	171	505
G10 (L-threonine)	18	33	66	259	59	183
G11 (D,L-carnitine)	7	8	4	6	5	53
G12 (γ-amino butyric acid)	2	17	3	21	103	198
Aromatic chemicals						
H1 (urocanic acid)	9	11	6	28	104	190
H2 (inosine)	15	87	98	369	92	375
H3 (uridine)	25	39	53	238	64	260
H4 (thymidine)	15	39	35	137	53	102
Amides						
H5 (phenyl ethylamine)	3	8	3	5	3	111
H6 (putrescine)	13	30	18	24	73	154
H7 (2-amino ethanol)	3	7	2	4	0	42
Alcohols						
H8 (2,3-butanediol)	10	16	8	6	15	21
H9 (glycerol)	22	45	96	168	240	363
Phosphorylated chemicals						
H10 (D,L-α-glycerol phosphate)	5	6	13	58	15	77
H11 (glucose-1-phosphate)	16	17	29	79	30	112
H12 (glucose-6-phosphate)	10	17	25	74	38	107

Table 19. Biolog-GN average percent change in O.D. values for strains isolated from the sediment-water interface of Conception Bay, Newfoundland on June 6 and September 15, 1995 and incubated at 5 and 15°C.

Group	5°C	15°C	ATCC
No. of strains	48	60	35
Polymers			
A2 (α-cyclodextrin)	53	43	84
A3 (dextrin)	168	182	261
A4 (glycogen)	134	143	216
A5 (tween 40)	180	181	305
A6 (tween 80)	105	130	285
Carbohydrates			
A7 (N-acetyl-D-galactosamine)	24	5	183
A8 (N-acetyl-D-glucosamine)	173	144	342
A9 (adonitol)	12	7	97
A10 (L-arabinose)	27	25	268
A11 (D-arabitol)	8	6	128
A12 (cellobiose)	94	120	170
B1 (i-erythritol)	9	8	95
B2 (D-fructose)	116	85	422
B3 (L-fucose)	21	17	62
B4 (D-galactose)	76	93	313
B5 (gentiobiose)	96	58	155
B6 (α-D-glucose)	145	143	476
B7 (m-inositol)	7	7	190
B8 (α-D-lactose)	53	61	87
B9 (lactulose)	20	26	65
B10 (maltose)	199	181	361
B11(D-mannitol)	98	66	256
B12 (D-mannose)	82	78	253
C1 (D-melibiose)	20	45	120
C2 (β-methyl D-glucoside)	31	49	187
C3 (D-psicose)	26	32	90
C4 (D-raffinose)	13	15	122
C5 (L-rhamnose)	15	18	69
C6 (D-sorbitol)	14	13	154
C7 (sucrose)	69	34	345
C8 (D-trehalose)	84	120	324
C9 (turanose)	21	22	245
C10 (xylitol)	9	12	33
Methyl esters			
C11 (methyl pyruvate)	117	131	281
C12 (mono-methyl-succinate)	41	28	135
Carboxylic acids			
D1 (acetic acid)	56	62	109
D2 (cis-aconitic acid)	32	28	360
D3 (citric acid)	18	16	266
D4 (formic acid)	6	18	133
D5 (D-galactonic acid lactone)	8	6	86
D6 (D-galacturonic acid)	15	11	172
D7 (D-gluconic acid)	55	68	309
D8 (D-glucosaminic acid)	9	8	57
D9 (D-glucuronic acid)	25	19	121
D10 (α-hydroxybutyric acid)	12	9	62
D11 (β-hydroxybutyric acid)	18	21	219
D12 (γ-hydroxybutyric acid)	7	7	41
E1 (D-hydroxy phenylacetic acid)	8	16	144
E2 (itaconic acid)	62	60	71
E3 (α-keto butyric acid)	18	18	70
E4 (α-keto gluctaric acid)	31	70	271
E5 (α-keto valeric acid)	14	12	47
E6 (D,L-lactic acid)	80	95	372
E7 (malonic acid)	12	12	59
E8 (propionic acid)	49	47	130
E9 (quinic acid)	8	9	107
E10 (D-saccharic acid)	9	8	132
E11 (sebacic acid)	6	7	10
E12 (succinic acid)	51	65	189
Brominated chemicals			
F1 (bromo succinic acid)	21	20	136
Amines			
F2 (succinamic acid)	23	26	90
F3 (glucuronamide)	13	11	24
F4 (alaninamide)	24	31	55
Amino acids and derivatives			
F5 (D-alanine)	24	72	246
F6 (L-alanine)	104	180	340
F7 (L-alanyl-glycine)	89	154	260
F8 (L-asparagine)	89	158	455
F9 (L-aspartic acid)	78	138	277
F10 (L-glutamic acid)	111	168	471
F11 (glycyl-L-aspartic acid)	94	131	191
F12 (glycyl-L-glutamic acid)	94	162	269
G1 (L-histidine)	18	38	181
G2 (hydroxy L-proline)	5	7	135
G3 (L-leucine)	40	30	132
G4 (L-ornithine)	26	34	108
G5 (L-phenylalanine)	10	10	103
G6 (L-proline)	49	138	436
G7 (L-pyroglutamic acid)	20	15	128
G8 (D-serine)	6	5	82
G9 (L-serine)	151	184	448
G10 (L-threonine)	50	134	162
G11 (D,L-carnitine)	7	6	45
G12 (γ-amino butyric acid)	8	15	182
Aromatic chemicals			
H1 (urocanic acid)	16	12	176
H2 (inosine)	144	150	327
H3 (uridine)	76	105	226
H4 (thymidine)	60	57	93
Amides			
H5 (phenyl ethylamine)	5	4	93
H6 (putrescine)	18	25	140
H7 (2-amino ethanol)	4	4	35
Alcohols			
H8 (2,3-butanediol)	9	11	20
H9 (glycerol)	61	98	342
Phosphorylated chemicals			
H10 (D,L-α-glycerol phosphate)	7	32	66
H11 (glucose-1-phosphate)	25	45	98
H12 (glucose-6-phosphate)	22	40	95

characterized separately from other strains studied. The data matrices of the presence or absence of a positive response after 96 hours and of the activity levels, after varying incubation times, are recorded in Appendices D and E, respectively. Figure 15 provides the hierarchical classification of the binomial data analysis of these strains. Table 20 provides a summary of the substrates utilized by these strains. As seen for the previously examined dendrograms, there is a gradual increase in substrate utilization as one proceeds from cluster A to E.

Table 21 lists the morphological and physiological features recorded for each of the environmental strains that tested positive in the Biolog control well. Perhaps because of the low Biolog-GN activity levels seen for members of group A, illegitimate gatherings of strains characterized cluster A. Cluster A contained Gram negative and Gram positive strains, catalase and oxidase positive and negative strains, strains having and not having a Na^+ requirement, as well as one strain having a fermentative metabolism and another being nonmotile. Cluster B contained three yellow pigmented isolates, from both the June and September collections, and one orange pigmented organism that did not appear to have a Na^+ requirement. Cluster C strains were all collected in September and shared characteristics most similar to the genus *Vibrio* except for one strain that did not appear to have a Na^+ requirement. Cluster D consisted of three Gram positive strains also isolated with the September collection. Cluster E, consisted of four isolates from the September collection and one type species, *Flavobacterium okeanokoites* (33414).

Figure 15. Hierarchical classification, based on binomial data analysis, of strains yielding a positive response in the control well of the Biolog-GN microplate. The dendrogram was generated using the squared Euclidean distance measure and between-groups linkage (UMPGA) clustering method. The rescaled distance cluster combine units are arbitrary and are based on the sum of the squared presence of characters. Strains were designated: P, pigmented; N, non-pigmented; V, initial isolation temperature 5 °C and XV, initial isolation temperature 15 °C.

Dendrogram using Average Linkage (Between Groups)

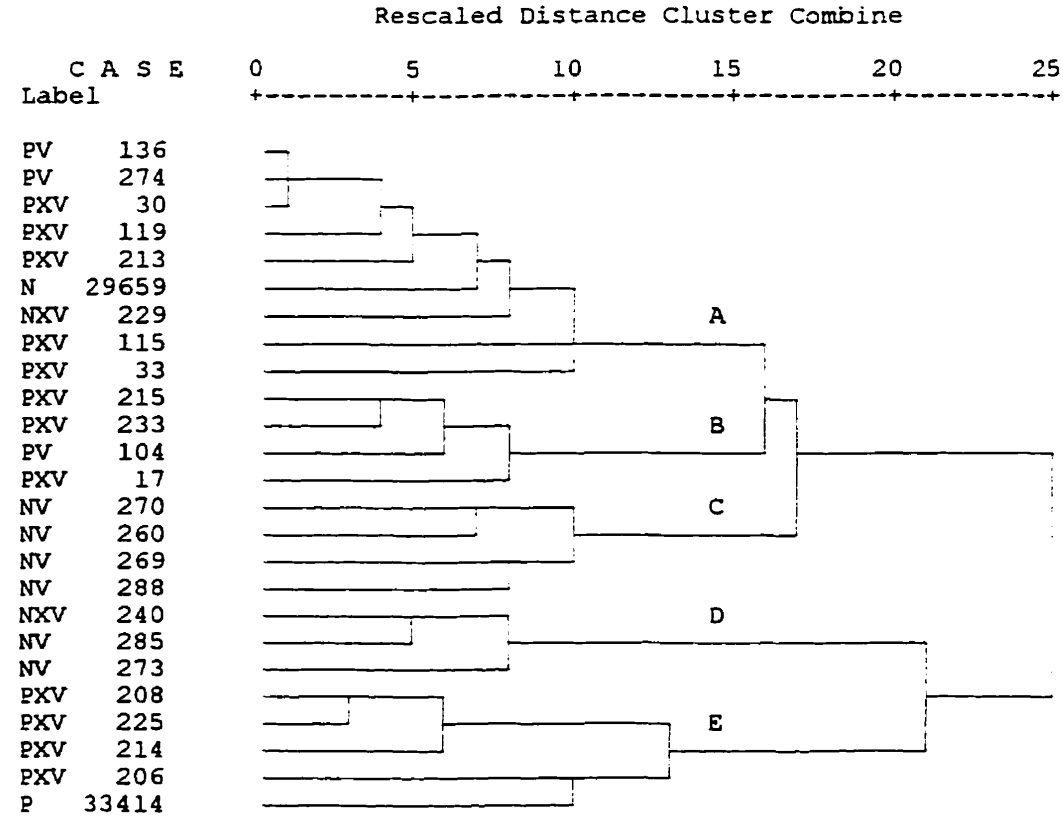


Table 20. Biolog-GN substrate utilization profiles for strains, both environmental and from the ATCC, yielding a positive response in the control well of the micro-plate. Environmental strains were collected from the sediment-water interface in Conception Bay, Newfoundland o June 6 and September 15, 1995.

Cluster	A	B	C	D	E
No. of strains	9	4	4	3	5
Polymers					
A2 (α-cyclodextrin)	-	-	-	-	40
A3 (dextrin)	22	+	+	-	+
A4 (glycogen)	22	75	+	-	+
A5 (tween 40)	67	75	50	+	+
A6 (tween 80)	22	25	50	+	-
Carbohydrates					
A7 (N-acetyl-D-galactosamine)	-	-	-	-	+
A8 (N-acetyl-D-glucosamine)	-	+	+	+	+
A9 (adonitol)	-	-	-	-	40
A10 (L-arabinose)	22	75	-	-	80
A11 (D-arabitol)	-	-	-	+	60
A12 (cellobiose)	-	75	50	-	80
B1 (i-erythritol)	-	-	-	-	40
B2 (D-fructose)	33	+	75	+	+
B3 (L-fucose)	-	-	-	-	+
B4 (D-galactose)	-	+	50	-	+
B5 (gentiobiose)	22	+	25	67	80
B6 (α-D-glucose)	33	+	+	+	+
B7 (m-inositol)	-	-	-	+	20
B8 (α-D-lactose)	-	+	25	-	+
B9 (lactulose)	-	+	-	-	+
B10 (maltose)	22	+	+	33	+
B11(D-mannitol)	22	50	50	+	+
B12 (D-mannose)	-	+	50	33	80
C1 (D-melibiose)	22	+	-	67	+
C2 (β-methyl D-glucoside)	-	+	25	+	+
C3 (D-psicose)	-	25	25	67	+
C4 (D-raffinose)	-	+	-	-	+
C5 (L-rhamnose)	-	25	-	33	+
C6 (D-sorbitol)	-	-	25	+	80
C7 (sucrose)	-	+	25	+	+
C8 (D-trehalose)	-	+	+	+	+
C9 (turanose)	-	+	-	33	+
C10 (xylitol)	-	-	-	67	+
Methyl esters					
C11 (methyl pyruvate)	22	-	75	+	80
C12 (mono-methyl-succinate)	22	25	25	+	80
Carboxylic acids					
D1 (acetic acid)	44	75	25	+	+
D2 (cis-aconitic acid)	22	-	50	+	+
D3 (citric acid)	-	-	25	33	+
D4 (formic acid)	-	-	-	67	80
D5 (D-galactonic acid lactone)	-	-	-	-	80
D6 (D-galacturonic acid)	-	25	-	-	+
D7 (D-gluconic acid)	-	-	50	+	+
D8 (D-glucosaminic acid)	-	25	-	-	+
D9 (D-glucuronic acid)	-	75	25	-	+
D10 (α-hydroxybutyric acid)	-	-	25	+	40
D11 (β-hydroxybutyric acid)	22	-	25	+	40
D12 (γ-hydroxybutyric acid)	-	-	-	-	20
E1 (D-hydroxy phenylacetic acid)	22	-	-	33	40
E2 (itaconic acid)	56	25	-	+	60

Continued →

Table 20. Continued.

Cluster	A	B	C	D	E
No. of strains	9	4	4	3	5
E3 (α-keto butyric acid)	-	-	-	+	40
E4 (α-keto gluctaric acid)	-	25	50	33	80
E5 (α-keto valeric acid)	33	-	-	+	40
E6 (D,L-lactic acid)	-	25	+	+	+
E7 (malonic acid)	22	-	-	33	60
E8 (propionic acid)	33	+	-	+	+
E9 (quinic acid)	-	-	-	+	+
E10 (D-saccharic acid)	-	-	-	-	+
E11 (sebacic acid)	-	-	-	+	-
E12 (succinic acid)	-	-	+	+	40
Brominated chemicals					
F1 (bromo succinic acid)	-	-	75	+	20
Amines					
F2 (succinamic acid)	-	-	25	67	+
F3 (glucuronamide)	-	25	-	33	+
F4 (alaninamide)	-	-	50	+	+
Amino acids and derivatives					
F5 (D-alanine)	-	-	+	+	80
F6 (L-alanine)	22	-	+	+	+
F7 (L-alanyl-glycine)	22	75	+	+	+
F8 (L-asparagine)	-	25	+	+	80
F9 (L-aspartic acid)	-	50	75	67	+
F10 (L-glutamic acid)	-	+	+	+	+
F11 (glycyl-L-aspartic acid)	-	50	+	-	+
F12 (glycyl-L-glutamic acid)	-	+	+	67	80
G1 (L-histidine)	-	75	25	33	40
G2 (hydroxy L-proline)	-	25	-	-	60
G3 (L-leucine)	-	-	75	+	60
G4 (L-ornithine)	-	75	25	-	+
G5 (L-phenylalanine)	-	-	-	+	60
G6 (L-proline)	22	75	+	67	+
G7 (L-pyroglutamic acid)	-	-	-	67	+
G8 (D-serine)	-	-	25	+	60
G9 (L-serine)	22	50	+	+	+
G10 (L-threonine)	-	25	+	+	+
G11 (D,L-carnitine)	-	-	-	-	20
G12 (γ-amino butyric acid)	-	-	-	+	20
Aromatic chemicals					
H1 (urocanic acid)	-	-	-	+	20
H2 (inosine)	-	-	+	-	40
H3 (uridine)	-	-	+	-	20
H4 (thymidine)	-	-	50	33	40
Amides					
H5 (phenyl ethylamine)	-	-	-	33	40
H6 (putrescine)	-	-	-	+	20
H7 (2-amino ethanol)	-	-	-	+	20
Alcohols					
H8 (2,3-butanediol)	-	-	-	67	60
H9 (glycerol)	-	75	75	+	+
Phosphorylated chemicals					
H10 (D,L-α-glycerol phosphate)	-	-	75	-	20
H11 (glucose-1-phosphate)	-	75	50	-	80
H12 (glucose-6-phosphate)	-	-	50	-	80

Symbols: +, 89% or more of the strains are positive: -, 89% or more of the strains are negative. The percentage of positive responses falling within this range are given.

Table 21. Morphological and physiological characteristics of environmental isolates producing a positive reaction in the A1 control well of the Biolog-GN microplate. Isolates are ranked according to that determined after the cluster analysis.

Isolate	Date	Inc.Temp.(C)	Shape	Elevation	Margin	Size (mm)	Surface	Pigment	Cell Shape	Length (µm)	Width (µm)
136	6/6/95	5	Circular	Umbonate	Entire	8.0	Smooth	Orange	Rod	0.9	0.3
274	9/15/95	5	Circular	Convex	Entire	7.0	Smooth	Yellow	Rod	0.7	0.5
30	6/6/95	15	Circular	Convex	Entire	5.7	Smooth	Yellow	Rod	0.6	0.2
119	6/6/95	15	Circular	Convex	Entire	2.5	Smooth	Yellow	Rod	0.9	0.3
213	9/15/95	15	Circular	Convex	Entire	3.0	Smooth	Dk Orange	Rod	3.5	0.3
229	9/15/95	15	Circular	Convex	Entire	3.0	Smooth	White	Rod	2.0	0.5
115	6/6/95	15	Circular	Umbilicate	Entire	2.0	Rough	Yellow	Rod	1.2	0.5
33	6/6/95	15	Circular	Raised	Entire	6.0	Smooth	Dk Orange	Rod	1.1	0.2
215	9/15/95	15	Irregular	Flat	Undulate	6.0	Rough	Yellow	Rod	1.8	0.3
233	9/15/95	15	Irregular	Flat	Lobate	10.0	Rough	Yellow	Rod	2.7	0.4
104	6/6/95	5	Circular	Flat	Filamentous	5.0	Rough	Yellow	Rod	1.4	0.3
17	6/6/95	15	Circular	Convex	Entire	4.5	Smooth	Dk Orange	Rod	0.9	0.4
270	9/15/95	5	Circular	Raised	Entire	9.0	Rough	Beige	Rod	0.8	0.7
260	9/15/95	5	Circular	Raised	Undulate	11.5	Smooth	Beige	Rod	1.0	0.6
269	9/15/95	5	Irregular	Flat	Undulate	21*24	Rough	Beige	Rod	0.7	0.5
288	9/15/95	5	Circular	Raised	Entire	9.0	Smooth	Beige	Rod	1.4	0.5
240	9/15/95	15	Circular	Convex	Entire	3.5	Smooth	Beige	Rod	1.6	0.3
285	9/15/95	5	Circular	Convex	Entire	9.0	Smooth	White	Rod	2.6	1.0
273	9/15/95	5	Circular	Convex	Entire	4.0	Smooth	White	Rod	2.3	0.8
208	9/15/95	15	Circular	Convex	Entire	2.0	Smooth	Dk Orange	Rod	3.9	0.2
225	9/15/95	15	Circular	Convex	Entire	1.5	Smooth	Dk Orange	Rod	3	0.2
214	9/15/95	15	Circular	Convex	Entire	1.5	Smooth	Orange	Rod	3.1	0.2
206	9/15/95	15	Circular	Convex	Entire	2.0	Smooth	Orange	Rod	3.2	0.2

Continued →

Table 21. Continued.

Isolate	Gram	Vanco	Catalase	Oxidase	Na+ Req.	O/F	Motility	TCBS	Biolog ID
136	-	R	+	-	+	O	M		
274	-	R	w	+	-	O	NM	No Growth	
30	-	R	+	-	+	O	M	No Growth	
119	-	R	-	+	+	F	M	No Growth	
213	-	R	w	+	+	O	M	No Growth	*Enterobacter agglomerans* biogroup 2B
229	+	S	+	+	-	O	M		*Acinetobacter radioresistens* /genospcs 12
115	-	R	w	+	+	O	M	No Growth	*Kingella kingae*
33	-	R	-	w	+	O	M		
215	-	R	w	+	+	O	M	No Growth	*Sphingobacterium thalpophilum*
233	-	R	w	+	+	O	M	No Growth	
104	-	R	-	w	+	O	M		CDC Group DF-3
17	-	R	+	+	-	O	M	No Growth	
270	-	R	+	+	+	F	M	Yellow	*Vibrio anguillarum*
260	-	R	+	+	+	F	M	Beige	
269	-	R	+	+	+	F	M	No Growth	*Vibrio*
288	-	R	+	+	-	F	M		
240	+	S	+	-	-	O	M		*Acidovorax*
285	+	S	+	-	-	O	M		
273	+	S	+	-	-	O	M		*Acidovorax*
208	-	R	+	+	+	O	M		
225	-	R	+	+	+	O	M		*Sphingobacterium mizutaii*
214	-	R	+	+	+	O	M		
206	-	R	+	+	+	O	M		

Symbols: Dk, Dark; Vanco, vancomycin (5 μg); R, resistant; S, sensitive; w, weak; O, oxidative; F, fermentative; M, motile; NM, nonmotile.

DISCUSSION

This study has addressed several questions about the characteristics of bacteria from the sediment-water interface of a seasonally-cold ocean. One of these was whether or not optimal recovery of the bacteria would be achieved by incubating the organisms at the environmental temperature at the time of sampling or at a temperature selective for psychrophilic or psychrotrophic bacteria. Morita (1975) defined psychrophilic organisms as those with an optimal growth temperature at about 15°C or lower, a maximal growth temperature at about 20°C, and a minimal growth temperature at 0°C or lower. Psychrotrophic organisms are similar to psychrophiles but have a higher temperature optimum. The results showed that 70 to 80% more of the viable bacterial population, determined by plate counting, was recovered when samples were incubated at 15°C rather than at 5°C. This shows a psychrotrophic population. Had the population been psychrophilic the numbers of culturable bacteria should have been the same at both incubation temperatures. For the June sampling, when the *in situ* temperature was 4.5°C, bacteria were 4 times more abundant when the plates were incubated at 15°C than at 5°C. For the September sampling, when the *in situ* temperature was 13°C, bacteria were 6 times more abundant when the plates were incubated at 15°C than at 5°C. Apparently, the bacteria were less stressed at 15°C, even when the ambient seasonal temperature was 4.5°C.

Newfoundland coastal-waters have been studied by several investigators interested in microbial processes at low temperatures. Gow and Mills (1984) established that the

region can support a psychrophilic and psychrotrophic bacterial population. Martin-Kearley and Gow (1994) found that most of the regional strains grew at temperatures associated with psychrotrophs, while a small proportion may have been psychrophiles. The present study shows a psychrotrophic bacterial population, at least during late spring and summer.

Bouvy and Delille (1988), Delille *et al.* (1988), and Delille (1993) have shown that temperature seems to have only a limited influence on bacterial populations in the Antarctic Ocean. Delille (1993) is of the opinion that a large majority of Antarctic bacterial strains are psychrotrophic as opposed to being truly psychrophilic. Hauxhurst *et al.* (1981), for bacterial populations from the Gulf of Alaska, found that most marine bacteria were quite tolerant of fluctuations in temperature beyond the limits to which they are naturally exposed. They concluded that it is an adaptive advantage to tolerate physiological stress beyond the range to which the habitat is subjected.

When incubated at 15°C, between 1.1 and 3.2% of the bacteria present, as determined by direct counts, could be cultured. It is known that only a small fraction of the natural microflora can be isolated on plating medium and that the greater part is not cultured. It is still an open question whether or not the uncultured portion consists of unknown bacteria with special growth requirements, or of cells that become permanently or transiently uncultivable under oligotrophic conditions, and remain in a starved but viable state (Rüger and Tan, 1992). Even though recovery is always low, the organisms that grow may include those species which are dominant. Powell *et al.* (1987) showed a

correlation between viable bacteria, determined by plating, and activity, determined by the heterotrophic potential method, for bacteria from Newfoundland coastal waters. Rehnstam *et al.* (1993) used techniques involving molecular biology to show that single species-sequence types of bacteria can dominate, at least in the pelagic realm. They believe that the dominant bacteria can be cultured and used in studies to help elucidate the physiological and biochemical bases of the adaptation of bacteria within the ocean environment. In samples from the Baltic Sea, the North Sea (Skagerrak), and the Northeastern Mediterranean Sea, Zweifel and Hagström (1995) found that up to 70% of the bacteria did not have nucleoids and therefore are inactive cells incapable of growing on the plating medium. The remaining bacterium-sized, or shaped, particles included in total counts may be cell residues of virus-lysed bacteria or remains of protozoan grazing. This could account, in part, for the low plating efficiency.

The results of the study showed that the total average bacterial numbers, determined by epifluorescence, were approximately the same for both sampling dates. The average number of viable cells, determined by plate counting, was approximately 2 to 4 times higher in June than in September depending upon the incubation temperature used to grow the bacteria. These numbers are probably more noteworthy for their similarities than their differences. There have been only a few studies of bacteria at the sediment-water interface and there is little information about what numbers should be expected. In a study of the pelagic zone of Conception Bay, Powell *et al.* (1987) reported average plate counts for spring and summer that were two orders of magnitude less than observed here for the

sediment-water interface. Total counts by epifluoresence were about 30 times less. Novitsky (1983*a*), in his study of Halifax Harbour, reported that the numbers and activities of bacteria in the water column were two to three orders of magnitude less than those of bacteria at the sediment-water interface. These observations suggest that the values for bacterial numbers, obtained in the present study, are reasonable.

Once cultures grow, they must be maintained. Based on an earlier comparison study by Mills (1982) of isolation media for enumeration of marine bacteria from the coastal waters of Newfoundland, modified Lib X medium was selected for the initial isolation of cells in this study. Generally, cell counts from plates increase significantly when a low-nutrient medium is used (Schut *et al.*, 1993). According to previous work in this area, Noble (1984) improved recovery by initially isolating on a low nutrient medium and then subculturing on a more nutrient rich medium. In the study presented here, the bacteria were isolated on modified Lib X medium, containing 1 g/L of yeast extract (Difco) and 1 g/L trypticase peptone (BBL) and then subcultured on the more nutrient rich Lib X medium containing 1.2 g/L of yeast extract and 2.3 g/L of trypticase peptone. Upon subculturing, between 50 and 70% of the strains isolated were maintained. The higher success rate was for strains isolated in September. Generally, the pigmented bacteria were more difficult to maintain than were the non-pigmented bacteria. This is common and has been reported in other studies. Hauxhurst *et al.* (1980) found that pigmented marine bacteria were difficult to maintain and that up to 70% were lost upon subculturing. Kaneko *et al.* (1979) and Hauxhurst *et al.* (1980) noted the requirement of

vitamins and growth factors for some strains in their studies. Vitamins, or growth factors, may be needed for optimal growth of some bacteria from this region as well. Although it was not investigated in depth, it was observed, that only a small number of strains were able to grow well on TSA medium, supplemented with artificial seawater, as opposed to Lib X medium. Lib X medium contains a much broader variety of vitamins, in greater quantities, than does TSA medium (Rohde, 1968). It was also observed, but not studied in depth, that only a small number of strains were able to grow well on Biolog's Universal Growth Medium (BUGM). This made BUGM unsuitable for the cultivation of bacteria from this region. The composition of BUGM medium is not listed on the product.

Clear separation of genera based on the use of arithmetically defined key features was not achieved by Kaneko *et al.* (1979) and Hauxhurst *et al.* (1980) until colony pigmentation, growth at different concentrations of NaCl, temperatures, and pH values were considered. As mentioned in the Introduction, pigmentation can protect bacteria against the lethal effects of solar radiation. Kaneko *et al.* (1979) also found a high percentage of pigmented bacteria in Beaufort Sea water and sediment samples; with as much as 77% of the 4°C water isolates and 68% of the 20°C sediment samples being pigmented. Hauxhurst *et al.* (1980) found a high incidence of diverse pigmented bacteria, 44% of the total isolates, in the Northeast Gulf of Alaska. In this study, a large proportion of the bacterial strains obtained were pigmented with most being isolated at 15°C, regardless of the ambient temperature of collection. It is possible that the orange and yellow pigmentation is an adaptive protective mechanism for these bacteria.

In this study, several isolates grew well on Lib X medium but did not metabolize substrates in the Biolog microplates. Rüger and Krambeck (1994) found sediment bacteria from the Greenland Sea that grew well on different carbon sources, but showed no positive results in Biolog microplates, similar to some of the results of this study. At the same time they were able to isolate a strain that gave a positive result in all of the substrate wells including the negative control. The failure of some bacterial strains to produce any response in the Biolog microplates suggests that the microplate environment is selective (Rüger and Krambeck, 1994; Zak *et al.*, 1994; Haack *et al.*, 1995). Bacteria which produce no response in the Biolog microplates may do so because the cells fail to maintain viability or because they do not use the substrate. In contrast, some strains were efficient enough to utilize the Biolog basal medium to give uniformly positive responses for all carbon substrates. The Biolog instruction manual does mention that false positive or negative results may be produced by oligotrophic bacteria. The manufacturer suggests that color in the substrate blank well could be due to spore formation in the wells, cell lysis, or utilization of endogenous or extracellular storage polymers. The manufacturer also suggests that particular growth media may be required to elicit a Biolog response from bacterial genera. This may explain why *Alteromonas espejiana*, *Flavobacterium okeanokoites* and some of the regional strains gave positive results in all of the wells including the control well. In the study presented here, the group of bacteria that gave uniformly positive results were studied separately from the rest of the bacteria. However, they made up about 17% of the strains studied.

Very few data have been collected on truly obligately oligotrophic marine bacteria. In fact, it is not even clear whether a boundary line between oligotrophic and eutrophic bacteria exists at all. Eutrophic organisms can be readapted to become obligate oligotrophs, and obligate oligotrophs can be converted into facultative oligotrophs (Schut *et al.*, 1993). Schut *et al.* (1993) have observed an unspecified adaptation to form colonies on solid medium containing higher nutrient concentrations for all their obligately oligotrophic cultures. The exact nutritional and physiological requirements of oligobacteria are not yet known. Obvious problems arise when attempting to use the Biolog system for oligobacterial strains. The computerized data base was generated using classical bacterial isolates from tissues, air, soil, water, etcetera. The compounds selected for identification are those used as substrates by these classical bacteria and their suitability for oligobacteria is unknown (Clancy and Cimini, 1991).

The predominance of non-fermentative Gram-negative rods in marine bacterial assemblages is recognized for temperate and tropical areas (Bianchi, 1981; Simidu *et al.*, 1980) and for higher latitudes (Hauxhurst *et al.*, 1981; Delille, 1993). Noble (1984), in his study of the pelagic and epibenthic bacteria of Newfoundland coastal waters, found that the epibenthic region predominantly consisted of oxidative bacteria belonging to the genera *Flavobacterium*, *Pseudomonas* and *Alteromonas*. With the exception of the genus *Flavobacterium*, these bacteria also occurred in the overlying waters. The study presented here confirms the predominance of oxidative bacteria at the sediment-water interface.

Hauxhurst *et al.* (1980) compared strains isolated from the Northeastern and Northwestern Gulf of Alaska. They observed that cold-ocean bacterial communities were nutritionally diverse. Hauxhurst *et al.* (1981) suggested that it would be of adaptive advantage if a diverse, nutritionally versatile population was maintained. Noble *et al.* (1990) in their study of the bacteria in the pelagic zone and at the sediment-water interface of coastal Newfoundland waters found that the population at the sediment-surface was more diverse than that of the pelagic zone. Although some pelagic and benthic strains were fastidious, most utilized a broad range of substrates. They stated that this was most evident among, although not restricted to, the marine pseudomonads of the benthos. If in cold waters the surface layer of the sediment is an important zone for detrital breakdown, the bacteria may be growing on biodegradation products that are more readily available in this region.

Approximately 80% of the strains studied were able to grow on the medium prepared without added NaCl. The most notable exceptions were the pigmented bacteria. Generally, Na^+ requirement is not a determinative characteristic of *Flavobacterium*, although these organisms may be common to marine and other salt-water ecosystems. Noble *et al.* (1990) suggested that, because *Flavobacterium* belongs to an ancient phylogenetic unit, the evolution of Na^+ dependency in groups of marine bacteria, such as *Vibrio* and *Pseudomonas*, may have occurred while flavobacteria were established residents of the marine environment. *Cytophaga* and *Flavobacterium* can be readily confused and further work is needed to firmly establish the identity of the pigmented

bacteria (Gherna and Woese, 1992). The Na^+ requirement of the strains that grew on the basal medium, containing 138 μg Na^+, will have to be verified. Further testing of these strains for growth under incubation conditions with even less contaminating levels of Na^+ would be desirable.

Although not used in this study, radio-labeled glucose and glutamic acid are often used to measure heterotrophic activity, through the determination of the amount of added organic substrate taken up in a unit of time. In this study, according to the results of the Biolog system, their utility for determining heterotrophic activity might be questioned because only 66% of all cultured strains utilized glucose and 62% utilized glutamic acid. Considering the alternatives, however, they were among the most widely utilized substrates on the Biolog microplate. They may, therefore, be the most appropriate choices for these studies as long as the percentage of the population actually taking them up is considered.

Again, although not used in this study, radio-labeled leucine and thymidine (TdR) are useful for determining heterotrophic growth rate through their incorporation into protein and DNA, respectively. According to the Biolog profiles obtained, these were poorly utilized by the pigmented bacteria relative to that of the non-pigmented bacteria. Overall, 38% of the strains (17% of the pigmented strains and 54% of the non-pigmented strains) utilized thymidine while only 20% utilized leucine. For the determination of heterotrophic growth rates such low utilization values are favorable. If radio-labeled substrates are being respired by growing cells, their use in estimating microbial growth

rates would underestimate the true microbial production.

Determination of the extent of TdR catabolism has become an important component of the TdR method. To circumvent this problem, several purification procedures have been developed to isolate the DNA fraction although differences in the degree of TdR catabolism reported can be traced to differences in the extraction method used (Chin-Leo, 1997). If the percentage of the total TdR that is incorporated into DNA is constant in a given system, it may not be necessary to perform the DNA isolation for every sample. According to the strains studied with the Biolog system, thymidine catabolism for June and September was approximately 34 and 43%, respectively. Researchers planning to use the TdR method in the area of this study, then, may need to perform DNA isolation for each sample over time. For a review of the rationale, advantages and disadvantages of using radio-labeled substrates for the determination of bacterial growth rates see Chin-Leo (1997).

One of the most informative studies about marine pigmented bacteria is that of Kaneko *et al.* (1979). Out of 316 strains of bacteria isolated from near-shore waters of the Beaufort Sea, 156 grouped in seven clusters that contained mostly pigmented bacteria. Ninety-three percent of these pigmented bacteria were found in five out of 17 clusters. Of these, 124 strains, found in three clusters, were fastidious and used few carbon compounds as sole sources of carbon and energy. The failure to detect as many compounds that could be used as carbon and energy sources as were detected in the present study may have been a result of the method used. Classical methods, where the

organism must grow on plating medium containing the substrate, may not be as sensitive as using a Biolog plate. Also the wells of Biolog plates contain low levels of other nutrients that may affect the results.

Kaneko *et al.* (1979) isolated twenty-one pigmented strains that were not fastidious. They were found relatively evenly distributed between two clusters. Twelve strains of these bacteria, found in one cluster, grew on most of the approximately 70 organic compounds tested. A further nine strains grew on about a third of the substrates tested. In this respect these strains resembled the pigmented strains studied by Noble *et al.* (1990). About 35% of the benthic bacterial population, that they described, was pigmented and these bacteria utilized a variety of substrates as sole sources of carbon and energy.

The Biolog system is easy to use and is well suited for both numerical taxonomic purposes and for the diversity studies of bacterial communities. Incorrect identifications and identifications that change with incubation time detract from the system's usefulness, however. Part of the difficulty in reliable identification of organisms could be alleviated by testing for motility, oxidation/fermentation, Na^+ requirement, cytochrome oxidase and catalase tests when the microplate is inoculated. In combination with these supplementary tests the Biolog system has proven to be well suited for biochemical characterization of environmental isolates (Rüger and Krambeck, 1994).

The degree to which a particular substrate is utilized can be quantified by measuring the intensity of the colour change caused by incorporation of tetrazolium dye

into a respiring culture. Each Biolog microplate yields a specific pattern of activities representing the functional attributes of the inoculated bacterium with respect to a suite of substrates (Bochner, 1989*a*). If the values for all substrate-containing wells are analysed by multivariate statistics, two types of distinctions between samples can be made. The presence or absence of a positive response to each of the 95 substrates or to groups of substrates (e.g. polymers) can be recorded. Secondly, when the same substrates are utilized by different communities, samples with consistently high values for certain substrates can be segregated by multivariate statistical procedures from those with consistently lower values for the same substrates.

Transforming data into binomial form invariably results in a loss of information. This approach works well with Biolog data if the interest is in whether or not a substrate is utilized by a particular strain or group of strains. Different isolates, however, may utilize substrates to differing extents. It was, therefore, decided to cluster the isolates using standardized levels of activity as measured by the Biolog MicroStation™ Reader. The resulting clusters were not significantly different from those produced using the binomial data. Despite this, however, the September isolates had a slightly higher activity level than did the June isolates. This may explain the better percent recovery upon subculturing for these strains as compared with the June strains.

The SPSS Professional statistical package was used extensively in this study. It provided many classification analysis options, plus ordination procedures and plotting routines, and was therefore particularly useful for determining whether the presumed

groups, or clusters, of samples were "robust" in that they are revealed by quite different classification methods. Concerning classification strategies used in this study, it is important to distinguish between the cluster-generating methods on the one hand, which are useful for imposing an initial class structure on the data, and discriminant-type methods on the other hand for the allocation of new sampling units to a number of defined groups. In the field of microbiology there has been a greater emphasis on the development and implementation of techniques that fit into the first category, while the application of discriminant-type methods for assignment has largely been restricted on a statistical basis. The reason for this is that microbial data invariably fail to satisfy the assumptions of multivariate normality and equality of covariance matrices that discriminant-type procedures such as canonical analysis often require (Bradfield and Orlóci, 1975). Despite these shortcomings, however, it was found that discriminant analysis was useful in classifying cases, confirming class memberships established using cluster analysis, and in identifying interesting characteristics in the data. In terms of the utilization profiles, discriminant analysis was able to detect differences for the June and September, 5 and 15°C, and pigmented and non-pigmented strains. After reviewing the raw data, however, these differences were not considered significant enough to indicate different populations or significantly different substrate utilizations.

The results showed that there were significant differences between the regional strains and most of the reference cultures. The reference strains were selected because they represent genera normally reported for marine ecosystems. On the basis of the

Biolog results, the reference cultures were more closely related to each other than they were to the regional strains. The majority of the reference strains were found to be more metabolically active and utilized a broader range of substrates than did the regional strains. Most of the ATCC reference strains were initially isolated from temperate regions, therefore it is not surprising that they, for the most part, grouped separately from the strains isolated from the marine ecosystem off Newfoundland. Additionally, these strains have been in culture and are possibly quite adapted to laboratory culture conditions an media. The fact that they had a tendency to cluster together, with respect to the regional strains, may be an artifact of the test system.

Besides simply identifying unknown microbes, the Biolog system also yields useful and practical metabolic information. In this study, for instance, it was found that a greater percentage of pigmented bacteria utilized D-mannose, which might aid in the development of growth media for these microorganisms. If a significantly greater number of pigmented bacteria utilized a particular substrate more so than the non-pigmented strains, the Biolog system could have then provided information for the development of a selective enrichment medium for these organisms. This is mentioned here to illustrate the potential that the Biolog system offers to the microbial ecologist.

No single method gives a complete picture of the structure and activity of microbial communities in nature. Determining bacterial numbers microscopically, or following the fate of nutrients and other chemical compounds in the habitat, does not yield enough details about the microorganisms involved in ecological processes. Analyses of

natural microbial populations by ribosomal RNA sequences, low molecular weight RNA profiles, or DNA hybridization requires the use of standards from pre-identified bacteria and offers no information about the metabolic activity of the organisms. As a result, isolating and cultivating the bacteria and further characterizing them *in vitro* is still important (Rüger and Tan, 1992). The study presented here showed that the microflora of the sediment-water interface near Newfoundland is dominated by oxidative Gram-negative rods. Approximately half of the isolates cultured were pigmented, with the greatest recovery obtained after incubation at 15°C regardless of the *in situ* ambient temperature. Strains recovered gave a diverse range of substrate utilization profiles with most being characterized as fastidious for both the June and September collections.

CONCLUSIONS

1. The functional diversity of marine bacteria from the sediment-water interface of Newfoundland coastal-waters was characterized. Although some benthic strains utilized a broad range of substrates many were considered fastidious. Bacteria with a strictly respiratory metabolism predominated at the sediment-water interface.
2. Close to 50% of the colonies that grew during incubation at 15°C incubation were pigmented while a much lower percentage were obtained at 5°C.
3. Approximately 80% of the strains isolated, mostly non-pigmented strains, required Na^+ for growth. The medium used to demonstrate Na^+ requirement may have

contained sufficient background levels of Na^+ to permit the growth of these bacteria. Further examination is necessary to definitively determine their requirements.

4. The Biolog method was easy to use and produced data rich in information about the functional biodiversity of bacteria. There was no functional difference in the substrates utilized for strains at each sampling date (June or September), incubation temperature (5 or 15°C), or between pigmented and non-pigmented bacteria found at the sediment-water interface.

5. According to the Biolog assay, strains were more metabolically active in September than in June.

6. Although not used in this study, radio-labeled thymidine and leucine are often used to determine bacterial biomass. According to the Biolog system, of the strains reported here, 38% (17% of the pigmented strains and 54% of the non-pigmented strains) utilized thymidine and only 20% utilized leucine. Low utilization figures are encouraging because if radio-labeled substrates are being respired by growing cells, their use in estimating microbial growth rates would underestimate the true microbial production occurring in a given region. Utilization rates were found to vary between sampling dates and between pigmented and non-pigmented organisms such that a greater underestimation would be expected in September, especially if non-pigmented bacteria are abundant.

7. The results showed that there were significant differences between the regional

strains and most of the reference cultures. The reference strains were found to be more metabolically active and utilized a broader range of substrates than did the regional strains.

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APPENDIX A

Morphological and physiological characteristics of environmental isolates collected from the sediment-water interface of Newfoundland coastal-waters. Symbols: Dk, dark; Vanco, vancomycin (5 μm); S, sensitive; w, weak; O, Oxidation; F, fermentation; F*, phenol red metabolized, M, motile; NM, nonmotile; floc, flocculent growth; ring, ring of growth adhering to flask; prec, growth forming a precipitate; 1, slight growth; 3, fair growth; 5, good growth.

Strain	Date	Inc Temp (C)	Shape	Elevation	Margin	Size (mm)	Surface	Pigment	Cell Shape	Length (µm)	Width (µm)	Gram	Vanco	Catalase	Oxidase	Na+ Req.	OF	Motility	Broth	TCBS
1	6/6/95	15	Circular	Convex	Entire	3 8	Smooth	Orange											3	
2	6/6/95	15	Circular	Convex	Entire	3 8	Smooth	Yellow											floc	
3	6/6/95	15	Circular	Umbonate	Undulate	3 0	Rough	Or/Yell	Rod	1 0	0 5	-		+	+	+	O	NM	floc	No growth
4	6/6/95	15	Circular	Raised	Entire	6 0	Smooth	Lt Yellow											3	
5	6/6/95	15	Circular	Convex	Entire	3 5	Smooth	Beige	Rod	2	0 6	-		+	+	+	O	M	floc 1	
6	6/6/95	15	Circular	Raised/Flat	Entire	4 0	Rough	Beige											1	
7	6/6/95	15	Irregular	Umbonate	Undulate	17*15	Rough	Beige	Rod	1 4	0 6	-		+	+	+	O	M	floc	No growth
8	6/6/95	15	Circular	Raised	Undulate	8 5	Smooth	Yellow												
9	6/6/95	15	Circular	Raised	Entire	7 5	Smooth	White	Cocci	0 8		-		+	+	+	O	M	1	
10	6/6/95	15	Circular	Convex	Entire	2 3	Smooth	Yellow											floc	
11	6/6/95	15	Circular	Raised	Entire	2 5	Smooth	Beige	Rod	0 6	0 5	-		w	+	+	O	M	1	No growth
12	6/6/95	15	Irregular	Raised	Undulate	3*3	Rough	Beige	Rod	0 8	0 7	-		+	+	+	O	M	1	No growth
13	6/6/95	15	Irregular	Flat	Lobate	18*13 5	Rough	Yellow	Rod	2 3	1 0	-		+	-	-	F	M	1	
14	6/6/95	15	Irregular	Raised	Undulate	5 5*4	Rough	Beige	Rod	1	0 3	-		+	+	+	F	M	1	
15	6/6/95	15	Circular	Convex	Entire	3 5	Smooth	Lt Orange	Rod	0 9	0 5	-		+	w	+	O	M	floc	
16	6/6/95	15	Circular	Convex	Undulate	3 2	Smooth	Lt Orange											3	
17	6/6/95	15	Circular	Convex	Entire	4 5	Smooth	Dk Orange	Rod	0 9	0 4	-	R	+	+	-	O	M	floc	No growth
18	6/6/95	15	Circular	Convex	Entire	5 1	Smooth	Orange	Rod	1 8	0 4	-		+	+	+	F	M	3	
19	6/6/95	15	Circular	Convex	Entire	4 5	Smooth	Yellow	Rod	1	0 5	-		+	+	+	O	M	5	
20	6/6/95	15	Circular	Raised	Entire	6 6	Smooth	Lt Yellow												
21	6/6/95	15	Circular	Raised	Entire	4 0	Smooth	White											ring	
22	6/6/95	15	Circular	Convex	Entire	2 2	Smooth	Yellow											floc 1	
23	6/6/95	15	Circular	Raised	Undulate	6 0	Rough	Purple											3	
24	6/6/95	15	Circular	Convex	Entire	1 5	Smooth	White	Rod	0 9	0 3	-		+	+	+	O	M	3	
25	6/6/95	15	Circular	Pulvinate	Entire	2 8	Smooth	Yellow											floc	
26	6/6/95	15	Circular	Raised	Undulate	6 0	Rough	White	Rod	1 0	0 8	-		+	+	+	O	M	1	
27	6/6/95	15	Circular	Umbonate	Entire	3 2	Smooth	Lt Beige												
28	6/6/95	15	Circular	Convex	Entire	2 5	Smooth	Yellow											1	
29	6/6/95	15	Circular	Convex	Entire	1 4	Smooth	Orange											floc 1	
30	6/6/95	15	Circular	Convex	Entire	5 7	Smooth	Yellow	Rod	0 6	0 2	-	R	+	-	+	O	M	floc 1	No growth
31	6/6/95	15	Circular	Umbonate	Entire	7 0	Smooth	Cl Yellow												
32	6/6/95	15	Irregular	Convex	Undulate	8*7	Smooth	White	Cocci	0 9		-		+	-	+	F	M	3	
33	6/6/95	15	Circular	Raised	Entire	6 0	Smooth	Dk Orange	Rod	1 1	0 2	-	R	-	w	+	O	M	5	
34	6/6/95	15	Circular	Convex	Undulate	3 0	Smooth	Or/Yell				-							floc	
35	6/6/95	15	Circular	Umbonate	Entire	4 5	Rough	Yell/Or	Rod	1 1	0 7	-		+	+		O	M	floc 1	
36	6/6/95	15	Circular	Convex	Entire	5 0	Smooth	Lt Yellow	Rod	0 9	0 4	-		+	+	+	O	M	floc 1	
37	6/6/95	15	Circular	Umbonate	Entire	3 0	Smooth	Cl Yellow											ring	
38	6/6/95	15	Circular	Raised	Entire	4 0	Smooth	Beige	Rod	0 6	0 3	-		+	+	+	O	M	3	
39	6/6/95	15	Circular	Flat	Lobate	19 0	Rough	White	Rod	1 0	0 8	-		+	+	+	F	M	1	
40	6/6/95	15	Circular	Convex	Entire	1 2	Smooth	White											1	
41	6/6/95	15	Circular	Pulvinate	Entire	2 5	Smooth	Yellow											ring	
42	6/6/95	5	Circular	Umbonate	Entire	2 5	Smooth	White	Rod	0 9	0 3	-		+	w	+	O	M	floc 1	
43	6/6/95	5	Irregular	Raised	Lobate	9*6	Smooth	White	Rod	1 7	0 5	-		-	w	+	F	M	floc	
44	6/6/95	5	Circular	Convex	Entire	1 0	Smooth	Orange	Rod	0 8	0 2	-		w	+	-	O		3	
45	6/6/95	5	Circular	Convex	Entire	2 5	Smooth	Orange				-							3	
46	6/6/95	5	Circular	Convex	Entire	2 0	Smooth	Yellow	Rod	1 5	0 6	-		-	+	-	F	M	floc	
47	6/6/95	5	Circular	Convex	Entire	1 5	Smooth	Yell/Or											1	
48	6/6/95	5	Circular	Convex	Entire	1 5	Smooth	Dk Orange											floc	
49	6/6/95	5	Circular	Pulvinate	Entire	1 5	Mucoid	Yellow											1 floc	
50	6/6/95	5	Circular	Convex	Entire	2 5	Smooth	White											prec	
51	6/6/95	5	Circular	Convex	Entire	1 8	Smooth	White											1 floc	
52	6/6/95	5	Circular	Convex	Entire	1 2	Smooth	Orange											floc	
53	6/6/95	5	Circular	Raised	Entire	4 5	Smooth	Clear											1	
54	6/6/95	5	Circular	Convex	Entire	2 0	Smooth	Yellow											1	
55	6/6/95	5	Circular	Convex	Entire	2 5	Smooth	Dk Yellow	Rod	0 9	0 4	-		+	-	+	O	M	1	
56	6/6/95	5	Circular	Umbonate	Entire	2 0	Smooth	White											floc	
57	6/6/95	5	Circular	Umbonate	Entire	2 0	Smooth	White	Rod	1 0	0 6	-		w	+	+	O	M	floc/ring	
58	6/6/95	5	Irregular	Raised	Entire	10*10 2	Smooth	Beige	Rod	0 9	0 5	-		+	+	-	F	M	prec	
59	6/6/95	5	Circular	Umbonate	Entire	2 4	Smooth	White	Rod	1 1	0 3	-		+	+	+	O	M	floc 1	
60	6/6/95	5	Circular	Convex	Entire	2 0	Smooth	White											1	
61	6/6/95	5	Circular	Pulvinate	Entire	1 7	Smooth	Orange											floc	
62	6/6/95	5	Circular	Convex	Entire	4 5	Smooth	Dk Yellow											1	
63	6/6/95	5	Circular	Convex	Entire	2 0	Smooth	Yellow	Rod	1 0	0 4	-		w	+	+	O	M	floc	
64	6/6/95	5	Circular	Convex	Entire	3 5	Smooth	Yellow	Rod	0 9	0 4	-		+	+	+	O	NM	1	
65	6/6/95	5	Circular	Pulvinate	Entire	1 8	Smooth	Yellow											1	

Strain	Date	Inc Temp.(C)	Shape	Elevation	Margin	Size (mm)	Surface	Pigment	Cell Shape	Length (µm)	Width (µm)	Gram	Vanco	Catalase	Oxidase	Na+ Req	OF	Motility	Broth	TCBS
66	6/6/95	5	Circular	Pulvinate	Entire	1 3	Smooth	Lt Orange	Cocci	0 8		-		+	-	+	F	M	floc	
67	6/6/95	5	Circular	Convex	Entire	1 5	Smooth	Yellow	Rod	0 9	0 3	-		+	+	+	O	M	1/floc	
68	6/6/95	5	Circular	Raised	Entire	5 0	Smooth	White											floc	
69	6/6/95	5	Circular	Convex	Entire	1 8	Smooth	Orange											floc	
70	6/6/95	5	Circular	Convex	Entire	2 2	Smooth	White	Rod	1 0	0 4	-		w	+	+	O	M	3	
71	6/6/95	5	Circular	Convex	Entire	2 6	Smooth	Lt Orange											floc	
72	6/6/95	5	Circular	Convex	Entire	3 8	Smooth	Beige	Rod	0 8	0 3	-		-	+	+	O	M	3/floc	
73	6/6/95	5	Circular	Convex	Entire	1 2	Smooth	Lt Yellow											3	
74	6/6/95	5	Circular	Convex	Entire	3 8	Smooth	Yellow	Rod	1 3	0 3	-		+	+	+	O	M	3	
75	6/6/95	5	Circular	Convex	Entire	3 0	Smooth	Yellow											1	
76	6/6/95	5	Circular	Umbonate	Entire	3 8	Smooth	White	Rod	1 5	1 0	-		+	+	-	O	M	3	
77	6/6/95	5	Irregular	Convex	Entire	2 2*2 8	Smooth	Yellow											3	
78	6/6/95	5	Circular	Convex	Entire	6 4	Rough	Beige	Rod	1 0	0 6	-		+	+	-	O	M	5	
79	6/6/95	5	Circular	Convex	Entire	2 0	Smooth	Yell/Or											1	
80	6/6/95	5	Circular	Convex	Entire	1 3	Smooth	Lt Yellow											floc	
81	6/6/95	5	Circular	Convex	Entire	2 7	Smooth	Lt Orange	Rod	1 3	0 3	-		+	+	+	O	M	floc	
82	6/6/95	5	Circular	Convex	Entire	2 5	Smooth	Yellow											floc	
83	6/6/95	5	Irregular	Raised	Undulate	9 2*7 5	Rough	White				-		-	+		F	M	1/ring	
84	6/6/95	5	Circular	Umbonate	Entire	2 2	Smooth	White											prec	
85	6/6/95	5	Circular	Convex	Entire	3 0	Smooth	Yellow	Rod	0 6	0 3	-		w	+		F	M	3	
86	6/6/95	5	Circular	Convex	Entire	6 0	Smooth	Yellow	Rod	0 9	0 3	-		w	+	+	O	M	5	
87	6/6/95	5	Circular	Raised	Erose	4 5	Rough	Yellow	Rod	1 1	0 2	-		+	+	+	O	M	floc/1	
88	6/6/95	5	Irregular	Raised	Undulate	9*11	Rough	Beige	Rod	1 1	0 3	-		+	+	+	F	M	1/floc	
89	6/6/95	5	Circular	Raised	Entire	3 0	Smooth	Yellow	Rod	1 3	0 4	-		w	w	-	F	NM	1	No growth
90	6/6/95	5	Circular	Convex	Entire	2 0	Smooth	Orange											floc	
91	6/6/95	15	Circular	Convex	Entire	2 0	Smooth	Yellow											floc	
92	6/6/95	15	Circular	Convex	Entire	6 5	Smooth	Yellow	Rod	0 8	0 5	-		+	+	+	O	NM	floc	
93	6/6/95	15	Circular	Convex	Entire	7 0	Smooth	Yellow											1/floc	
94	6/6/95	15	Circular	Convex	Entire	4 0	Smooth	Yellow	Rod	0 9	0 3	-		+	+	+	O	M	1	
95	6/6/95	15	Circular	Convex	Entire	3 2	Smooth	Orange												
96	6/6/95	15	Circular	Convex	Entire	2 0	Smooth	Beige	Rod	1	0 4	-		+	+	+	O	M	prec	No growth
97	6/6/95	15	Irregular	Convex	Undulate	9*8	Smooth	Beige	Rod	1 1	0 5	-		w	+	+	O	M	5	
98	6/6/95	5	Circular	Flat	Entire	4 5	Smooth	White												
99	6/6/95	5	Circular	Convex	Lobate	2 0	Bumpy	Lt Beige	Rod	1 0	0 3	-		+	-	-	O	M	3	
100	6/6/95	5	Circular	Raised	Entire	4 3	Smooth	Beige	Rod	1 2	0 4	-		+	+	-	O	M	3	
101	6/6/95	5	Circular	Flat	Entire	9 0	Smooth	Beige	Rod	1 0	0 4	-		-	+	+	F	M	3	
102	6/6/95	5	Circular	Convex	Entire	4 5	Smooth	Beige												
103	6/6/95	5	Circular	Flat	Entire	5 5	Smooth	Beige	Rod	1 0	0 3	-		-	+	+	O	M	3	
104	6/6/95	5	Circular	Flat	Filamentous	5 0	Rough	Yellow	Rod	1 4	0 3	-	R	-	w	+	O	M	floc/3	
105	6/6/95	5	Circular	Convex	Entire	6 2	Smooth	Yellow	Rod	0 6	0 5	-		-	+	+	O	M	3	
106	6/6/95	15	Circular	Umbonate	Entire	6 5	Smooth	Yellow	Rod	1 2	0 3	-		+	-	-	O	M	3	
107	6/6/95	15	Circular	Convex	Entire	3 0	Smooth	Orange	Rod	0 7	0 3	+	S						floc	
108	6/6/95	15	Circular	Convex	Entire	2 0	Smooth	Orange	Rod	3 2	1 6	-		+	w	-	O	NM	floc	No growth
109	6/6/95	15	Circular	Umbonate	Umbonate	8 0	Mucoid	Beige	Rod	1 1	0 5	-		-	+	+	O	M	5	
110	6/6/95	15	Circular	Umbonate	Entire	5 5	Smooth	White	Rod	0 8	0 5	-		w	+	+	-	NM	1	
111	6/6/95	15	Circular	Umbonate	Entire	6 5	Smooth	White											floc	
112	6/6/95	15	Circular	Convex	Entire	2 2	Smooth	Yellow	Rod	0 9	0 3	-		-	+	+	O	M	floc 1	
113	6/6/95	15	Circular	Flat	Lobate	7 5	Rough	Beige	Rod	2 3	1	-		-	-	-	F	M	1	No growth
114	6/6/95	15	Circular	Pulvinate	Undulate	2 0	Rough	Orange											1	
115	6/6/95	15	Circular	Umbilicate	Entire	2 0	Rough	Yellow	Rod	1 2	0 5	-	R	w	+	+	O	M	1	No growth
116	6/6/95	15	Circular	Convex	Entire	3 5	Smooth	Dk Orange	Rod	0 7	0 6	-		+	-	+	O	M	3	
117	6/6/95	15	Circular	Flat	Entire	6 0	Rough	Orange											1	
118	6/6/95	15	Circular	Raised	Entire	3 5	Smooth	Yellow											1	
119	6/6/95	15	Circular	Convex	Entire	2 5	Smooth	Yellow	Rod	0 9	0 3	-	R	-	+	+	F	M	1	No growth
120	6/6/95	15	Circular	Convex	Entire	3 0	Smooth	Orange												
121	6/6/95	15	Circular	Raised	Entire	2 5	Smooth	Beige	Rod	0 8	0 4	-		+	+	-	O	M	1	
122	6/6/95	15	Circular	Convex	Entire	2 2	Smooth	Yellow											floc	
123	6/6/95	15	Circular	Convex	Entire	4 5	Smooth	Yellow											3 floc	
124	6/6/95	15	Circular	Convex	Entire	3 0	Smooth	Orange											5	
125	6/6/95	15	Circular	Raised	Undulate	4 0	Rough	Beige	Rod	1 2	0 5	-		+	+	+	O	NM	3	
126	6/6/95	15	Circular	Convex	Entire	2 5	Smooth	Yellow											1	
127	6/6/95	15	Circular	Pulvinate	Undulate	2 0	Rough	Orange											1	
128	6/6/95	15	Circular	Raised	Entire	3 0	Smooth	Orange											3	
129	6/6/95	15	Circular	Convex	Entire	4 0	Smooth	Dk Orange	Rod	1 1	0 3	+		+	+	+	F	M	floc 1	
130	6/6/95	15	Circular	Pulvinate	Entire	2 0	Rough	Orange											floc	

Strain	Date	Inc Temp (C)	Shape	Elevation	Margin	Size (mm)	Surface	Pigment	Cell Shape	Length (µm)	Width (µm)	Gram	Vanco	Catalase	Oxidase	Na+ Req	OF	Motility	Broth	TCBS
131	8/8/95	15	Circular	Convex	Entire	1 5	Smooth	Yellow											floc	
132	8/8/95	15	Circular	Raised	Undulate	11 5	Rough	Beige											floc	
133	8/8/95	5	Circular	Convex	Entire	4 5	Smooth	Yellow											floc	
134	8/8/95	5	Circular	Convex	Entire	4 0	Smooth	Orange											1	
135	8/8/95	5	Circular	Convex	Entire	2 5	Smooth	White											floc	
136	8/8/95	5	Circular	Umbonate	Entire	8 0	Smooth	Orange	Rod	0 9	0 3	-	R	+	-	+	O	M	5	
137	8/8/95	5	Circular	Umbonate	Entire	3 0	Smooth	White	Rod	0 8	0 5	-		+	+	+	O	M	1	
138	8/8/95	5	Circular	Pulvinate	Entire	2 0	Rough	Orange	Rod	0 8	0 3	-		+	+	+	O	M	1	
139	8/8/95	5	Circular	Convex	Entire	5 0	Smooth	Orange											3	
140	8/8/95	5	Circular	Convex	Entire	2 0	Smooth	Orange	Rod	0 8	0 5	-		+	+	+	O	NM	1	
141	8/8/95	5	Circular	Convex	Entire	2 0	Smooth	Yellow											1	
142	8/8/95	5	Circular	Umbonate	Entire	3 0	Rough	Beige												
143	8/8/95	5	Circular	Raised	Entire	6 0	Rough	Orange	Rod	1 8	0 3	-		-	w	+	F	M	3	
144	8/8/95	5	Circular	Convex	Entire	2 2	Smooth	Yellow											floc	
145	8/8/95	5	Circular	Convex	Entire	2 2	Smooth	Lt Yellow											floc	
146	8/8/95	5	Circular	Convex	Entire	2 0	Smooth	Orange											3	
147	8/8/95	5	Circular	Convex	Entire	2 5	Smooth	Lt Yellow											1 floc	
148	8/8/95	5	Circular	Convex	Entire	2 0	Rough	Orange											1	
149	8/8/95	5	Circular	Raised	Undulate	10 0	Smooth	Beige											3	
150	8/8/95	5	Circular	Convex	Entire	4 0	Smooth	Yellow											1	
151	8/8/95	5	Circular	Convex	Entire	5 0	Smooth	Orange											1	
152	8/8/95	5	Circular	Convex	Entire	3 0	Smooth	Yellow	Rod	0 7	0 3	-		-	+		O	M	5	
153	8/8/95	5	Circular	Convex	Entire	3 0	Smooth	Lt Yellow	Rod	0 9	0 5	-		-	+		O	M	floc	
154	8/8/95	5	Circular	Convex	Entire	2 0	Smooth	Yellow											1	
155	8/8/95	5	Circular	Umbonate	Entire	3 0	Rough	Beige	Rod	0 8	0 3	-		+	+	+	O	M	1	No growth
156	8/8/95	5	Circular	Flat	Entire	6 0	Smooth	White											floc	
157	8/8/95	5	Circular	Convex	Entire	5 0	Smooth	Yellow											floc	
158	8/8/95	5	Circular	Raised	Entire	3 0	Rough	Yell/Or	Rod	1 5	0 5	-		+	+	+	O	M	ring	
159	8/8/95	5	Circular	Pulvinate	Entire	2 0	Rough	Orange											floc 1	
160	8/8/95	5	Circular	Convex	Entire	2 0	Smooth	White												
161	8/8/95	5	Circular	Convex	Entire	2 5	Smooth	Lt Yellow											floc	
162	8/8/95	5	Circular	Convex	Entire	2 0	Smooth	Dk Orange	Rod	0 9	0 3	-		+	+	+	O	M	floc	
200	9/15/95	15	Circular	Flat	Entire	3 5	Rough	Dk Orange	Rod	3 6	0 5	-		+	+	+	O	M	1	
201	9/15/95	15	Irregular	Convex	Undulate	4 0	Smooth	Beige	Rod	3 5	0 3	-		+	w	+	F	M	3	
202	9/15/95	15	Circular	Flat	Lobate	11 5	Rough	Beige	Rod	1 1	0 8	-		+	+	+	F	M	3	
203	9/15/95	15	Circular	Convex	Entire	2 8	Smooth	Beige												
204	9/15/95	15	Circular	Flat	Entire	7 0	Rough	Beige	Rod	1 5	0 3	-		+	+	-	F	M	1	
205	9/15/95	15	Circular	Convex	Entire	6 5	Smooth	Yellow	Rod	1 7	0 2	-		+	+	+	O	M	3	
206	9/15/95	15	Circular	Convex	Entire	2 0	Smooth	Orange	Rod	3 2	0 2	-	R	+	+	+	O	M	1	
207	9/15/95	15	Circular	Convex	Entire	4 0	Smooth	Yell/Or	Rod	0 8	0 3	-		+	+	+	F	M	floc/3	
208	9/15/95	15	Circular	Convex	Entire	2 0	Smooth	Dk Orange	Rod	3 9	0 2	-	R	+	+	+	O	M	3	
209	9/15/95	15	Circular	Flat	Lobate	15 0	Rough	Beige	Rod	1 1	0 3	-		+	+	+	F	M	3	
210	9/15/95	15	Circular	Flat	Lobate	12 5	Rough	Beige	Rod	1 0	0 7	-		+	+	-	O	M	3	
211	9/15/95	15	Irregular	Raised	Lobate	10 0	Rough	Beige	Rod	1 4	0 3	-		+	+	+	F	M	5	
212	9/15/95	15	Circular	Flat	Lobate	18 0	Rough	Beige	Rod	1 1	0 5	-		+	+	+	F	M	5	
213	9/15/95	15	Circular	Convex	Entire	3 0	Smooth	Dk Orange	Rod	3 5	0 3	-	R	w	+	+	O	M	3	No growth
214	9/15/95	15	Circular	Convex	Entire	1 5	Smooth	Orange	Rod	3 1	0 2	-	R	+	+	+	O	M	1	
215	9/15/95	15	Irregular	Flat	Undulate	6 0	Rough	Yellow	Rod	1 8	0 3	-	R	w	+	+	O	M	floc	No growth
216	9/15/95	15	Circular	Umbonate	Entire	5 0	Smooth	Lt Yellow	Rod	0 9	0 3	-		+	-	-	O	M	3	
217	9/15/95	15	Circular	Convex	Entire	3 0	Smooth	Dk Yellow				-		+	+	+	F	M	floc	
218	9/15/95	15	Circular	Convex	Entire	2 5	Smooth	Yellow	Rod	1 2	0 5	-		w	+	+	F	M	floc	
219	9/15/95	15	Irregular	Raised	Undulate	11 0	Smooth	Beige	Rod	0 8	0 2	-		+	+	+	O	M	3	
220	9/15/95	15	Circular	Convex	Entire	3 5	Smooth	Dk Orange	Rod	1 1	0 2	-		+	w	+	F	M	floc	
221	9/15/95	15	Circular	Convex	Entire	4 0	Smooth	Dk Yellow	Rod	0 9	0 2	-		w	+	+	F	M	floc	
222	9/15/95	15	Circular	Convex	Entire	1 5	Smooth	Pink				-		+	+	+	O	M	3	
223	9/15/95	15	Circular	Convex	Entire	3 0	Smooth	Lt Yellow	Rod	1 5	0 3	-		w	+	+	O	M	3	
224	9/15/95	15	Circular	Raised	Entire	2 5	Smooth	Beige	Rod	1 2	0 5	-	R	w	+	+	O	M	1	
225	9/15/95	15	Circular	Convex	Entire	1 5	Smooth	Dk Orange	Rod	3	0 2	-		+	+	+	O	M	1	
226	9/15/95	15	Circular	Flat	Entire	8 5	Rough	White	Rod	1 5	0 5	-		+	+	+	F	M	3	
227	9/15/95	15	Circular	Flat	Undulate	5 5	Rough	Beige	Rod	1 5	0 3	-		+	+	+	O	M	3	
228	9/15/95	15	Circular	Convex	Entire	2 5	Smooth	Yellow	Rod	0 9	0 3	-		+	+	-	O	M	1	Beige
229	9/15/95	15	Circular	Convex	Entire	3 0	Smooth	White	Rod	2	0 5	+	S	+	+	-	O	M	3	
230	9/15/95	15	Circular	Raised	Entire	3 0	Smooth	Dk Orange	Rod	2 6	0 2	-		+	+	+	O	M	3	
231	9/15/95	15	Irregular	Flat	Lobate	25 0	Rough	Yellow	Rod	2 5	0 3	-		w	+	+	O	M	3	
232	9/15/95	15	Circular	Flat	Entire	19 0	Smooth	Lt Yellow	Rod	1 6	0 5	-		+	+	+	F	M	3	

Strain	Date	Inc Temp (C)	Shape	Elevation	Margin	Size (mm)	Surface	Pigment	Cell Shape	Length (µm)	Width (µm)	Gram	Vanco	Catalase	Oxidase	Na+ Req	OF	Motility	Broth	TCBS
233	9/15/95	15	Irregular	Flat	Lobate	10 0	Rough	Yellow	Rod	2 7	0 4	-	R	w	+	+	O	M	5	
234	9/15/95	15	Irregular	Flat	Lobate	14 0	Rough	Yellow	Rod	3 4	0 2	-		w	+	+	F	M	3	
235	9/15/95	15	Circular	Convex	Entire	3 0	Smooth	Lt Orange				-		+	+	+	O	M	3	
236	9/15/95	15	Circular	Raised	Lobate	8 0	Rough	Yellow	Rod	1 1	0 8	-		+	+	-	O	M	5	
237	9/15/95	15	Circular	Flat	Entire	8 5	Rough	Beige	Rod	1 9	0 4			+	+	-	F	M	3	
238	9/15/95	15	Circular	Raised	Lobate	18 5	Smooth	Beige	Rod	1 0	0 4	-		+	+	+	F	M	3	
239	9/15/95	15	Circular	Raised	Entire	11 5	Rough	Beige	Rod	1 5	0 4	-		+	+	+	F	M	3	
240	9/15/95	15	Circular	Convex	Entire	3 5	Smooth	Beige	Rod	1 6	0 3	+	S	+	-	-	O	M	3	
241	9/15/95	15	Circular	Convex	Entire	4 0	Smooth	Beige	Rod	1 3	0 4	-		+	-	+	F	M	3	
242	9/15/95	15	Circular	Convex	Entire	6 0	Smooth	Yellow	Rod	1 5	0 4			+	+	+	F	M	3	
243	9/15/95	15	Circular	Pulvinate	Entire	1 5	Smooth	Yellow	Rod	1 2	0 2	-		w	+	+	O	M	1	
244	9/15/95	15	Irregular	Raised	Lobate	5 0	Smooth	Beige	Rod	1 7	0 3			+	+	+	O	M	5	
245	9/15/95	15	Circular	Flat	Entire	3 0	Smooth	Beige	Rod	1 4	0 3	-		+	+	+	O	M	3	
246	9/15/95	15	Circular	Flat	Entire	1 5	Rough	Dk Orange	Rod	1 3	0 3			+	+	+	O	M	1	
247	9/15/95	5	Circular	Convex	Entire	5 0	Smooth	Yell/Or												
248	9/15/95	5	Circular	Convex	Entire	7 0	Smooth	Yell/Or												
249	9/15/95	5	Circular	Pulvinate	Entire	2 2	Smooth	Yell/Or												
250	9/15/95	5	Irregular	Convex	Entire	8 0	Rough	Beige	Rod	1 0	0 5	-		+	+	+	F*	M	floc	
251	9/15/95	5	Circular	Raised	Entire	11 5	Smooth	Beige	Cocci	0 5		-		+	+	+	F	M	floc	Yellow
252	9/15/95	5	Circular	Pulvinate	Entire	3 0	Smooth	Yellow												
253	9/15/95	5	Circular	Umbonate	Entire	6 5	Rough	Yellow												
254	9/15/95	5	Circular	Raised	Entire	10 5	Rough	Beige	Rod	0 9	0 3	-		+	+	+	O	M	floc	
255	9/15/95	5	Circular	Convex	Entire	3 0	Smooth	Orange												
256	9/15/95	5	Circular	Raised	Entire	6 0	Smooth	Beige	Rod	0 9	0 4	-		+	+	+	O	M		
257	9/15/95	5	Circular	Flat	Undulate	10 5	Smooth	Beige	Rod	1 0	0 4	-		+	+	+	O	M		
258	9/15/95	5	Irregular	Flat	Undulate	10*13	Rough	Yellow	Rod	1 3	0 5	-		+	+	+	F	M	3	Yellow
259	9/15/95	5	Irregular	Raised	Entire	5*9	Smooth	White	Rod	0 8	0 3	-		-	+	+	O	M		
260	9/15/95	5	Circular	Raised	Undulate	11 5	Smooth	Beige	Rod	1 0	0 6	-	R	+	+	+	F	M	5	Beige
261	9/15/95	5	Irregular	Flat	Undulate	15*23	Rough	Beige	Rod	1 1	0 3	-		+	+	+	F*	M	1	Beige
262	9/15/95	5	Circular	Convex	Entire	4 0	Smooth	White	Rod	1 3	1 0	-		+	+	-	F	M		
263	9/15/95	5	Irregular	Raised	Undulate	4*7	Rough	Beige	Rod	0 7	0 2			+	+	+	F*	M	3	
264	9/15/95	5	Circular	Convex	Entire	1 0	Smooth	Yellow												
265	9/15/95	5	Circular	Raised	Entire	8 0	Rough	Yellow	Rod	1 2	0 3	-		+	+	+	F	M	3	Beige
266	9/15/95	5	Irregular	Raised	Entire	5*7	Rough	Beige												
267	9/15/95	5	Circular	Convex	Entire	3 5	Smooth	Orange												
268	9/15/95	5	Circular	Convex	Entire	6 0	Smooth	Beige												
269	9/15/95	5	Irregular	Flat	Undulate	21*24	Rough	Beige	Rod	0 7	0 5	-	R	+	+	+	F	M		No growth
270	9/15/95	5	Circular	Raised	Entire	9 0	Rough	Beige	Rod	0 8	0 7	-	R	+	+	+	F	M	3	Yellow
271	9/15/95	5	Circular	Convex	Entire	1 0	Smooth	White	Rod	0 7	0 5			+	+	+	F	M	3	Yellow
272	9/15/95	5	Circular	Flat	Entire	2 5	Smooth	Beige												
273	9/15/95	5	Circular	Convex	Entire	4 0	Smooth	White	Rod	2 3	0 8	+	S	+	-	-	O	M		
274	9/15/95	5	Circular	Convex	Entire	7 0	Smooth	Yellow	Rod	0 7	0 5	-	R	w	+	-	O	NM	3	No growth
275	9/15/95	5	Circular	Pulvinate	Entire	3 5	Smooth	Orange												
276	9/15/95	5	Circular	Convex	Entire	3 0	Smooth	Yell/Or												
277	9/15/95	5	Circular	Convex	Entire	7 0	Smooth	Orange												
278	9/15/95	5	Circular	Umbilicate	Entire	9 0	Rough	White	Rod	0 8	0 5	-		+	+	+	F	M	1	
279	9/15/95	5	Circular	Convex	Entire	4 0	Smooth	Yellow												
280	9/15/95	5	Circular	Convex	Entire	2 0	Rough	White				-		+	+	+	O	M		
281	9/15/95	5	Circular	Convex	Entire	2 0	Smooth	Yellow												
282	9/15/95	5	Circular	Convex	Entire	4 0	Smooth	Dk Orange												
283	9/15/95	5	Irregular	Raised	Undulate	8*10	Rough	Dk Orange	Rod	1 3	0 3	-		+	+	-	F*	M	1	
284	9/15/95	5	Circular	Convex	Entire	1 5	Smooth	Beige												
285	9/15/95	5	Circular	Convex	Entire	9 0	Smooth	White	Rod	2 6	1	+	S	+	-	-	O	M	3	
286	9/15/95	5	Circular	Convex	Entire	3 5	Smooth	Dk Orange												
287	9/15/95	5	Circular	Convex	Entire	4 0	Rough	Yellow	Rod	1 1	0 3	-		+	+	+	O	M		
288	9/15/95	5	Circular	Raised	Entire	9 0	Smooth	Beige	Rod	1 4	0 5	-	R	+	+	-	F	M		
289	9/15/95	5	Circular	Convex	Entire	4 0	Smooth	Beige	Rod	0 5	0 3	-		+	+	+	O	M		
290	9/15/95	5	Circular	Convex	Entire	4 0	Smooth	Orange												

Symbols: Dk, Dark; Vanco, vancomycin (5 µg); R, resistant; S, sensitive; w, weak; O, oxidative; F, fermentative; F*, phenol red metabolized; M, motile; NM, nonmotile; floc, flocculent growth; ring, ring of growth adhering to flask; prec, growth forming a precipitate; 1, slight growth; 3, fair growth; 5, good growth.

APPENDIX B

Data matrix of the Biolog-GN test results for 108 regional strains from the sediment-water interface of Newfoundland coastal waters and 35 reference strains obtained from the ATCC. The presence or absence of a positive response after 96 hours incubation at 20°C to each of the 95 substrates was recorded as 1 and 0 respectively.

Strain (96h incubation)	A2 (α -cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 ((D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)	B5 (gentiobiose)	B6 (α -D-glucose)	B7 (m-inositol)	B8 (α-D-lactose)	B9 (lactulose)	B10 (maltose)	B11(D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (β-methyl D-glucoside)	C3 (D-psicose)
3	0	0	1	1	0	0	0	1	0	0	0	0	0	1	0	1	1	1	0	0	1	0	1	0	1	1
5	0	0	1	1	0	0	0	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0
7	0	0	1	1	0	0	0	0	1	0	0	0	1	1	1	0	0	0	1	1	1	0	0	0	1	1
9	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
12	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	1	1	1	1	0	0	1	0	0	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	0
14	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
18	0	1	1	1	0	0	1	0	0	0	1	0	1	0	1	1	1	0	0	0	1	1	1	1	1	1
19	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0
32	0	1	1	1	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	1
36	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0
38	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	1	0	1	1	1	0	0	1	1	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0
42	0	1	1	1	0	0	1	1	1	1	0	1	1	0	1	0	1	0	1	0	1	1	1	0	0	0
43	1	1	1	1	0	0	1	0	1	0	1	0	1	1	0	1	1	0	0	0	1	1	1	1	1	1
46	1	1	1	1	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	1	0	1	0	0	0
55	0	0	1	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	1	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
58	0	1	1	1	1	0	1	0	0	0	1	0	1	0	1	1	1	0	1	0	1	1	1	0	1	1
59	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	0	1	0	0	0	1	0	1	1	1	0
64	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0
67	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	1	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
72	0	0	1	1	0	0	0	0	1	1	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0
74	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0
78	1	0	1	1	1	1	1	1	1	1	0	0	1	0	0	1	0	0	0	1	0	0	0	0	1	1
81	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
86	0	0	1	1	0	0	0	1	1	0	0	0	1	0	0	1	1	1	1	1	1	0	0	0	0	1
88	0	1	1	1	0	0	1	1	1	0	1	0	1	1	1	1	1	0	1	0	1	1	0	1	1	1
89	0	1	1	0	0	0	0	0	0	0	1	0	1	1	1	1	1	0	1	1	1	0	1	0	1	0
92	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
94	0	0	1	1	0	0	0	0	1	0	0	0	0	1	0	1	1	1	0	0	1	1	1	0	0	0
96	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Strain (96h incubation)	A2 (α -cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 ((D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)	B5 (gentiobiose)	B6 (α -D-glucose)	B7 (m-inositol)	B8 (α-D-lactose)	B9 (lactulose)	B10 (maltose)	B11(D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (β-methyl D-glucoside)	C3 (D-psicose)
97	0	0	1	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0
99	0	1	1	1	1	0	0	0	0	0	1	0	1	1	1	1	1	0	0	0	1	1	1	0	0	1
100	0	0	1	1	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
101	1	1	1	1	1	1	1	0	0	0	0	0	1	0	1	0	1	0	0	0	1	0	1	0	0	1
103	0	0	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	1	1	1	1	0	1	1	0	0	0	0	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0
106	0	1	1	1	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0	1	1	1	0	0	1
108	0	0	1	1	1	0	0	0	0	1	0	0	1	0	1	1	1	0	0	0	1	0	1	0	1	0
109	1	1	1	1	1	0	1	0	0	0	1	0	1	0	0	1	1	0	0	0	1	0	0	0	0	0
113	0	1	1	1	0	0	1	0	1	0	1	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1
116	0	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
121	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
125	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
137	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
138	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0
140	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0
143	0	1	1	1	1	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	1	1	0	1	0	1
155	1	0	1	1	1	0	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
158	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
162	0	1	1	1	0	0	1	0	0	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1
200	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
201	0	1	1	1	1	0	1	0	0	0	0	0	1	1	1	0	1	0	0	1	1	0	0	0	0	0
202	0	1	1	1	1	0	1	0	0	0	1	0	1	0	1	0	1	0	1	1	1	1	1	1	0	1
204	0	1	1	1	1	0	1	0	1	0	0	0	0	1	1	0	1	0	0	0	1	0	0	0	0	1
205	0	1	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
206	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
207	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0
209	0	1	1	1	1	0	1	0	0	0	1	0	1	0	1	1	1	0	1	0	1	1	1	1	1	1
210	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
211	1	1	1	1	1	0	1	0	0	0	1	1	1	1	0	1	1	0	0	0	1	0	0	0	1	0
212	0	1	1	1	1	0	1	0	0	0	1	0	1	0	1	0	1	0	1	0	1	1	1	1	0	1
216	0	1	1	1	1	1	1	0	0	0	1	0	1	0	1	1	1	0	0	0	1	1	1	0	1	0
218	0	1	0	1	1	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	1	0	1	0	1	0
219	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
220	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0
221	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0
223	0	0	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
224	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
226	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Strain (96h incubation)	A2 (α -cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 ((D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)	B5 (gentiobiose)	B6 (α -D-glucose)	B7 (m-inositol)	B8 (α-D-lactose)	B9 (lactulose)	B10 (maltose)	B11(D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (β-methyl D-glucoside)	C3 (D-psicose)
227	0	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
228	0	0	0	1	1	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0	0	1	1	0	0	0
230	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
231	1	1	1	1	0	0	0	0	1	0	1	0	1	1	0	1	1	0	1	1	1	0	1	1	1	1
232	1	1	1	1	1	0	1	0	1	0	0	1	0	1	1	0	1	0	1	0	1	0	0	0	1	0
233	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	1	0	0
234	0	1	1	1	0	0	1	0	1	0	1	0	1	0	1	1	1	1	1	1	1	0	1	1	1	1
236	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
237	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
238	0	1	1	1	1	0	1	0	0	0	1	0	1	0	1	0	1	0	1	0	1	1	1	0	0	1
239	0	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	1	0
241	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
242	1	1	1	1	0	0	1	0	1	0	0	0	1	1	0	1	1	0	1	1	1	0	1	1	1	0
243	0	1	1	1	1	0	1	0	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1
244	1	1	1	1	1	0	1	0	0	0	1	0	1	1	1	1	1	0	0	0	1	0	0	0	1	0
245	0	0	1	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
246	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
250	1	1	1	1	1	1	1	0	0	0	1	1	1	0	0	1	1	0	0	0	1	0	0	0	1	0
251	0	1	1	1	1	0	1	0	0	0	1	0	1	0	1	1	1	0	1	0	1	1	1	1	0	1
254	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
256	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
257	1	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	1	0	0	0	1
258	1	1	1	1	1	0	1	0	0	0	1	0	1	0	1	1	1	0	1	0	1	1	1	0	0	1
259	1	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1
261	0	0	0	1	1	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	1
262	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
263	1	1	1	1	1	0	1	0	1	0	1	0	1	1	0	1	1	0	0	0	1	0	0	0	0	0
265	1	1	1	0	0	0	1	0	0	0	0	0	1	0	1	1	1	0	1	0	1	0	1	0	0	0
271	0	1	1	1	1	0	1	0	0	0	1	0	1	0	1	1	1	0	1	0	1	1	1	1	0	1
278	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0
283	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
289	0	1	1	1	1	0	0	0	1	0	1	0	1	0	1	1	1	0	0	0	1	1	1	0	0	1
7708	1	1	1	1	1	0	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	0	1	0	1	1
8071	1	0	0	1	1	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
10144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
11040	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
14393	1	1	1	1	1	0	1	0	0	1	0	1	1	0	0	1	1	1	0	0	1	1	1	0	1	1
17749	1	1	1	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
19260	0	1	1	1	1	0	0	0	1	0	1	0	1	1	0	1	1	0	0	0	1	1	1	0	0	1

Strain (96h Incubation)	A2 (α -cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 ((D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)	B5 (gentiobiose)	B6 (α -D-glucose)	B7 (m-inositol)	B8 (α-D-lactose)	B9 (lactulose)	B10 (maltose)	B11(D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (β-methyl D-glucoside)	C3 (D-psicose)
19323	0	1	1	1	1	1	1	0	1	0	0	0	1	1	1	1	1	1	0	0	1	1	1	1	1	1
19326	1	1	1	1	0	1	0	0	1	0	1	0	1	0	1	1	1	0	1	1	1	0	1	1	1	0
23597	0	1	1	1	1	0	0	0	0	1	0	1	1	0	1	0	1	1	0	0	1	1	0	1	1	1
25374	1	1	1	1	1	0	0	0	0	1	0	1	1	1	1	0	1	1	0	0	1	1	1	0	1	1
25521	1	1	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	1	0	0	1	0	1	1	0	1
25915	0	1	1	1	1	1	1	0	0	0	0	0	1	0	1	1	1	0	0	0	1	0	1	0	0	1
27118	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1
27119	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
27122	1	1	1	1	1	0	1	0	0	1	0	1	1	0	1	1	1	0	0	0	1	0	0	1	1	1
27123	1	0	0	1	0	0	0	1	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	1
27124	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
27125	0	1	1	1	1	0	1	0	0	0	0	1	1	0	1	1	1	0	0	0	1	0	0	1	1	1
27126	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
27128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
27130	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27132	0	1	1	1	1	0	0	0	0	1	0	1	1	0	1	0	1	1	0	0	1	1	1	1	1	1
27562	0	0	0	1	1	0	1	1	1	1	0	1	1	0	1	0	1	1	0	0	0	1	1	0	0	0
27593	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0
27950	1	1	1	1	1	0	0	0	1	0	0	0	1	0	0	1	1	0	0	0	1	0	1	0	1	0
29570	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
29659	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33127	1	1	1	1	1	0	0	0	1	1	0	0	1	0	0	1	1	1	0	0	1	0	1	0	1	1
33414	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
33539	1	1	1	1	1	1	1	0	1	0	1	0	1	0	1	1	1	0	0	0	1	0	1	0	1	1
33653	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	0	1	1
35016	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1
35084	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	0	1	0	1	1	1	1	1	1
35912	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1
51192	1	0	0	1	1	1	1	0	0	0	0	1	1	1	0	0	1	0	0	0	0	0	0	1	0	1
51288	1	1	1	1	1	0	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	0	1	1	1

Strain (96h Incubation)	C4 (D-raffinose)	C5 (L-rhamnose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	C1 (acetic acid)	D2 (cis-aconitic acid)	D3 (citric acid)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (α-hydroxybutyric acid)	D11 (β-hydroxybutyric acid)	D12 (γ-hydroxybutyric acid)	E1 (p-hydroxy phenylacetic acid)	E2 (itaconic acid)	E3 (α-keto butyric acid)	E4 (α-keto gluctanc acid)	E5 (α-keto valeric acid)
3	1	1	1	1	1	1	0	0	1	1	0	1	0	0	1	1	1	0	0	0	0	0	0	1	0	0
5	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
7	0	1	0	1	1	0	0	1	0	1	1	1	0	0	0	0	0	1	1	1	0	0	1	1	1	0
9	0	1	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	1	1	0	0	1	0	0	0
11	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1
12	0	1	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0
13	1	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	1	1	0	1	1	1	0	0	0	0	0	1	0	0	0	1	0	0	1	1	0	1
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
26	0	1	0	0	0	0	0	1	1	1	1	0	0	1	0	0	0	0	1	1	0	0	1	0	1	0
32	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
36	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	1	0	0	1	1	1	1	1	0	0	0	0	1	0	0	1	0	0	1	0	1	1
42	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	1	0	1	1	1	1	0	1	0	0	0	0	0	0	1	1	0	1	0	0	0	0	1	0	1	1
46	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0
57	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0
58	0	1	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
63	0	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
70	0	1	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	1	1	0	0	1
72	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	0	0	0	1	1	0	1	1	1	1	1	1	0	0	1	0	0	0	1	0	0	1	1	0	1	0
78	0	1	0	1	1	0	0	1	1	1	1	0	0	0	1	0	0	0	1	1	0	0	1	1	1	1
81	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
86	0	1	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1
88	0	0	1	1	1	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	1
89	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
92	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0

Strain (96h incubation)	C4 (D-raffinose)	C5 (L-mannose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	D1 (acetic acid)	D2 (cis-aconitic acid)	D3 (citric acid)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (α-hydroxybutyric acid)	D11 (β-hydroxybutyric acid)	D12 (γ-hydroxybutyric acid)	E1 (p-hydroxy phenylacetic acid)	E2 (itaconic acid)	E3 (α-keto butyric acid)	E4 (α-keto gluctanc acid)	E5 (α-keto valenc acid)
97	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0
99	1	0	0	1	1	1	0	1	1	1	0	0	0	0	0	1	0	0	1	0	0	1	1	0	1	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
101	0	0	0	0	1	0	0	1	1	1	1	1	0	1	0	0	0	1	0	0	0	0	1	0	0	0
103	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
105	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
106	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
108	0	0	0	0	1	0	0	1	1	0	1	0	1	0	0	0	0	0	0	1	1	0	1	0	0	0
109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
113	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
116	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
121	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
137	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	1	0	0	0
138	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
143	0	0	0	1	1	1	0	1	0	1	1	0	0	0	0	0	0	0	1	1	0	0	1	1	1	1
155	0	1	0	1	0	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0
158	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
162	1	1	0	1	1	1	1	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0
200	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
201	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	0	1	0
202	0	0	0	0	1	0	0	1	0	1	1	1	1	0	0	1	0	0	0	0	0	0	1	0	1	0
204	0	1	0	0	1	0	0	1	0	0	1	1	0	0	1	0	1	1	0	0	0	0	1	0	0	1
205	0	1	0	1	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	1
206	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
209	0	0	1	0	1	0	0	1	1	1	1	1	1	0	0	1	0	1	0	0	0	0	1	0	1	0
210	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	0	1	1
211	0	0	0	0	0	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
212	0	0	1	0	1	0	0	1	1	1	1	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0
216	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
218	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
219	0	0	0	0	0	0	0	1	0	1	1	0	1	0	1	0	0	0	0	0	1	1	1	1	0	1
220	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
221	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
223	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
224	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0

Strain (96h incubation)	C4 (D-raffinose)	C5 (L-rhamnose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	D1 (acetic acid)	D2 (cis-aconitic acid)	D3 (citric acid)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (α-hydroxybutyric acid)	D11 (β-hydroxybutyric acid)	D12 (γ-hydroxybutyric acid)	E1 (p-hydroxy phenylacetic acid)	E2 (itaconic acid)	E3 (α-keto butyric acid)	E4 (α-keto gluctanc acid)	E5 (α-keto valeric acid)
227	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
228	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
230	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
231	1	1	0	1	1	1	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	0
232	0	1	0	1	1	0	0	1	1	1	1	1	0	0	0	1	0	0	1	0	0	0	1	1	1	1
233	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
234	1	1	0	1	1	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0
236	0	1	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1
237	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
238	0	0	0	0	1	0	0	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	1	0	1	0
239	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
241	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
242	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
243	0	1	1	1	1	1	0	1	0	1	0	0	1	0	0	0	0	1	1	1	1	0	1	1	0	0
244	0	1	0	1	1	1	0	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1
245	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1
246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
250	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1
251	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0
254	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
256	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
257	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
258	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
259	1	1	1	1	1	1	0	1	0	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	1	0
261	1	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0
262	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
263	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
265	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
271	0	0	1	1	1	1	0	1	0	0	1	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0
278	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
283	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
289	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
7708	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	0	0	0	1	0	1	0
8071	0	1	0	0	1	1	0	1	1	1	1	1	1	0	0	0	0	0	1	1	0	0	1	1	1	1
10144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
11040	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	1	0
14393	0	0	1	1	1	1	0	1	1	1	1	1	1	0	0	1	1	0	1	1	0	1	0	1	1	1
17749	1	1	0	0	1	1	0	1	1	1	1	1	1	0	0	1	1	1	1	1	0	0	1	0	1	1
19260	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	1	1	0	0	0

Strain (96h Incubation)	C4 (D-raffinose)	C5 (L-rhamnose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	D1 (acetic acid)	D2 (cis-aconitic acid)	D3 (citric acid)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (α-hydroxybutyric acid)	D11 (β-hydroxybutyric acid)	D12 (γ-hydroxybutyric acid)	E1 (p-hydroxy phenylacetic acid	E2 (itaconic acid)	E3 (α-keto butyric acid)	E4 (α-keto glutaric acid)	E5 (α-keto valeric acid)
19323	1	0	1	1	1	1	0	1	0	1	1	1	1	0	1	1	0	0	0	0	0	1	1	0	1	0
19326	1	1	0	1	1	1	0	0	0	1	0	0	0	0	1	1	0	1	0	0	0	0	1	0	0	0
23597	0	1	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1	1	0	1	1	1	1
25374	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
25521	1	0	1	0	0	1	0	1	1	1	1	1	0	0	0	1	0	0	0	0	0	0	1	0	1	0
25915	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
27118	1	1	1	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
27119	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	0	0	0	1	0	1	0
27122	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
27123	1	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	1	1	0	0	1	1	1	1
27124	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	1
27125	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	1	0	1	1	0	1	1
27126	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0
27128	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0
27130	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	1	0	1	1	0	1	0
27132	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0	0	1	1	1	0	0	1	1	1
27562	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	1	0
27593	1	0	0	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	0	0	0	1	0	0	1	0
27950	0	1	0	1	0	1	0	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	1
29570	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0
29659	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	1
33127	1	0	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1	1	1	1
33414	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
33539	1	1	0	0	1	1	0	1	1	1	0	0	0	0	0	1	1	0	1	0	0	0	1	0	1	0
33653	0	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	0	1	0	0	0	0	1	0
35016	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	1	0	1	0
35084	1	0	1	1	1	1	0	1	1	1	1	1	0	0	1	1	0	1	0	1	0	0	0	0	1	0
35912	1	1	1	1	1	1	0	1	1	1	1	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0
51192	0	1	0	0	0	0	1	1	1	1	1	1	1	0	0	1	1	0	1	1	1	0	1	1	1	1
51288	1	0	1	1	1	1	0	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	1	0	1	0

Strain (96h incubation)	E6 (D,L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 (quinic acid)	E10 (D-saccharic acid)	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alaninamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-aspartic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)	G5 (L-phenylalanine)	G6 (L-proline)	G7 (L-pyroglutamic acid)
3	0	0	1	1	1	0	0	0	0	0	1	0	1	1	0	1	1	1	1	0	0	0	1	0	1	0
5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	1	1	1	0	1	0	0	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	1
9	1	0	1	0	0	0	1	1	1	0	1	1	1	0	1	0	1	0	0	1	0	1	1	1	1	1
11	1	1	0	0	0	0	0	0	0	1	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0
12	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
13	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	1	0	0	1	0	1	0
14	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	1	0	0	0	1	1	1	0	1	1	1	0	1	1	1	0	0	1	1	1	1	1	1	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	1	0	0	0	0	0	0	0	1	0	1	1	0	1	1	1	1	0	0	0	0	0	1	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	1	0	1	0	0	1	1	1	1	0	0	1	1	1	1	1	1	0	1	1	0	1	0	0	1	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
43	0	1	1	0	0	0	0	0	0	1	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0
46	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0
55	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0
58	0	0	1	0	0	0	1	1	1	1	0	0	1	1	1	1	1	1	1	0	0	0	0	1	1	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	1	0	1	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	0	0	0	1	0	1	0
64	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	0	0	0	0	0	0	0	0
66	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	1	1	1	0	0	0	1	1	1	0	1	1	1	0	1	1	1	0	0	1	0	1	1	1	1	1
78	1	1	1	0	1	1	1	1	1	0	0	1	1	0	1	1	1	0	1	1	0	1	1	1	0	0
81	0	0	1	0	0	0	0	0	0	1	0	0	1	1	0	1	1	1	1	1	0	1	1	0	0	0
86	0	1	1	0	1	0	0	0	0	0	0	0	0	1	0	1	1	1	1	0	0	1	1	0	1	1
88	0	1	1	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0
89	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	1	1	0	0	0	1	0	1	0
92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
94	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Strain (96h Incubation)	E6 (D L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 (quinic acid)	E10 (D-saccharic acid)	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alaninamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-aspartic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)	G5 (L-phenylalanine)	G6 (L-proline)	G7 (L-pyroglutamic acid)
97	1	1	1	0	0	0	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1
99	1	1	1	0	0	1	0	0	0	0	1	1	1	1	1	1	0	0	0	1	0	0	0	0	0	1
100	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	1	0	0	0	0	0	1	1	0	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	1	0
103	0	0	1	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	0	0	1	0	0	1	0
105	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	1	1	1	1	0	0	1	1	0	1	0
106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0
108	0	0	0	1	0	1	0	0	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	1
109	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0
113	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
125	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
138	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	0
140	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0
143	1	0	1	0	0	0	1	1	1	0	1	0	1	1	1	1	1	1	1	0	0	1	0	0	0	0
155	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
162	1	0	1	0	0	0	0	0	1	0	1	0	1	1	1	1	1	1	1	1	0	0	1	0	1	0
200	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
201	1	1	1	0	1	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	0	0	1	0	1	0
202	1	0	1	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1	0
204	1	1	0	0	0	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	0
205	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
206	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
209	1	0	1	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1	0
210	1	0	1	0	0	1	1	1	1	0	0	1	1	1	1	1	1	0	1	0	1	1	1	0	1	0
211	0	0	1	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	0	0	1	0	0	1	0
212	1	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1	0
216	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	1	0
218	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
219	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	0	0	1	0	0	1	0
220	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
221	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
223	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0
224	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
226	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Strain (96h Incubation)	E6 (D,L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 (quinic acid)	E10 (D-saccharic acid)	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alaninamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-aspartic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)	G5 (L-phenylalanine)	G6 (L-proline)	G7 (L-pyroglutamic acid)
227	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	0	0	1	0	0	1	0
228	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
231	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	0	1	1	1	0	0	0	1	0	1	0
232	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	0
233	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
234	1	0	1	0	0	0	0	0	0	0	1	0	1	1	0	1	1	0	1	0	0	0	1	0	1	0
236	0	0	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0
237	1	0	0	0	0	0	1	0	1	0	0	1	1	1	1	1	1	1	1	0	0	0	1	0	1	0
238	1	0	1	0	0	0	1	1	1	0	0	1	1	1	1	1	1	1	1	1	0	0	1	0	1	0
239	1	0	0	0	0	0	1	0	1	0	0	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0
241	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
242	1	0	0	0	0	0	1	0	1	0	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	0
243	1	0	1	0	0	0	0	0	1	0	1	0	1	1	1	1	1	0	1	1	1	0	1	1	1	1
244	0	1	1	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	0	0	1	0	0	1	0
245	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
250	0	0	1	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	0	0	1	0	0	1	0
251	1	0	0	0	0	0	1	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	1	0	1	0
254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
256	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
257	0	0	1	1	0	0	0	0	1	0	1	0	1	1	0	1	1	1	1	0	0	0	1	0	1	0
258	0	0	0	0	0	0	1	1	1	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0
259	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	1	1
261	1	0	1	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	0	1	0	0	1	0
262	1	0	1	0	0	1	1	1	1	0	0	1	1	0	1	0	1	0	0	1	0	1	1	1	1	1
263	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	1	1	1	0	0	1	0	0	0	0
265	0	0	0	0	0	0	1	1	1	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	1	0
271	1	0	1	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	1
278	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
283	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
289	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7708	1	1	1	1	1	0	1	1	1	0	1	0	0	1	1	1	1	1	1	1	0	0	1	0	1	1
8071	1	1	1	1	0	0	1	1	1	0	1	0	1	1	1	1	1	1	1	0	0	1	0	1	1	1
10144	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11040	1	1	1	1	1	0	1	1	0	1	0	1	1	1	1	1	1	1	1	0	1	0	0	1	0	0
14393	1	1	1	1	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
17749	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1
19260	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

Strain (96h incubation)	E6 (D,L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 (quinic acid)	E10 (D-saccharic acid)	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alaninamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-aspartic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)	G5 (L-phenylalanine)	G6 (L-proline)	G7 (L-pyroglutamic acid)
19323	1	0	1	0	0	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	0
19326	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	0	1	0
23597	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1
25374	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	0	1	0	0	1	1	1	1	1
25521	1	0	1	0	0	0	1	1	1	0	1	0	1	1	1	1	1	1	1	0	1	0	1	1	1	0
25915	1	0	0	0	0	0	1	1	1	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	1	0
27118	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
27119	1	0	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1
27122	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
27123	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1
27124	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0
27125	1	0	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
27126	0	0	1	0	0	0	0	0	1	0	0	0	1	1	1	1	1	0	1	1	0	0	0	1	1	0
27128	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
27130	1	0	1	1	0	0	1	1	1	0	1	1	1	0	0	1	1	0	1	0	0	1	1	1	1	0
27132	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
27562	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
27593	1	1	0	1	1	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1
27950	0	0	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	1	1	1	1	0
29570	0	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	0	0	0	0	0	0
29659	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33127	1	1	1	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0	0	1	0	0	1	1
33414	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
33539	1	0	1	0	0	0	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	1	0
33653	1	1	1	0	1	0	1	1	1	1	0	1	1	1	1	1	1	0	0	0	0	1	0	0	1	0
35016	1	1	1	0	1	0	1	1	0	0	0	1	0	1	1	0	1	0	1	0	0	0	1	0	1	0
35084	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	1	0
35912	1	0	1	0	1	0	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	1	0
51192	1	0	1	1	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0	0	1	0	1	1	0
51288	1	0	1	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	1	0	1	1

Strain (96h incubation)	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D,L-carnitine)	G12 (γ-amino butyric acid)	H1 (urocanic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D,L-α-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
3	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
7	0	1	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0
9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	1	0	0	0	1	0	1	0	0	1	0	0	0
12	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
13	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	1	0	0	0	0	1	1	0	0	0	1	1	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
36	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	1	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0
42	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0
43	1	0	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
57	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0
58	0	1	1	0	0	0	1	1	1	0	1	0	0	1	1	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
70	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0
72	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	1	1	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0
81	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
86	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
88	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
94	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
96	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0

Strain (96h incubation)	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D L-carnitine)	G12 (γ-amino butyric acid)	H1 (urocanic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D,L-α-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
97	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0
99	0	1	1	0	0	1	1	1	1	0	1	0	1	1	0	0	0
100	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
101	0	1	1	0	0	0	1	1	1	0	0	0	0	1	0	1	1
103	1	1	1	0	0	1	1	1	1	0	1	0	0	0	0	0	0
105	0	1	1	0	0	1	0	1	0	0	0	0	0	0	0	1	1
106	0	0	0	0	0	0	1	1	1	0	1	0	0	1	0	0	0
108	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
109	0	1	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0
113	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
116	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
121	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
137	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0
138	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
140	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
143	0	1	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0
155	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0
158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
162	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0
200	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0
201	0	1	1	0	0	1	1	1	0	0	1	0	0	1	0	0	0
202	0	1	1	0	0	0	1	1	1	0	0	0	0	1	1	1	1
204	1	1	1	0	0	0	1	1	1	1	1	0	0	1	1	0	0
205	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
206	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
207	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
209	0	1	1	0	0	1	1	1	1	0	1	0	0	1	1	0	1
210	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
211	0	1	1	0	0	1	1	1	1	0	1	0	0	0	0	0	0
212	0	1	1	0	0	1	1	1	1	0	0	0	0	1	1	1	1
216	0	0	0	0	0	0	1	1	1	0	1	0	0	1	0	0	0
218	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
219	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
220	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
221	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
223	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
224	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Strain (96h Incubation)	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D,L-carnitine)	G12 (γ-amino butyric acid)	H1 (urocanic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D,L-α-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
227	0	1	1	0	0	1	1	1	1	0	1	0	0	0	0	0	0
228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
231	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
232	0	1	1	0	0	1	1	1	1	0	1	0	1	1	1	0	1
233	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
234	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
236	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
237	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0
238	0	1	1	0	0	1	1	1	1	0	0	0	0	1	1	1	1
239	0	1	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0
241	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
242	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
243	0	1	1	0	1	1	1	1	1	0	0	1	0	1	0	0	0
244	0	1	1	0	0	0	1	1	1	0	0	0	0	0	0	1	0
245	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
250	0	1	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0
251	0	1	1	0	0	1	1	1	1	0	0	0	0	1	0	0	0
254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
256	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
257	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0
258	0	0	0	0	0	0	1	1	1	0	0	0	0	1	1	0	0
259	0	1	1	1	0	0	1	1	1	0	0	0	0	1	0	1	1
261	0	1	1	0	1	1	1	1	1	0	1	0	0	0	0	0	0
262	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
263	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0
265	0	1	1	0	0	0	1	1	1	0	0	0	0	1	0	1	1
271	0	1	1	0	0	1	1	1	1	0	0	0	0	1	0	0	0
278	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
283	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
289	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
7708	1	0	0	1	0	0	1	1	1	0	0	0	1	1	0	0	1
8071	0	1	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0
10144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11040	1	1	0	0	1	1	1	1	1	0	1	0	0	1	0	1	1
14393	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0
17749	1	1	1	0	1	1	1	0	0	0	1	0	1	0	0	0	0
19260	0	0	0	0	0	0	1	0	1	0	1	0	0	1	0	0	0

Strain (96h Incubation)	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D,L-carnitine)	G12 (γ-amino butyric acid)	H1 (urocanic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D,L-α-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
19323	1	1	1	0	1	1	1	1	1	0	1	0	0	1	1	1	1
19326	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
23597	1	1	1	0	1	0	0	0	1	0	0	1	0	1	0	0	0
25374	1	1	1	1	1	0	1	1	1	0	0	0	1	1	1	0	0
25521	1	1	1	0	0	0	1	1	1	1	0	0	1	1	1	1	1
25915	1	1	1	0	0	0	1	1	1	0	0	0	0	1	0	1	1
27118	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	0
27119	0	1	1	1	1	1	1	1	0	0	0	0	0	1	0	0	0
27122	0	1	1	1	1	1	1	1	0	1	1	0	1	1	1	0	0
27123	1	1	1	1	1	1	1	0	0	0	1	0	0	0	0	0	0
27124	1	1	1	1	1	1	1	0	1	0	1	0	0	1	0	1	0
27125	0	1	1	0	1	1	1	1	0	1	1	0	0	1	1	0	0
27126	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
27128	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27130	0	0	0	0	1	0	0	0	0	1	1	0	0	1	0	0	0
27132	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	0	0
27562	0	1	1	1	1	1	1	1	0	0	1	1	0	1	0	0	0
27593	0	1	0	0	1	1	1	1	1	0	1	0	0	1	1	1	1
27950	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	1	1
29570	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
29659	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1
33127	0	1	1	1	0	0	1	0	0	0	0	1	1	1	0	0	0
33414	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1	1
33539	0	1	1	0	0	0	1	1	1	0	0	0	0	1	1	1	1
33653	1	1	0	0	1	0	1	1	1	0	0	0	0	1	0	0	0
35016	0	1	0	0	1	0	1	1	1	0	0	0	0	1	1	1	1
35084	0	1	1	0	1	1	1	1	1	0	0	0	0	1	1	1	1
35912	1	1	1	0	0	0	1	1	1	0	0	0	0	1	0	0	0
51192	1	1	1	0	0	0	1	1	1	0	1	0	1	0	0	0	0
51288	1	1	1	0	0	1	1	1	1	0	0	0	1	1	0	0	0

APPENDIX C

Data matrix of the average percent change in optical density values of the Biolog-GN test results as recorded over a range of incubation times for 108 regional strains and 35 reference strains.

Strain	Time	A2 (a-cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 ((D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)	B5 (gentiobiose)	B6 (a-D-glucose)	B7 (m-inositol)	B8 (a-D-lactose)	B9 (lactulose)	B10 (maltose)	B11(D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (b-methyl D-glucoside)
3	24	9	9	11	36	-15	11	-3	10	14	4	27	-1	19	14	9	24	38	13	6	2	17	0	48	-2	4
	48	3	17	22	44	-16	15	-12	16	18	10	19	6	20	24	14	35	52	21	16	15	31	14	49	2	14
	96	-1	21	38	124	-18	14	-21	22	18	14	13	14	14	35	20	46	74	31	23	30	39	23	55	58	11
5	24	-13	-3	11	77	29	-8	-8	0	26	1	9	-2	30	1	16	-9	0	-5	-9	-4	-9	-1	4	10	1
	48	-7	-2	16	85	18	-5	-8	1	27	2	8	-1	33	8	17	-7	1	-3	-8	-3	-9	-1	6	13	2
	72	4	4	27	97	17	2	-3	6	39	5	9	3	40	13	26	-3	5	0	-3	1	-5	3	11	20	6
	96	15	8	44	122	23	8	4	14	53	13	10	6	53	26	39	4	13	6	3	8	2	10	16	31	13
7	24	-1	0	10	49	8	-5	-3	-3	25	-6	2	-5	8	36	17	-1	2	-6	0	2	-3	0	-4	3	-1
	48	9	13	32	67	14	5	11	15	46	16	7	10	18	52	38	21	22	9	17	26	21	17	7	7	21
	72	20	25	55	94	26	12	24	22	56	23	10	24	28	63	57	34	33	20	31	39	36	29	13	14	32
	96	28	28	65	109	17	11	24	24	59	26	14	21	34	60	64	38	31	23	40	45	43	32	15	16	38
9	24	33	4	28	190	332	0	-1	-5	-3	-14	0	3	25	21	-3	12	8	-4	2	1	-12	-14	-11	11	30
	48	24	4	14	149	501	3	-2	-4	6	-5	-19	10	23	10	-31	10	-2	-21	6	-7	-7	-6	-10	10	18
	72	20	6	17	151	552	1	-2	-2	6	-5	-15	12	21	12	-10	15	0	-26	7	-5	-7	-8	-6	11	18
	96	16	8	20	154	600	-4	-3	-1	6	-6	-12	13	20	14	-7	20	1	-31	8	-7	-6	-9	-4	11	19
	120	-6	-1	29	187	613	0	2	7	14	5	1	6	15	-8	-10	6	-5	-14	4	-3	5	-13	-5	8	7
11	24	-2	0	6	52	3	-2	-6	-6	26	-3	1	-1	12	13	1	-4	6	0	-3	0	-4	0	-2	3	0
	72	11	17	34	103	30	15	13	12	50	16	7	13	37	28	20	15	28	17	18	19	12	18	10	13	20
	96	6	7	29	108	22	13	8	11	44	13	3	16	22	25	20	5	60	11	8	16	15	8	6	15	11
12	24	4	1	14	69	10	4	-2	1	26	0	-6	1	17	23	10	7	13	7	0	1	-1	2	0	3	4
	48	8	7	33	82	18	4	3	13	39	3	-7	6	30	27	21	15	23	13	10	12	7	12	1	6	13
	72	9	7	43	87	21	0	4	17	35	-2	-10	8	28	24	21	16	23	12	15	16	11	9	-2	4	13
	96	12	9	47	84	14	0	8	19	38	-1	-9	1	24	11	21	13	17	12	16	16	6	12	-1	-1	12
13	4	42	80	34	0	-42	4	5	-11	5	-2	123	-2	41	23	62	126	122	9	125	50	109	23	55	80	131
	24	151	193	111	37	-49	9	14	-4	6	-2	209	0	110	27	189	236	236	8	241	161	207	63	150	195	210
	48	205	296	165	51	-48	12	25	-2	9	-2	253	0	160	26	255	331	319	8	296	216	270	98	198	245	239
	72	202	340	164	57	-48	15	26	-11	2	-8	364	0	161	23	245	358	342	6	353	202	345	95	202	254	256
	96	261	404	218	68	-46	21	39	-6	3	0	423	2	211	27	305	440	443	10	483	250	500	164	280	378	357
14	24	-8	-11	-7	47	-32	0	-14	-6	5	-6	-5	0	-1	0	-5	-7	-5	-10	-9	-2	-9	-1	-16	4	-10
	48	-7	-11	-3	73	-36	3	-14	-8	6	-11	-11	0	-4	-4	-10	-9	-3	-13	-13	-5	-12	-2	-21	-2	-11
	72	-5	-3	5	118	-29	11	-12	-3	19	-1	-12	3	6	-2	-4	-2	4	-11	-7	0	-5	4	-26	4	-9
	96	-14	-8	2	302	-32	12	-14	-9	13	-8	-21	-5	5	-8	-6	-3	-2	-14	-10	-12	-10	-1	58	2	-13
18	24	8	48	42	26	-57	-5	17	2	19	-3	33	5	47	13	15	39	24	2	14	8	40	23	37	17	32
	48	11	55	52	36	-57	-5	20	3	24	-2	39	8	53	18	19	43	24	3	16	9	42	30	40	23	36
	72	15	63	81	47	-58	-4	22	3	27	-1	44	11	57	20	24	48	23	4	19	10	44	36	44	27	40
	96	19	65	69	55	-55	-1	26	7	31	1	44	11	60	21	25	50	28	4	21	12	51	40	49	26	42
19	4	-12	-6	8	39	-11	-12	-10	-17	3	-12	-10	-22	-5	-5	1	-3	7	-13	-10	-8	14	-12	-8	-9	-19
	24	-12	3	15	58	-11	-14	-17	-17	1	-15	-8	-15	1	-3	1	-4	6	-13	-9	-9	16	-15	-6	-7	-21
	48	-13	6	20	79	-9	-12	-17	-12	6	-12	-10	-10	6	0	0	-1	9	-9	-6	-6	18	-14	-6	-3	-19
	96	-10	8	25	85	-10	-12	-20	-8	6	-12	-9	-9	7	0	0	0	8	-7	-5	-5	25	-10	-4	0	-10
24	24	12	1	3	49	-1	0	-2	0	10	1	10	-1	17	6	10	0	7	-7	-1	-1	17	3	0	5	0
	48	16	-3	2	55	-3	-5	-4	-4	5	-1	9	-2	15	0	6	-6	0	-10	-5	-4	11	0	-1	2	-7
	72	15	2	10	61	-2	-3	2	-2	7	-4	10	0	25	5	5	2	9	-5	0	0	13	-1	-1	4	0

Strain	Time	A2 (a-cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 ((D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)	B5 (gentiobiose)	B6 (a-D-glucose)	B7 (m-inositol)	B8 (a-D-lactose)	B9 (lactulose)	B10 (maltose)	B11(D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (b-methyl D-glucoside)
	96	10	5	10	65	-8	-3	5	1	8	-4	14	0	25	4	4	6	14	-4	0	3	17	1	-3	3	3
	4	13	3	6	43	37	-2	-2	0	8	-7	-3	4	7	9	5	-1	5	-4	-1	1	-4	-8	-5	3	7
	24	18	6	21	157	196	4	9	7	31	-3	6	13	13	20	-3	8	11	-3	6	7	-1	-5	1	23	36
26	48	24	10	29	218	270	11	19	12	35	6	5	19	15	24	-11	17	14	0	11	15	4	0	-2	28	46
	72	28	17	35	258	296	13	21	14	30	9	1	18	19	23	-11	24	8	7	15	21	9	7	-3	25	45
	96	25	20	42	285	309	15	22	17	32	11	-2	18	20	24	-8	24	7	9	14	24	11	9	-1	25	42
	4	7	3	16	43	10	-6	-5	0	9	6	0	-1	17	5	15	-3	40	-7	-5	-1	5	-2	8	2	-8
	24	-13	1	21	85	-1	-12	-19	-10	7	-16	-17	-19	25	-1	6	-29	53	-34	-28	-8	-7	-26	-27	-22	-3
32	48	-13	2	28	87	-5	-12	-16	-8	4	-16	-27	-25	30	-3	3	-35	45	-43	-31	-10	-3	-36	-35	-31	-30
	72	-11	12	48	109	-21	-9	-18	-3	12	-18	-32	-26	54	-5	13	-32	59	-45	-31	-10	13	-31	-32	-26	-34
	96	12	52	94	132	11	-12	-8	8	23	31	-21	-22	64	-4	18	-1	129	-11	-17	-9	36	0	-21	-19	-18
	24	-15	91	72	139	8	-7	-27	-13	-12	-20	-3	-15	-4	-12	-14	-8	64	-14	-8	4	113	-22	19	-15	-12
36	48	-16	103	94	203	18	-8	-27	-14	-14	-20	-5	-11	-4	-12	-12	-9	84	-15	-7	2	117	-21	22	-15	-11
	72	-15	109	105	215	21	-6	-26	-11	-12	-19	-6	-9	0	-10	-5	-8	95	-15	-5	4	120	-19	26	-8	-9
	96	-14	112	116	221	24	-3	-25	-9	-10	-16	-8	-7	11	-9	2	-7	102	-12	-3	6	124	-17	32	2	-6
	24	-13	-15	-18	39	-17	-20	-15	-14	-3	-18	-17	0	-7	-14	-15	-14	-13	-15	-23	-12	-19	-12	-8	-13	-18
38	48	-11	-11	-15	52	-13	-22	-18	-18	-6	-18	-21	2	-8	-11	-16	-13	-15	-14	-25	-11	-20	-11	-18	-12	-16
	72	-7	-9	-13	53	-14	-18	-13	-15	-9	-18	-22	-2	-11	-7	-13	-10	-17	-12	-23	-7	-18	-12	-14	-10	-18
	96	-7	-10	-15	48	-17	-19	-14	-18	-15	-23	-29	-2	-12	-6	-14	-12	-19	-14	-25	-8	-20	-13	-15	-10	-19
	24	46	10	36	203	259	3	11	14	33	-5	6	30	20	15	7	17	7	-2	4	8	2	-6	0	20	27
39	48	60	17	52	269	435	10	28	25	51	3	11	30	33	26	7	31	11	2	13	26	12	3	13	18	40
	72	59	23	49	267	445	9	11	24	47	3	7	28	28	24	21	25	10	18	10	25	15	0	8	11	27
	96	58	29	45	266	458	9	-7	23	44	2	-6	26	26	19	27	20	10	24	7	22	17	-4	5	9	-3
	24	-11	10	18	74	13	-11	7	9	13	12	21	18	154	-19	18	-16	179	-17	16	-6	19	12	101	-5	-10
42	48	-10	20	15	51	-3	-18	19	26	6	33	13	20	191	-26	33	-27	235	-30	0	-13	67	15	139	-11	-22
	72	0	45	49	78	15	-9	59	74	30	95	13	60	195	-19	87	-19	235	-25	21	10	78	42	139	-7	-16
	96	1	66	60	92	23	0	87	111	40	127	14	72	197	-11	116	-17	235	-20	35	23	89	69	141	-1	-13
	120	7	78	77	109	38	3	97	140	54	154	17	98	208	-7	128	-10	249	-16	55	48	95	96	144	3	-9
	24	46	78	99	82	4	5	159	4	63	2	122	-8	165	41	10	67	119	4	32	7	109	108	49	44	30
43	48	47	108	123	97	3	10	211	9	64	10	113	-2	196	46	7	118	112	8	39	9	129	189	55	53	36
	72	51	113	136	105	4	4	168	6	65	7	91	-2	188	33	11	166	106	4	39	8	116	205	48	52	29
	96	60	115	159	127	9	11	167	12	74	8	88	-2	202	46	20	184	118	4	24	5	120	227	50	49	27
	4	26	20	17	17	-22	-3	1	1	3	-7	13	0	12	12	18	19	32	2	14	2	17	-3	20	-2	-2
	24	49	58	40	17	-53	0	4	13	24	-18	26	5	29	25	40	57	48	-3	40	20	39	5	38	6	14
46	48	58	72	56	23	-55	-1	2	3	26	-23	27	4	30	16	38	60	41	-12	32	19	33	-1	40	4	5
	72	62	70	72	25	-57	-1	5	0	27	-24	24	1	35	12	38	59	39	-14	28	21	32	-1	45	4	-1
	96	65	73	82	31	-57	3	10	3	30	-25	19	1	41	18	34	59	40	-17	25	23	35	2	48	6	4
	24	0	3	15	95	37	-5	2	6	28	7	12	32	1	1	-3	-7	0	-5	1	-3	4	9	4	10	0
55	48	2	4	23	130	54	2	4	12	29	3	2	33	5	3	-9	-6	-4	-3	3	2	3	12	4	1	7
	72	5	9	34	161	64	11	4	19	38	8	-3	38	11	10	-8	-3	-4	2	6	8	4	14	1	-1	8
	96	15	14	41	179	88	15	3	21	40	8	-4	35	18	18	1	10	7	7	11	19	14	15	0	-5	9
	24	7	1	10	73	2	-5	-6	-4	42	5	12	4	14	21	12	5	5	7	0	2	1	4	2	12	2
57	72	10	9	27	106	-6	7	3	8	50	6	7	11	13	25	12	8	1	13	1	6	4	5	6	13	5

Strain	Time	A2 (a-cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 ((D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)	B5 (gentiobiose)	B6 (a-D-glucose)	B7 (m-inositol)	B8 (a-D-lactose)	B9 (lactulose)	B10 (maltose)	B11(D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (b-methyl D-glucoside)
	96	12	13	36	118	-6	9	7	10	54	3	7	13	20	38	16	16	12	21	11	15	12	11	9	16	13
	24	1	300	95	80	20	-12	369	8	6	-6	336	-2	360	4	61	254	357	0	4	10	251	319	236	7	106
58	48	5	430	121	85	36	-11	519	7	7	-3	544	4	624	12	159	481	564	-12	19	4	499	660	496	13	280
	72	8	480	143	94	37	-10	529	8	6	-6	565	3	698	15	379	687	650	-8	198	5	630	850	590	9	440
	96	10	520	152	103	38	-7	538	10	4	-9	587	0	708	16	421	711	701	-6	264	4	729	961	685	5	538
	120	12	483	163	106	27	-4	536	13	6	-8	565	3	781	14	451	649	733	1	438	6	801	999	660	11	503
	24	8	-4	17	84	-3	-2	-7	-1	15	-12	-8	-1	14	5	3	2	-3	-9	-7	5	-51	-6	0	6	-2
59	48	-1	-14	28	108	-4	1	-6	-4	14	-12	-8	-7	10	-6	1	5	-1	-13	-4	-3	-61	-17	-11	-6	-10
	72	7	-17	46	138	-6	14	8	3	32	-4	-9	-4	21	-4	11	11	1	-3	3	4	-58	-13	-6	-4	-9
	96	9	-20	55	155	-7	25	15	9	54	0	-9	-6	35	-3	22	22	5	0	6	6	-52	-15	-5	-1	-8
	24	77	98	92	27	-42	-4	-44	-6	-17	-5	31	19	32	145	106	19	130	-23	4	5	134	-19	110	20	41
63	48	103	130	120	32	-44	-4	-45	-5	-19	-4	49	22	33	156	139	23	167	-23	5	6	146	-18	132	22	44
	96	146	153	158	31	-47	-2	-46	-5	-20	-4	78	25	37	164	158	29	205	-22	10	9	149	-15	149	27	50
	24	-7	-9	-11	20	-35	-1	-11	-3	-13	-13	-12	-15	-10	-6	-8	-6	-6	-4	-3	-10	-8	-12	-27	-17	-11
64	48	-11	-6	-6	68	-35	-1	-12	2	-13	-12	-13	-17	-5	-3	-3	-3	-1	0	2	-7	-1	-10	-27	-12	-12
	72	-9	-4	-4	95	-36	4	-11	6	-11	-10	-9	-15	13	1	2	1	6	4	7	-2	6	-5	-22	-7	-7
	96	-3	-4	-2	115	-36	8	-8	8	-11	-12	-8	-15	104	3	5	4	6	6	9	2	8	-4	-23	-6	-7
	24	1	10	8	57	-37	2	-7	-3	1	-11	-6	-3	11	0	4	17	20	-1	3	0	10	-13	6	-1	0
66	48	-5	13	11	79	-42	4	-18	-1	7	-11	-9	1	16	6	7	24	34	3	7	5	16	-7	14	-2	6
	96	-13	19	22	102	-45	8	-27	7	14	-6	-9	8	10	10	12	35	55	7	11	8	26	0	29	3	8
	4	-20	-1	9	64	-5	-2	-1	0	19	2	11	1	-46	3	7	0	5	0	4	0	3	1	5	8	-25
	24	-27	-2	17	99	-17	-3	-4	0	30	2	-6	0	-39	2	1	-4	1	-3	2	-1	-2	-3	-3	6	-26
67	48	-25	-1	26	118	-20	-1	-5	-3	32	-3	-6	1	-38	-5	-8	-11	-8	-12	-1	-4	-6	-8	-10	0	-33
	72	-20	4	39	136	-21	3	0	3	30	-1	-6	6	-34	1	-5	-9	3	-14	-5	0	-3	-12	-8	7	-31
	96	-13	10	56	163	-15	7	9	10	37	8	-7	11	-29	9	0	-1	10	-7	7	10	5	-7	-6	12	-26
	24	2	-1	18	97	32	2	1	2	40	1	6	1	7	14	7	0	7	0	5	8	2	2	4	4	-1
70	48	15	8	43	120	38	9	7	7	51	8	-4	8	15	28	7	9	13	9	15	26	13	11	6	-3	9
	72	20	9	50	118	35	4	5	8	46	6	-8	11	1	18	6	3	7	1	9	25	9	8	0	-2	5
	96	31	19	64	133	51	9	13	14	47	11	-11	15	4	14	14	5	26	5	19	29	16	17	0	5	14
	24	8	24	9	54	-19	0	-6	0	24	6	4	1	18	7	3	1	5	-6	-3	-1	-6	-1	3	8	6
72	48	15	14	19	78	-14	5	-4	2	37	19	-1	6	44	23	-3	5	16	-3	-1	1	1	12	3	8	21
	72	16	17	28	91	-9	7	-4	3	41	27	3	11	55	33	0	6	25	-5	0	1	2	21	6	11	21
	96	15	17	39	101	-8	8	1	6	46	29	1	12	61	29	5	10	25	-5	7	4	3	20	1	12	13
	24	-16	0	-3	42	-18	-10	-12	-15	1	-12	-4	-10	-8	-8	-13	-12	-8	-10	-10	-17	-10	-17	-11	-8	-13
74	48	-17	1	0	56	-18	-8	-12	-15	2	-9	-7	-8	-10	-10	-15	-14	-8	-13	-13	-19	-12	-18	-9	-7	-15
	72	-14	3	3	66	-26	-6	-11	-12	5	-10	-7	-8	-6	-6	-9	-12	-3	-10	-11	-17	-10	-16	-9	-4	-11
	96	-15	5	6	78	-28	-5	-12	-11	9	-10	-7	-9	-7	-8	-10	-13	-5	-11	-12	-18	-11	-17	-9	-5	-12
	4	33	10	28	193	333	1	5	5	18	-7	-6	5	4	15	-7	2	1	1	4	6	0	-2	-2	9	13
	24	33	10	28	193	333	1	5	5	18	-7	-6	5	4	15	-7	2	1	1	4	6	0	-2	-2	9	13
76	48	26	18	39	317	586	20	13	14	29	9	-11	21	24	25	-5	25	11	11	18	25	13	8	9	2	39
	96	17	22	40	355	868	18	9	9	18	11	-10	13	29	20	-5	32	7	10	19	29	11	5	-1	0	46
	120	10	15	27	320	829	13	0	-4	9	5	-11	16	22	9	-15	10	2	8	8	9	1	-7	-14	-1	29
	4	18	0	7	64	62	-3	-2	-1	5	-11	2	0	1	1	-2	0	-4	-4	-1	1	-7	-8	-2	-3	2

Strain	Time	A2 (a-cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 (D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)	B5 (gentobiose)	B6 (a-D-glucose)	B7 (m-inositol)	B8 (a-D-lactose)	B9 (lactulose)	B10 (maltose)	B11(D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (b-methyl D-glucoside)
78	24	16	-9	16	22	192	2	-1	4	20	-12	0	-5	12	-1	-10	3	-11	-7	-2	1	-13	-20	-7	-6	-3
	48	11	1	13	244	266	16	26	20	10	11	-10	12	6	4	-19	16	-18	-1	12	-4	-3	-14	1	-7	8
	72	28	11	48	340	417	26	26	37	40	15	4	15	35	-7	-3	13	1	4	16	40	-3	6	18	-1	18
	96	38	13	61	419	264	35	30	44	54	26	0	15	45	5	7	35	13	9	22	53	15	21	25	1	27
81	24	24	-11	-7	23	-14	7	-1	-1	4	-2	9	-11	-5	-3	5	-7	7	-6	-7	-1	1	-7	15	-10	-8
	48	29	-11	6	66	-12	6	6	0	6	-1	8	-6	6	2	9	-5	6	-6	-1	1	11	-6	16	-3	-8
	96	42	0	17	155	-12	20	18	11	23	33	8	2	16	7	18	5	20	5	10	10	21	8	27	2	-1
86	4	2	2	4	27	-16	-1	-1	2	9	-2	4	-1	10	1	3	6	5	0	7	9	5	2	5	4	1
	24	-1	3	10	54	-16	0	-3	4	16	-3	5	1	23	0	-4	12	12	1	9	11	6	-8	7	9	7
	48	3	6	21	81	-11	5	5	15	26	3	2	8	34	10	0	22	16	10	15	16	14	-5	10	10	12
	72	9	4	38	96	-9	10	7	17	22	7	1	5	35	8	3	22	8	12	19	20	9	-1	9	7	2
	96	18	21	58	123	-4	16	16	32	40	18	3	9	54	18	16	44	29	28	39	42	31	23	12	13	11
88	4	11	35	18	77	16	10	76	15	19	10	21	7	21	11	7	17	106	9	8	9	58	91	14	-1	15
	24	15	288	59	101	8	6	234	15	23	5	208	1	304	20	44	144	212	7	42	15	199	198	37	28	46
	48	15	326	68	98	7	7	260	20	28	5	230	0	331	16	97	186	257	2	87	16	228	242	21	28	39
	72	20	267	109	114	10	15	222	28	36	10	217	-2	302	17	182	204	274	7	120	15	208	232	14	30	60
	96	28	288	133	141	19	18	230	41	43	7	195	0	332	24	211	226	300	8	220	21	233	271	14	37	78
89	24	-3	66	38	14	-26	-8	-21	-4	2	-16	57	-8	36	85	40	57	53	-13	53	69	82	-9	70	2	14
	48	-6	75	57	18	-36	-8	-23	-2	5	-14	43	-5	48	101	35	60	49	-10	50	78	79	-6	89	0	36
	96	-4	85	77	30	-42	-4	-19	5	4	-8	37	-3	62	111	44	73	60	-8	60	92	85	3	105	3	60
	120	2	88	89	37	-41	-4	-17	6	5	-8	39	0	69	124	53	80	70	-8	68	106	93	7	113	8	66
92	4	-24	-10	-3	14	-19	-13	-13	-16	-7	-16	-15	-10	-15	-9	-6	-12	-15	-10	-18	-16	-16	-23	-22	-12	-16
	24	-20	-10	-1	35	-21	-16	-17	-17	-4	-17	-18	-12	-13	-11	-7	-15	-15	-14	-18	-17	-19	-24	-22	-12	-21
	48	-19	-8	6	50	-21	-16	-16	-16	1	-15	-19	-10	-13	-10	-5	-15	-14	-14	-19	-17	-19	-23	-23	-9	-22
	72	-18	-6	14	61	-29	-14	-13	-13	6	-13	-20	-9	-7	-2	1	-9	-7	-8	-14	-13	-16	-19	-22	-5	-17
	96	-17	-6	24	70	-33	-15	-10	-13	9	-10	-22	-8	-5	0	2	-10	-5	-8	-11	-13	-17	-19	-22	-4	-15
94	24	12	21	28	57	-9	-2	-24	-1	32	3	23	-15	11	24	26	26	44	8	11	7	34	8	31	11	-8
	48	-2	14	29	58	-11	-8	-30	-5	28	5	9	-12	12	31	12	26	42	10	8	9	30	11	23	12	-3
	72	4	19	43	71	-6	-1	-27	3	40	16	10	-9	19	47	18	40	56	21	18	21	44	22	28	15	7
	96	6	21	49	80	-10	2	-25	8	45	17	9	-10	21	46	22	45	65	23	25	28	52	27	32	15	14
96	24	11	-17	-2	96	13	-18	-6	-8	-2	-19	-8	-16	-11	7	-12	-11	-20	-17	-17	-11	-18	-27	-16	-18	-16
	48	8	-15	6	97	10	-16	-6	-5	-6	-17	-9	-14	-31	10	-15	-9	-23	-18	-15	-7	-18	-31	-35	-21	-18
	72	15	-10	19	106	9	-14	0	1	6	-17	-10	-12	-23	17	-5	-6	-22	-14	-11	-5	-13	-37	-34	-18	-15
	96	18	-12	26	108	7	-14	2	1	7	-17	-10	-13	-21	19	-1	-5	-21	-13	-8	-3	-12	-37	-33	-17	-15
97	4	17	4	13	43	6	2	1	4	17	1	3	3	9	4	10	2	6	0	2	4	0	0	2	9	1
	24	8	-1	16	49	-4	3	0	3	24	6	0	6	12	9	1	3	15	-8	1	4	-7	-4	4	17	3
	48	13	-2	27	50	-7	14	8	13	33	16	-1	16	25	16	9	13	26	-4	9	15	1	4	13	25	13
	72	15	-3	39	51	5	17	5	17	41	16	-3	13	26	18	11	18	35	0	15	17	12	7	12	29	14
	96	23	11	52	50	3	23	14	24	45	20	-6	20	35	27	27	26	45	6	26	31	16	18	22	32	25
99	24	4	44	45	37	10	0	2	-1	11	-7	41	0	28	17	19	32	48	-2	22	5	56	34	44	2	2
	48	10	64	64	46	17	1	4	-3	12	-11	41	-1	35	29	22	42	69	-1	21	7	91	61	58	4	-1
	72	17	70	81	54	22	5	2	1	16	-7	41	4	33	34	31	46	89	0	11	9	122	75	55	11	-4
	96	29	139	134	72	47	13	10	11	23	-7	44	6	49	61	51	65	137	11	27	22	206	130	73	24	6

Strain	Time	A2 (a-cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 ((D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)	B5 (gentobiose)	B6 (a-D-glucose)	B7 (m-inositol)	B8 (a-D-lactose)	B9 (lactulose)	B10 (maltose)	B11(D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (b-methyl D-glucoside)
100	24	-4	-8	20	83	-8	-2	-7	-3	29	-8	0	-2	12	28	2	-1	-3	-6	-7	-3	-4	-8	-7	-6	-8
	48	14	9	37	126	7	14	-3	1	36	-5	12	-3	22	45	10	1	4	-3	-2	1	-3	-5	1	-5	-4
	72	17	5	48	139	8	10	-3	3	44	-4	3	-2	21	48	11	3	1	-3	-1	1	-2	-6	0	-1	-6
	96	22	7	58	157	10	12	1	7	50	-2	4	-1	26	51	16	5	8	0	2	4	-2	-3	2	1	-4
101	4	17	20	15	52	5	-3	67	3	15	-1	10	-3	39	8	4	4	69	-1	1	4	30	-1	39	4	0
	24	32	238	136	121	34	110	231	17	28	5	32	3	202	23	103	20	239	22	10	17	197	5	242	23	12
	48	37	339	229	170	93	255	333	15	33	-1	21	-9	226	22	180	12	283	20	4	15	259	-4	336	15	9
	72	36	391	282	278	272	433	329	11	27	1	23	-10	250	18	340	9	283	14	0	17	332	-5	360	8	3
	96	63	484	364	330	364	568	320	5	18	17	-5	-14	284	10	509	22	284	22	13	14	390	5	312	0	-11
103	24	-12	7	50	142	27	4	-6	6	46	4	4	5	17	18	-1	12	12	8	1	12	5	9	-1	3	5
	48	-2	9	64	191	55	11	14	10	51	3	-10	2	24	22	-8	19	17	12	6	19	2	8	-7	-5	14
	96	-2	14	85	224	90	2	51	3	48	2	-13	-1	14	12	-2	21	14	14	8	28	2	4	-2	0	15
	120	-1	1	105	277	123	0	47	3	58	-3	-17	0	21	17	7	31	11	17	3	23	5	-5	-6	5	1
105	24	67	55	48	43	-33	37	80	10	19	0	11	-1	19	15	44	14	102	6	64	29	97	-2	89	8	6
	48	73	88	57	72	-40	52	151	10	18	-5	7	-1	19	17	124	11	180	6	144	46	158	-1	134	5	10
	72	95	139	69	76	-41	85	185	13	17	-2	7	2	19	15	180	11	220	6	212	75	175	0	173	8	12
	96	103	149	76	79	-42	106	212	14	16	0	7	3	20	13	201	11	247	5	230	60	217	-1	228	10	14
	120	104	155	80	91	-38	126	236	13	19	1	13	0	20	17	221	18	269	7	254	70	249	10	267	15	15
106	24	17	60	51	59	16	-5	-3	2	6	-10	12	-6	160	20	14	-3	31	-10	-2	0	26	56	46	7	[illegible]
	48	15	67	60	69	17	-3	-4	5	12	-5	-1	0	178	23	10	0	41	-5	1	2	27	68	22	2	4
	96	24	82	87	74	21	8	4	11	23	5	7	11	213	41	40	15	59	7	14	10	34	120	45	15	16
	120	13	48	67	75	9	6	2	9	23	1	7	4	167	31	44	6	48	-1	8	9	30	94	38	17	12
108	24	10	-4	29	53	24	2	-3	1	16	11	5	2	3	-2	25	9	1	-5	6	-8	4	-2	9	4	11
	48	10	-1	36	59	34	2	-3	2	17	17	4	4	16	0	64	27	23	-6	4	-8	16	1	57	6	19
	72	14	4	48	67	63	5	0	6	22	24	4	6	28	7	88	77	76	-2	7	-4	26	11	118	12	31
	96	15	10	61	64	76	5	2	8	25	28	2	5	42	9	96	141	124	-2	8	-3	37	17	141	11	37
109	24	103	462	275	136	18	-3	97	-4	12	-8	113	-3	7	5	1	87	192	-8	-5	-2	435	-7	-8	-2	-6
	48	115	820	458	189	28	-1	237	-2	16	-4	208	5	18	16	-1	197	228	-4	-1	3	731	-1	-9	4	0
	72	125	754	502	210	49	4	268	3	18	-1	343	10	19	13	0	387	265	-1	1	5	733	-1	-3	5	1
	96	137	750	537	233	54	14	285	12	25	8	352	12	25	9	9	556	285	6	9	13	712	7	2	8	7
113	24	7	27	37	45	-3	-1	6	-2	47	-6	33	6	22	9	17	17	33	-4	27	15	16	9	17	33	42
	72	22	63	61	76	-10	7	21	3	55	0	42	7	50	12	23	35	69	1	60	28	55	30	28	60	78
	96	24	69	71	83	-5	10	25	7	77	1	39	7	52	16	26	39	73	3	64	33	56	32	30	60	76
116	4	8	0	12	33	0	-3	-3	-8	5	-5	5	-3	3	0	6	-1	0	-3	-2	2	-3	2	2	1	-5
	24	3	-3	18	39	-32	-3	-4	-11	6	-8	-5	-4	6	0	-5	-1	-3	-9	-1	6	-7	-2	-3	-3	-5
	48	4	-6	25	50	-34	4	9	-1	15	4	-8	8	13	8	-11	9	0	-8	10	15	-5	8	-2	-4	-2
	72	2	-8	40	70	-29	4	3	-4	13	4	-10	13	14	2	-1	-3	-7	-7	5	15	-13	6	-5	-1	-9
	96	13	1	61	87	-20	11	23	4	28	17	-6	26	30	6	11	15	6	3	9	24	2	21	-7	7	-3
121	24	14	9	20	96	12	0	2	7	34	6	22	4	22	16	20	7	11	3	7	3	10	2	8	13	8
	48	11	-2	28	113	7	-3	-3	-4	19	-8	15	-4	1	6	8	-8	-7	-11	-8	-4	-6	-11	-5	-1	-8
	72	20	-7	36	128	-4	2	3	0	28	-3	10	-3	5	8	17	-5	-12	-12	-11	4	-1	-14	-4	3	-9
	96	5	-1	59	114	-18	-10	-6	-1	18	-6	-3	3	-1	7	-11	-5	0	-1	-2	27	-8	2	-10	0	-26
	120	-10	-19	53	112	-18	-16	-14	-10	12	-12	-1	-1	-14	-12	-18	-27	-21	-21	-25	12	-23	-22	-21	-3	-31

Strain	Time	A2 (a-cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 (D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)	B5 (gentobiose)	B6 (a-D-glucose)	B7 (m-inositol)	B8 (a-D-lactose)	B9 (lactulose)	B10 (maltose)	B11(D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (b-methyl D-glucoside)
125	24	-19	-12	-8	14	13	-12	-12	-12	1	-10	2	1	-9	-3	-8	-12	-7	-13	-11	-4	-7	-9	-9	0	-17
	48	-18	-10	-6	19	9	-10	-12	-9	4	-12	-9	5	-5	0	-5	-10	-3	-13	-12	-3	-7	-10	-5	1	-14
	96	4	12	23	44	10	-1	-2	1	31	-1	-3	8	7	17	9	12	10	6	4	10	10	9	3	10	-1
137	24	3	-1	23	93	19	5	-8	-3	52	-1	-2	3	16	3	-9	6	-5	-3	-6	8	-5	-2	-1	-7	-6
	48	8	1	34	109	27	6	-3	3	58	6	-3	10	31	6	-10	16	3	0	1	22	6	5	-5	-3	1
	72	14	6	53	125	25	9	-1	5	55	12	1	16	39	9	1	19	3	1	3	24	5	6	-5	6	4
	96	9	-3	54	117	14	5	1	6	41	3	-7	8	22	3	9	16	5	-3	-1	10	0	2	-11	5	-2
138	24	12	9	17	55	-12	3	-16	4	48	0	12	-7	21	18	8	24	41	14	20	5	30	4	36	-2	7
	48	9	13	22	61	-23	4	-23	6	41	0	12	-5	15	16	6	28	49	14	21	7	38	5	38	-3	6
	72	3	21	26	63	-32	5	-27	7	39	1	10	-1	13	19	7	34	57	14	24	9	43	7	42	-1	9
	96	-2	27	34	65	-38	5	-29	11	34	2	9	3	9	18	6	38	59	15	25	11	50	9	44	-1	9
140	24	-10	3	6	25	-20	-3	-8		9	-2	5	2	1	5	-13	2	10	-1	0	-1	18	-10	14	0	-4
	48	-9	6	9	56	-24	-5	-13	1	7	-1	1	2	1	10	-10	6	17	-1	1	0	22	-6	16	0	0
	96	-3	15	24	101	-21	1	-5	6	10	6	8	12	4	16	-5	16	37	3	7	4	33	-1	37	9	7
143	24	-1	459	175	145	22	-4	-5	2	2	-8	74	23	92	12	39	48	125	-12	5	8	546	134	12	55	9
	72	-5	627	382	234	158	2	2	6	7	-7	171	22	109	22	50	89	354	-1	17	21	623	734	10	53	20
	96	-2	679	424	293	465	4	4	9	10	-5	338	27	114	27	71	148	589	1	22	25	639	709	14	61	25
155	24	7	4	7	107	20	-1	4	3	40	2	-1	5	13	25	-2	5	0	2	3	5	-1	2	9	-3	4
	48	20	18	28	141	37	4	16	19	48	16	1	21	32	46	6	24	13	17	18	21	13	12	10	10	20
	72	28	24	47	159	41	13	24	34	56	19	2	38	45	54	15	37	22	28	28	28	28	15	13	20	32
	96	105	18	48	135	36	16	31	36	49	25	1	30	206	46	23	37	23	32	37	29	30	16	11	22	34
158	24	6	4	16	44	-13	-4	-3	-2	22	-3	7	3	16	5	9	0	6	-3	0	0	3	-4	0	11	2
	48	16	14	37	64	-11	7	8	7	24	4	3	13	37	16	11	10	18	8	11	8	16	7	0	15	10
	72	25	24	57	84	-6	12	17	20	36	13	5	22	55	24	14	20	36	19	22	19	27	15	7	22	17
	96	39	30	82	105	1	21	30	36	51	24	14	28	61	31	24	39	49	32	37	38	46	31	9	27	26
162	24	28	87	49	52	-21	18	59	10	29	5	94	4	102	33	28	129	131	12	128	95	137	33	103	95	79
	48	28	115	58	60	-20	14	83	5	19	1	100	1	136	37	31	151	157	14	152	134	157	45	117	115	91
	72	29	141	75	74	-24	16	100	6	21	1	110	4	162	36	39	169	175	21	172	167	173	60	134	138	113
	96	28	149	90	85	-27	14	122	6	20	4	107	8	171	34	45	174	157	22	183	187	173	73	139	148	127
200	24	3	-10	7	72	20	0	2	4	28	5	5	-3	-4	17	1	-2	9	6	6	12	10	7	4	-2	-11
	48	3	-10	10	87	28	-2	4	6	33	7	0	1	-2	19	5	-2	12	6	10	15	10	7	2	-1	-9
	72	11	-4	17	94	41	-2	6	6	37	5	2	8	6	39	13	5	13	8	15	19	15	9	2	9	-1
	96	13	-4	24	95	86	0	10	9	34	3	0	8	6	41	13	7	13	10	17	22	15	8	0	9	-1
201	24	-4	-9	-9	35	-27	-20	-37	-7	2	-12	-6	-7	4	7	7	-7	-13	-10	-8	2	-9	-11	-8	-2	-8
	48	6	29	18	76	-4	-5	18	2	5	-9	-9	-6	23	23	23	9	38	-2	6	21	38	-1	1	-1	1
	96	14	111	45	116	68	3	218	7	11	-5	-11	6	36	27	39	21	137	4	17	37	119	6	1	6	-7
202	24	-5	536	514	109	92	-14	571	-5	8	-20	496	-13	605	21	464	0	512	-6	2	-3	533	503	452	135	-10
	48	-12	694	567	189	233	-24	675	-7	-3	-25	638	-19	674	19	682	6	549	-1	354	-4	446	536	530	210	-13
	96	-9	999	873	526	596	-26	846	-1	6	-19	999	-11	802	9	999	15	501	5	903	213	546	586	631	566	-7
204	24	26	407	39	128	33	-1	358	-1	22	-9	5	-2	8	20	24	4	419	-4	-1	4	312	-6	4	3	-5
	48	25	682	101	299	29	4	595	2	22	-6	1	2	3	18	29	5	596	-3	3	9	599	-3	2	-4	-1
	72	27	875	185	350	65	5	635	8	30	-3	0	8	6	21	36	12	628	2	8	18	800	0	1	-3	8
	96	29	912	226	378	97	7	670	17	36	1	-1	12	9	25	44	18	664	7	14	25	964	7	-1	-2	13

Strain	Time	A2 (a-cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 (D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)	B5 (gentiobiose)	B6 (a-D-glucose)	B7 (m-inositol)	B8 (a-D-lactose)	B9 (lactulose)	B10 (maltose)	B11(D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (b-methyl D-glucoside)
205	24	-3	-11	-4	113	16	-8	1	-3	31	-3	0	3	-1	10	-7	-1	0	-11	0	2	-10	-6	0	3	-3
	48	4	-5	11	150	-1	-7	4	1	30	4	1	12	2	11	-8	4	1	-7	9	16	-1	2	3	4	7
	96	15	66	36	204	-2	4	12	9	55	22	-4	31	8	20	14	20	2	0	20	25	9	14	-4	20	17
207	24	5	-7	-8	105	-8	8	-21	-10	-10	-18	71	-28	-30	-32	-23	70	66	-23	-25	-6	55	-17	84	-36	-4
	48	13	2	-2	132	-3	4	-16	-7	-8	-16	81	-26	-28	-27	-19	79	78	-16	-19	-3	67	-13	94	-29	0
	72	16	7	2	147	12	6	-13	-5	-6	-14	87	-24	-25	-24	-17	82	84	-16	-16	-1	73	-11	100	-25	3
	96	18	10	5	151	58	7	-12	-5	-6	-11	90	-25	-24	-23	-15	87	88	-15	-15	-2	78	-9	103	-23	5
209	24	11	557	372	122	102	-2	540	0	32	-14	447	-10	516	8	278	11	553	0	3	4	537	436	395	25	0
	48	2	696	608	221	254	-18	665	-1	17	-18	605	-12	743	7	598	28	681	-9	8	2	50	657	489	116	-3
	72	1	825	802	374	405	-15	815	5	28	-11	801	-8	835	9	812	35	725	-8	112	8	543	853	552	445	19
	96	0	999	999	536	547	-11	999	8	31	-8	999	-3	879	12	947	46	783	-8	236	18	556	999	592	748	29
210	24	12	0	15	160	221	4	8	2	56	-3	2	5	6	13	14	6	25	-10	2	10	-2	-9	9	13	13
	48	-5	5	15	324	526	3	15	1	59	5	3	9	13	13	16	7	18	-11	3	10	-16	-11	-2	17	6
	72	-9	3	13	395	565	2	11	0	47	7	10	9	11	13	16	4	17	-13	2	6	-18	-15	-3	16	3
	96	-10	-1	11	446	593	0	8	-2	34	10	14	10	6	13	16	0	11	-14	2	0	-20	-17	-3	15	-1
211	24	293	498	191	201	82	-11	138	-5	9	-10	444	25	94	22	-9	68	148	-12	-1	-2	735	-10	-15	23	31
	48	427	999	394	308	183	-11	651	-1	10	-8	999	29	110	28	-4	140	176	-8	2	3	999	-5	-14	19	41
	72	578	999	543	360	339	-8	825	2	13	-7	999	33	110	26	-3	222	296	-8	2	5	999	-5	-14	22	42
	96	792	999	692	412	495	-4	999	4	16	-6	999	36	110	24	-2	304	416	-7	2	7	999	-5	-13	24	43
212	24	0	487	473	116	94	-10	428	-10	11	-17	424	-17	446	0	434	-2	408	-13	-1	-2	412	389	415	22	-9
	48	-6	448	444	216	264	-15	395	-8	5	-23	384	-16	489	-6	599	-6	408	-17	177	-9	328	340	363	17	-8
	72	0	478	473	266	461	-17	464	-8	6	-19	428	-14	491	-5	728	1	424	-16	461	-9	358	364	383	25	-6
	96	6	507	501	316	658	-19	533	-7	7	-15	472	-12	493	-3	857	8	440	-15	744	-9	387	388	403	33	-4
216	24	-8	148	49	105	12	-16	34	-7	-10	-9	58	-6	64	1	23	34	113	-16	-4	-7	102	77	88	0	2
	48	-4	323	83	240	74	-4	87	-2	-10	-7	133	-4	187	9	139	105	243	-14	4	2	231	242	206	4	12
	72	-2	420	94	298	122	11	105	-5	-10	-7	235	-3	272	9	222	185	334	-15	2	-2	324	341	313	6	16
	96	-3	548	10	399	330	33	159	-3	-9	-6	497	-3	403	7	301	325	477	-15	0	-2	417	506	541	7	27
218	24	30	12	4	126	56	-11	-8	7	-5	5	146	-17	-8	-15	-3	161	155	-6	-9	5	164	15	188	-16	43
	48	30	14	4	146	106	-10	-9	4	-3	3	150	-18	-10	-17	-5	159	157	-8	-10	2	168	8	189	-17	44
	72	31	16	6	159	158	-8	-7	5	-2	4	155	-17	-10	-17	-5	162	161	-8	-9	3	173	7	194	-16	41
	96	34	17	8	183	265	-6	-6	6	0	6	161	-15	-7	-13	-2	164	167	-6	-7	4	179	9	202	-14	43
219	24	10	6	30	55	9	2	4	5	19	-4	0	6	10	7	7	8	7	4	7	9	3	5	-2	8	12
	48	7	7	36	67	7	1	3	8	18	-6	1	8	4	4	11	6	9	4	5	14	2	7	-6	6	12
	96	12	13	54	73	4	7	9	13	23	3	2	14	6	13	13	7	20	8	12	27	11	11	-2	13	16
220	24	55	29	28	149	-7	-4	-6	-23	-3	-8	169	-24	-11	-16	-12	43	60	-10	-6	-14	38	-5	76	-15	0
	48	55	35	30	201	-9	1	-3	-20	2	-4	172	-23	-11	-15	-11	46	69	-5	-3	-13	41	-3	83	-14	3
	72	59	40	35	220	-10	6	1	-17	7	0	180	-21	-9	-13	-9	51	78	-1	1	-9	48	3	88	-11	5
	96	63	45	40	238	-6	10	4	-13	13	3	191	-17	-1	-10	-5	57	84	3	5	-6	54	13	94	-8	8
221	24	21	-8	0	110	33	-5	-16	-12	9	-16	61	-22	-6	-20	-17	31	34	-19	-10	-7	47	12	69	-14	-1
	48	23	-6	-3	168	73	-6	-20	-9	5	-16	82	-20	-8	-22	-20	32	36	-20	-10	-8	46	9	73	-13	-4
	96	29	-1	4	231	100	-2	-18	-6	8	-15	90	-17	-3	-19	-16	39	40	-16	-7	-5	126	13	83	-11	1
223	24	8	27	17	71	-5	11	18	8	19	11	16	21	20	28	19	23	20	18	116	16	4	12	13	19	13
	48	10	30	21	83	-4	17	20	14	25	17	23	25	23	30	23	27	23	19	19	19	9	14	18	21	16

Strain	Time	A2 (a-cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 ((D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)	B5 (gentiobiose)	B6 (a-D-glucose)	B7 (m-inositol)	B8 (a-D-lactose)	B9 (lactulose)	B10 (maltose)	B11:(D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (b-methyl D-glucoside)
	72	9	30	21	90	15	16	19	16	26	17	22	26	22	30	22	27	22	18	19	19	10	14	19	21	15
	96	6	27	19	94	55	14	15	15	25	17	18	24	19	27	19	29	19	16	17	17	8	12	17	19	13
	24	-11	-15	-9	39	-27	-22	-20	-15	-1	-15	-20	-9	-17	-13	-16	-19	-18	-21	-18	-16	-16	-16	-21	-14	-22
224	48	-6	-10	-6	64	-22	-19	-25	-18	3	-17	-30	-7	-19	-10	-15	-16	-24	-17	-22	-18	-19	-20	-36	-18	-34
	72	-7	-17	-7	70	-3	-24	-26	-18	-2	-20	-34	-8	-29	-10	-26	-20	-37	-23	-29	-24	-28	-29	-39	-22	-43
	96	-6	-21	-8	75	48	-26	-29	-24	-5	-24	-40	-9	-34	-14	-33	-21	-36	-23	-36	-30	-37	-33	-40	-25	-44
	24	-9	-1	11	53	-37	3	3	2	26	4	7	7	3	9	1	2	7	3	2	12	1	8	5	-3	0
226	48	-10	1	14	54	-42	2	5	3	25	3	5	4	5	11	3	3	8	3	4	11	3	5	7	0	3
	96	-9	4	21	64	-42	5	9	7	30	4	6	5	7	15	7	5	11	6	7	15	6	5	11	2	4
	24	-37	16	52	103	17	-5	41	-1	16	-5	0	-2	3	0	-3	7	8	-2	-4	-1	132	-6	-6	2	-4
227	48	-42	32	62	133	80	-11	99	-3	13	-3	-3	1	-3	0	-13	8	12	-4	-7	-2	332	-6	-8	1	-13
	96	-28	85	113	318	416	-11	488	3	21	5	-6	4	6	9	-6	21	72	6	1	6	999	3	-10	11	-1
	24	-6	-7	-14	14	3	-18	-13	-2	-11	-1	-9	-12	-8	-14	-5	-18	-9	-16	-15	-16	-11	4	-1	-15	-11
228	48	0	2	-4	25	15	-11	-5	40	1	32	-5	-4	3	-7	17	-10	7	-9	-5	-6	3	27	24	-7	-2
	72	2	5	-1	30	28	-10	-4	64	2	40	-7	-3	2	-9	37	-13	14	-11	-7	-8	4	31	43	-8	-4
	96	3	8	2	38	49	-8	-3	79	4	47	-7	-3	8	-7	67	-11	25	-10	-6	-7	8	38	68	-7	-1
	24	-9	-29	-12	171	-31	-24	-34	-22	-21	-24	-17	-17	-35	-34	-32	-35	-33	-20	-35	-19	-31	-15	-17	-35	-20
230	48	-5	-22	-8	256	-32	-24	-32	-21	-20	-23	-17	-11	-31	-26	-28	-27	-25	-16	-32	-16	-25	-12	-17	-31	-15
	72	2	-18	-6	318	-29	-23	-26	-18	-16	-21	-18	-6	-26	-21	-23	-22	-25	-12	-27	-15	-21	-11	-19	-22	-9
	96	5	-13	0	584	-22	-19	-20	-13	-12	-15	-15	-1	-21	-15	-17	-16	-20	-7	-23	-10	-14	-6	-17	-16	-3
	24	59	74	31	19	-37	5	2	3	66	-2	75	-7	38	33	17	87	81	5	92	85	97	-2	33	79	56
231	48	66	91	41	33	-34	4	19	6	88	-3	77	-12	50	41	21	99	81	11	97	93	113	-2	46	77	69
	96	71	92	49	34	-38	4	22	3	94	-4	77	-2	64	33	21	105	80	3	95	101	113	-9	62	89	74
	24	25	233	172	74	26	1	266	-2	21	-1	11	4	14	31	5	3	314	-1	2	-1	276	-8	4	3	134
232	48	18	442	359	116	43	-3	337	-3	10	-5	3	3	12	33	7	1	393	-6	-1	-7	408	-10	0	-5	397
	96	47	621	447	199	84	5	445	16	34	5	13	25	20	47	36	25	486	20	29	16	654	8	14	5	916
	24	25	56	42	14	-36	14	32	6	31	-3	43	3	54	25	67	55	63	11	34	59	54	1	61	58	60
234	48	25	91	51	30	-35	18	70	10	33	-1	48	7	124	30	111	88	83	30	56	111	81	-1	73	98	106
	72	22	113	51	31	-40	18	95	6	58	-1	54	8	169	21	132	94	82	59	92	136	81	-5	110	137	126
	96	18	134	50	32	-45	17	119	2	82	0	60	9	214	11	153	99	80	87	127	161	81	-9	146	175	145
	24	-2	11	19	63	33	-1	4	0	15	0	0	8	19	9	14	3	11	-2	4	3	6	25	8	21	3
236	48	1	11	30	69	62	1	7	5	23	6	0	9	13	-2	11	7	20	0	7	9	9	30	7	17	3
	96	8	19	46	92	63	3	4	0	15	7	-6	12	15	5	11	2	35	-1	4	4	20	30	2	19	0
	24	4	153	144	55	-9	-13	189	-4	19	-11	-2	-7	-10	4	-7	-6	246	-13	-6	-3	142	-11	-7	-6	-9
237	48	9	283	240	74	-6	-10	262	-4	16	-10	-8	-6	-6	8	-11	-3	356	-12	-4	3	261	-9	-7	-8	-7
	96	21	448	301	115	2	-11	304	-2	23	-8	-15	-2	12	22	-4	13	377	-3	6	22	460	3	-10	-6	-5
	24	-2	580	501	116	89	3	532	5	14	-12	420	-8	516	0	433	6	552	-5	3	3	576	518	356	12	-14
238	48	-14	804	729	223	241	-4	718	6	16	-14	608	-3	738	6	597	20	633	-5	10	9	621	605	593	9	-13
	96	-21	999	999	384	623	-9	965	3	13	-14	956	1	756	-1	935	23	571	-10	554	7	656	619	767	16	-11
	24	11	296	133	117	47	3	289	5	14	-1	2	-5	0	8	5	-4	286	5	0	35	266	-1	-4	8	209
239	48	9	502	155	155	48	0	367	3	10	-3	-7	0	-2	9	11	-2	414	1	3	40	437	-4	-5	10	318
	96	3	633	175	203	94	-9	413	1	-3	-16	-16	-1	-15	11	17	4	427	0	-6	46	663	-7	-13	15	496
	24	-9	-14	10	90	9	-10	-14	-5	33	-8	-1	-4	-1	4	-10	-10	-9	-13	-13	-4	-12	-12	-3	-6	-12

Strain	Time	A2 (a-cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 ((D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)	B5 (gentiobiose)	B6 (a-D-glucose)	B7 (m-inositol)	B8 (a-D-lactose)	B9 (lactulose)	B10 (maltose)	B11(D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (b-methyl D-glucoside)
241	48	-6	-11	26	117	-5	-5	-15	1	32	-5	2	-2	-2	2	-10	-3	-13	-11	-10	5	-14	-11	-7	-12	-6
	96	9	0	63	163	0	17	2	19	44	15	2	20	11	14	9	7	-3	-1	11	20	-4	8	4	7	12
242	24	109	173	141	54	-13	5	210	9	33	-3	30	4	27	29	26	35	256	4	45	23	163	-3	32	27	61
	48	102	255	189	97	-21	-1	253	8	43	-3	22	9	37	34	23	42	314	2	46	29	233	-3	35	21	148
	96	75	316	279	147	-30	0	262	9	103	-3	29	6	48	48	22	48	327	-1	38	33	296	-7	37	28	242
243	24	10	20	27	92	-12	0	28	-1	27	0	3	-2	27	34	38	15	29	27	-5	25	35	25	65	25	26
	48	13	44	48	139	-12	1	43	0	33	8	22	1	50	52	71	30	57	40	-3	51	56	51	113	47	40
	72	12	61	58	163	14	3	51	1	38	18	42	0	68	62	98	41	85	45	-2	70	70	74	133	75	50
	96	11	85	66	193	60	4	65	1	43	41	80	-1	90	75	128	55	118	52	-2	98	87	102	157	123	60
244	24	225	379	162	129	84	1	168	-2	-2	-5	362	14	68	13	86	54	189	2	13	2	434	-5	-15	17	17
	48	452	475	432	215	195	7	500	4	1	-2	478	16	84	26	108	101	227	10	23	12	516	6	-11	16	30
	96	542	512	520	365	470	9	565	5	2	6	503	18	96	34	113	396	521	10	26	21	533	5	-9	20	38
245	24	1	3	8	109	34	-3	-6	-3	28	-7	9	1	18	27	-3	-1	7	-5	-1	3	-5	-6	7	3	-1
	48	2	-8	13	128	4	-1	-8	1	39	-5	-4	1	10	27	3	1	-7	-4	0	7	-4	-5	-2	-7	-1
	96	12	7	38	176	37	3	3	11	54	0	-13	14	14	38	10	17	-3	9	9	15	1	6	-11	8	11
246	24	7	0	-7	44	1	-12	-15	-9	1	-12	-8	-3	2	-3	-1	-3	-5	-4	-5	-10	-11	-1	-9	-1	-8
	48	4	3	-6	71	54	-23	-21	-4	-8	-17	-13	-5	4	-5	-5	-1	-7	-2	1	-3	-12	3	-13	-9	-4
	72	2	-5	-12	70	108	-28	-22	-9	-12	-20	-17	-10	-9	-18	-18	-12	-23	-14	-5	-9	-17	1	-24	-15	-19
	96	-3	-10	-15	74	227	-31	-24	-11	-14	-21	-23	-10	-9	-22	-20	-12	-25	-12	-7	-10	-20	0	-27	-15	-20
250	24	121	276	158	251	79	10	89	-24	-16	-18	231	15	65	3	-15	50	85	0	-3	-21	472	-16	-26	8	12
	48	305	884	534	367	182	29	617	-21	-15	-12	999	16	96	9	-12	84	127	7	2	-18	958	-11	-22	15	27
	72	523	999	899	443	272	43	999	-18	-9	-10	999	21	108	12	-8	183	164	11	7	-13	999	-9	-20	21	30
	96	726	999	999	586	379	53	999	-15	-4	-9	999	24	116	13	-4	324	767	11	9	-10	999	-8	-16	22	33
251	24	-9	46	11	59	13	-9	250	-14	-4	-23	27	-11	129	-13	3	85	167	-19	-7	-17	31	126	192	-1	-21
	48	-12	33	6	79	9	-1	218	-13	-11	-26	18	-14	145	-30	6	136	133	-28	-7	-26	47	100	170	-11	-29
	96	-1	180	73	112	66	-2	512	1	-5	-23	171	-14	368	-5	152	531	279	-11	169	-10	156	376	380	26	-22
254	24	-15	-15	-12	269	-20	-10	-22	-22	-7	-20	-22	-19	-18	-18	-15	-18	-18	-23	-25	-24	-17	-21	-29	-22	-28
	48	-10	-20	-15	454	-21	-7	-26	-24	-11	-23	-25	-17	-18	-22	-23	-23	-23	-26	-28	-27	-23	-27	-33	-23	-27
	96	1	-13	-5	487	-14	9	-11	-14	1	-16	-23	-6	-10	-17	-17	-19	-20	-21	-24	-22	-20	-22	-29	-13	-22
256	24	-5	-18	-11	89	-22	-21	-11	-20	-4	-20	-19	-14	-5	-16	-20	-19	-9	-25	-17	-21	-9	-26	-17	-14	-17
	48	1	-13	-6	144	-31	-12	-20	-23	-6	-22	-18	-6	-12	-15	-26	-26	-24	-31	-28	-30	-20	-30	-27	-19	-24
	96	2	-16	-5	190	-29	-5	-12	-14	-7	-17	-26	-9	-15	-23	-19	-12	-16	-25	-20	-17	-14	-23	-29	-10	-26
257	24	16	14	8	29	-41	-6	-13	2	-8	-9	-6	3	15	2	-1	1	7	-7	-4	3	34	19	6	-2	10
	48	24	44	29	77	-39	-5	-20	3	-6	-13	-7	8	32	7	3	11	25	-3	1	11	102	68	4	0	10
	72	28	63	48	111	-36	-1	-23	1	-4	-15	-9	10	35	11	8	18	40	2	5	17	132	92	5	4	12
	96	36	80	60	150	-39	6	-26	-4	-8	-15	-9	13	44	12	14	18	53	6	3	12	142	104	9	6	15
258	24	37	355	232	89	46	-24	388	-10	7	3	367	-19	399	-17	135	322	372	-19	23	-7	356	68	361	2	-39
	48	41	415	316	92	50	-26	462	-8	8	2	341	-18	477	-18	294	420	412	-19	102	-10	403	128	402	3	-40
	72	45	427	376	97	54	-24	505	-5	12	4	355	-15	508	-16	348	446	431	-16	221	-7	426	151	404	6	-41
	96	45	430	423	102	56	-23	500	-5	13	4	357	-15	521	-14	400	449	443	-15	278	-5	437	170	411	8	-41
259	24	39	112	234	126	51	52	172	9	63	-23	144	-10	146	54	93	150	199	24	113	57	168	100	-19	80	122
	72	63	115	252	203	55	57	210	17	61	-24	140	-12	195	58	240	198	211	27	260	55	177	181	-18	197	186
	96	67	123	258	260	74	59	225	19	62	-24	140	-11	223	59	308	143	230	27	256	53	181	201	-8	314	200

Strain	Time	A2 (a-cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 ((D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)	B5 (gentiobiose)	B6 (a-D-glucose)	B7 (m-inositol)	B8 (a-D-lactose)	B9 (lactulose)	B10 (maltose)	B11(D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (b-methyl D-glucoside)
261	24	-3	3	13	275	9	-9	35	-6	8	-12	-11	7	9	2	-6	-6	14	-12	-7	-8	-9	-11	-23	0	6
	48	-22	4	11	273	79	-14	102	-4	6	-7	-13	2	10	4	-8	-3	49	-11	-6	-3	18	-8	-35	-1	-1
	72	-12	12	15	336	180	-9	396	-2	14	-5	-17	5	18	11	-5	2	100	-11	-3	0	242	-5	-36	6	-4
	96	-6	14	20	532	401	-6	996	-4	21	-6	-22	9	27	17	4	8	155	-9	1	0	963	-6	-30	12	3
262	24	2	1	-5	108	255	-10	-7	-8	-9	-10	-6	-1	-4	-6	-6	-10	-10	-10	-8	-8	-17	-16	-9	-4	-3
	48	6	-8	-6	198	387	-18	-8	-10	-13	-18	-11	-9	-18	-1	-5	-18	-21	-20	-29	-18	-12	-18	-19	-16	-15
	96	0	12	7	231	665	-19	-5	-12	-7	-8	-2	5	2	1	12	-4	-2	1	-7	0	-17	-2	-6	3	-4
263	24	286	377	245	249	59	-7	66	-5	32	-8	437	-3	38	19	-3	16	141	-6	-2	-4	505	-8	-3	-6	-2
	48	310	982	391	320	90	-12	454	-8	24	-10	999	-5	30	15	-10	40	135	-12	-5	-8	977	-12	-14	-9	-6
	96	529	999	559	461	328	-3	999	5	43	-3	999	2	35	25	-4	187	189	-1	9	4	999	1	-7	-4	6
265	24	24	278	237	13	-31	-40	351	-12	-1	-25	10	-23	271	-15	178	24	325	-27	-3	-4	305	-27	-15	-4	-21
	48	47	324	345	30	-20	-33	422	0	6	-17	13	-12	368	-5	265	39	399	-21	0	7	360	-23	-9	14	-10
	72	44	323	373	24	-25	-35	417	-5	-1	-25	0	-16	387	-10	268	35	392	-24	86	3	354	-22	-25	11	-15
	96	51	345	431	26	-31	-31	438	-4	-2	-26	-2	-18	425	-9	292	41	425	-21	98	6	378	-19	127	9	-26
271	24	-3	67	22	49	33	-13	280	-2	0	-11	46	-11	222	-10	20	120	246	-10	10	-10	65	207	217	6	-14
	48	8	121	55	74	55	-7	420	3	1	-8	75	-14	333	-9	56	254	381	-5	70	-6	127	298	388	14	-16
	72	16	176	84	106	102	3	473	14	9	-3	90	-8	495	-4	107	434	457	5	161	1	180	494	571	30	-16
	96	21	229	98	127	191	13	511	17	6	-3	123	-9	610	-4	176	615	497	15	263	7	267	738	638	36	-20
278	24	-9	4	30	45	8	-8	-9	2	-9	-14	15	-12	1	-5	-10	0	-2	-13	-5	-2	135	13	23	-4	-12
	48	3	13	42	61	13	-8	-7	1	0	-11	5	-6	9	-5	-7	7	10	-11	-4	0	148	21	20	-7	-18
	72	11	22	60	74	13	-11	-9	0	-4	-15	2	-6	19	-3	-1	19	24	-7	3	5	174	34	22	-2	-11
	96	16	10	79	85	7	-12	-10	-3	-6	-16	1	-11	15	-7	3	14	30	-13	-1	1	192	30	24	-1	-16
283	24	49	132	54	298	-3	-23	7	-14	1	-21	-5	-4	-12	-14	-4	-13	-4	-19	3	-18	229	-16	-22	-17	-18
	48	89	740	249	260	32	-23	344	-5	2	-18	9	3	-2	-8	7	0	22	-15	6	-12	935	-8	-21	-8	-12
	96	108	999	503	214	102	-10	999	12	19	-7	28	7	7	1	22	17	43	-3	17	0	999	0	-15	9	-6
289	24	-15	96	19	89	36	-7	-4	-9	14	-11	11	-3	20	-2	13	7	35	-14	-5	-8	111	137	36	-15	-8
	48	-15	224	35	189	111	-7	-6	-12	15	-15	19	-5	39	-1	48	28	123	-15	-8	-8	233	251	70	-13	-4
	72	-14	351	51	288	186	-7	-8	-14	16	-19	26	-7	57	0	82	49	211	-16	-11	-8	354	365	103	-11	0
	96	-18	456	62	394	304	-3	-8	-16	68	-9	69	-6	128	1	117	101	306	-20	-18	-13	446	456	152	-10	2
7708	24	28	138	106	203	98	16	53	32	54	22	47	23	49	46	35	55	102	24	22	26	63	33	88	16	75
	48	63	183	152	279	123	31	68	32	75	35	52	30	78	68	59	81	141	44	50	31	73	58	10	22	106
	72	62	123	149	285	111	20	40	20	65	25	39	17	50	35	24	48	90	18	21	26	58	23	77	18	100
	96	79	118	200	419	101	15	47	26	66	23	39	13	45	40	26	41	104	23	30	36	70	26	73	20	97
8071	24	17	3	7	234	110	7	108	11	456	-11	-13	39	35	16	2	4	21	-4	9	15	5	-8	-18	19	34
	48	24	9	11	352	214	9	173	15	655	-6	-18	42	41	22	4	9	25	-1	17	20	9	-5	-17	21	40
	72	30	10	17	396	328	9	372	13	677	-10	-23	33	32	22	1	8	15	-7	13	17	3	-6	-19	15	44
	96	35	11	23	439	442	9	571	11	699	-14	-28	23	23	22	-2	7	4	-13	9	13	-4	-7	-21	9	48
10144	24	13	-3	3	-17	-10	-10	-6	-5	13	-4	-3	0	-6	-2	-5	1	-3	-6	-8	-6	3	-8	-3	-4	-9
	48	13	-1	11	-8	-14	-9	-7	-5	18	-2	-10	3	-3	5	-4	4	-6	-4	-9	-5	-1	-8	-2	1	-4
	96	24	-9	23	6	16	-7	7	-3	24	5	19	5	-6	8	-7	32	-5	-5	-2	5	1	-6	-2	2	0
11040	24	-2	70	37	89	69	78	152	-2	169	-8	70	5	143	-6	99	13	151	6	95	-1	61	98	124	76	104
	48	8	173	87	251	235	265	321	65	637	51	260	37	297	26	236	55	293	63	240	31	248	190	247	236	337
	72	14	242	150	402	438	358	555	193	742	211	366	38	581	69	332	231	555	148	431	50	378	339	333	308	457

Strain	Time	A2 (a-cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 ((D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)	B5 (gentobiose)	B6 (a-D-glucose)	B7 (m-inositol)	B8 (a-D-lactose)	B9 (lactulose)	B10 (maltose)	B11(D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (b-methyl D-glucoside)
	96	19	310	213	553	640	451	788	320	846	370	471	39	864	112	427	407	816	232	621	68	507	487	419	380	576
	24	25	106	86	87	92	-3	99	4	9	44	10	23	93	4	2	22	125	97	9	4	107	84	21	18	29
14393	48	32	182	112	170	179	1	18	8	14	70	11	28	185	8	6	29	232	179	13	8	222	151	22	24	35
	72	38	227	127	206	193	4	191	9	16	179	10	26	403	9	9	34	453	350	14	5	389	439	25	22	38
	96	44	272	142	242	206	7	363	9	18	288	8	24	620	10	12	39	673	520	15	2	556	727	27	19	41
	24	56	21	23	236	330	14	9	7	33	4	7	22	17	28	1	10	15	7	8	10	0	9	8	-1	23
17749	48	82	54	61	548	780	32	22	15	71	24	10	39	48	55	17	25	32	23	12	22	3	38	11	-6	57
	72	88	44	54	586	999	-5	-4	-10	80	5	-15	12	25	54	8	25	9	17	13	27	6	19	3	-6	20
	96	102	35	68	622	999	19	1	-4	75	4	-2	11	24	28	-5	-5	8	13	21	21	5	1	-8	-1	11
	24	11	154	33	24	39	-2	7	4	51	-5	58	6	39	44	15	54	104	-2	11	1	120	12	53	13	10
19260	48	13	385	57	124	119	4	5	-3	59	-3	97	2	30	55	10	88	205	-8	9	4	326	24	69	5	18
	72	11	519	67	157	142	3	7	-7	52	-8	122	-1	30	57	17	97	372	-13	10	2	497	38	78	3	11
	96	12	650	78	189	185	4	9	-9	57	-6	135	0	32	55	25	105	450	-10	10	3	545	49	87	4	13
	24	40	69	48	86	97	63	177	2	95	-6	16	-11	109	166	110	13	111	182	-5	4	91	99	101	104	97
19323	48	16	165	56	195	213	161	427	0	217	-12	9	-18	404	295	372	42	221	339	-6	0	186	204	382	230	455
	72	18	340	66	343	421	549	645	2	545	-13	6	-19	999	528	734	135	802	674	-8	2	630	754	847	606	741
	96	21	424	72	401	505	801	737	1	827	-14	4	-20	999	742	948	220	999	843	-6	4	737	898	904	765	786
	24	444	471	307	73	5	335	6	-3	512	-1	385	3	435	8	373	484	448	2	454	190	463	0	401	307	346
19326	48	438	527	559	134	6	434	13	-15	680	0	513	-3	532	4	535	565	456	2	514	352	480	-6	474	441	513
	72	398	603	686	119	3	560	12	-19	992	-4	843	-14	562	-1	568	675	491	-10	505	445	480	-15	558	689	638
	96	478	773	712	117	1	706	15	-20	999	-9	999	-17	578	2	594	744	604	-13	527	484	491	-17	847	804	741
	24	21	95	24	118	126	11	15	15	7	8	6	36	64	19	13	-1	144	10	12	14	117	7	0	25	39
23597	48	18	135	37	152	169	5	11	12	1	9	-5	37	115	19	11	-9	167	11	15	17	163	9	-14	26	43
	72	20	166	64	167	178	8	10	12	6	21	-6	38	144	18	19	1	198	19	15	20	196	22	-17	33	53
	96	22	196	90	182	187	10	8	12	10	32	-7	39	173	16	26	11	229	26	15	23	228	34	-19	39	63
	24	23	92	34	162	104	14	23	20	16	77	27	36	195	20	197	20	182	147	10	16	123	157	83	30	40
25374	48	29	120	53	424	276	19	20	13	28	159	12	23	405	19	346	22	328	255	8	17	220	336	91	19	33
	72	38	129	64	476	382	9	21	14	14	205	10	23	557	22	492	16	448	426	10	20	293	452	100	20	33
	96	45	147	82	544	692	8	21	15	17	299	10	21	754	26	706	20	627	624	17	27	404	667	121	22	37
	24	8	142	136	39	-8	131	396	-13	-5	-18	9	-8	320	11	209	75	216	-8	-11	-19	143	-21	263	23	1
25521	48	14	165	163	52	-3	242	419	-8	-2	-13	-1	-9	410	19	303	93	342	-4	-2	-10	145	-18	363	33	3
	72	31	207	212	88	18	304	593	-5	2	-9	6	-4	490	25	519	104	437	11	6	4	197	-9	432	45	6
	96	47	249	260	124	38	365	766	-1	8	-4	13	1	569	30	735	115	531	26	13	17	249	0	501	57	9
	24	2	281	281	63	21	220	428	-9	15	-14	40	-4	344	14	279	110	368	-8	7	0	374	1	212	25	-7
25915	48	0	340	297	105	53	331	492	-16	4	-15	7	-2	438	2	393	106	373	-20	-4	-7	379	-10	276	23	-11
	72	13	411	325	162	71	503	577	-17	10	-10	3	-1	514	-5	496	92	498	-24	-10	-12	530	-4	333	22	-12
	96	26	482	353	218	88	674	662	-17	16	-5	-1	0	590	-11	599	77	623	-28	-16	-16	680	2	389	20	-13
	24	17	34	38	168	109	17	28	4	27	3	8	30	32	29	31	40	226	6	13	-4	21	-1	16	14	24
27118	48	15	46	47	267	228	15	42	7	24	11	4	40	67	38	39	48	440	9	16	0	36	9	53	17	38
	72	27	63	73	379	381	36	65	15	50	26	4	46	137	39	58	61	720	11	18	-1	61	20	172	34	35
	96	38	79	98	490	533	57	87	23	75	40	3	51	206	39	77	73	999	12	19	-2	86	30	291	51	32
	24	50	97	67	49	-4	3	62	94	104	110	99	136	161	36	54	34	131	89	13	10	139	119	96	37	70
27119	48	44	121	84	78	7	4	116	159	222	191	173	272	254	43	88	45	214	163	16	20	252	191	156	29	76

Strain	Time	A2 (a-cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 ((D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)	B5 (gentiobiose)	B6 (a-D-glucose)	B7 (m-inositol)	B8 (a-D-lactose)	B9 (lactulose)	B10 (maltose)	B11(D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (b-methyl D-glucoside)
	96	59	124	145	152	37	10	270	395	555	393	343	540	552	41	224	54	493	338	20	29	514	475	363	34	85
27122	24	14	69	54	80	76	-1	93	3	6	2	5	20	76	17	5	21	131	-8	13	8	102	-2	2	12	31
	48	20	114	86	174	163	6	321	-2	3	6	-13	23	288	22	9	24	335	-6	10	6	251	0	-10	17	28
	72	25	137	106	239	20	5	426	-1	8	10	-15	14	446	29	18	36	537	-3	18	12	431	9	-7	32	26
	96	50	192	160	315	245	11	488	7	22	29	-7	32	723	21	37	44	906	7	26	7	693	26	8	49	31
27123	24	10	-5	-3	38	-5	-3	-6	0	16	-3	-4	23	223	4	14	-3	0	-8	-5	4	-5	-5	-3	11	9
	48	9	0	5	40	-7	-6	-10	-6	9	-12	-18	15	487	2	11	-5	12	-9	-8	-2	-5	-4	-17	-2	3
	72	21	9	16	51	-16	-7	-9	-2	14	-10	-18	13	725	2	32	-2	15	4	2	3	4	2	-13	-2	2
	96	38	9	18	100	-18	-33	-2	57	51	1	-16	34	999	22	59	10	7	15	15	11	12	4	-7	-5	4
27124	24	32	136	99	129	109	0	274	159	300	183	266	175	328	29	271	244	327	121	237	279	255	233	288	162	189
	48	54	296	213	289	297	3	824	548	915	727	813	817	867	19	880	594	967	490	614	710	669	759	845	462	429
	72	42	327	209	337	282	0	920	812	999	905	812	999	999	20	999	709	999	670	753	856	810	946	999	566	528
	96	41	361	231	331	255	1	914	999	999	999	856	999	999	25	999	988	999	968	999	999	999	999	999	790	699
27125	24	15	54	44	118	166	-6	73	0	2	-8	-8	18	75	8	-2	8	108	-9	-2	3	79	-6	4	7	18
	48	19	131	78	294	457	1	333	7	4	-3	-17	29	234	2	-9	7	429	-12	-1	3	328	-2	-11	16	15
	72	29	174	111	455	679	-3	480	7	4	2	-9	18	390	24	10	32	835	5	17	17	629	9	-5	29	38
	96	28	200	140	705	838	18	475	19	18	15	-2	39	546	20	25	47	999	19	21	24	846	19	1	37	37
27126	24	5	3	3	58	-27	-15	-13	-9	17	-11	-13	7	-7	-5	-7	-13	-11	-17	-10	-11	-13	-11	-11	-1	-5
	48	10	7	13	67	-26	-10	-7	-6	29	-6	-6	13	-1	2	0	-7	-5	-10	-4	-5	-7	-5	0	3	4
	72	15	10	17	70	-28	-10	-6	-1	31	-5	-8	14	2	4	2	-5	-5	-9	-6	-5	-9	-5	-4	5	9
	96	30	16	27	85	-24	-5	-1	9	40	1	-5	20	12	13	8	2	2	2	4	5	1	5	2	13	11
27128	24	2	8	4	0	-12	-4	-5	2	6	-3	-2	19	8	3	0	-5	31	2	-5	6	12	-7	-3	11	5
	48	7	6	2	1	-16	-4	-4	3	7	-1	-3	13	11	4	-3	-4	27	3	-6	7	8	-5	-2	11	6
	96	8	9	5	12	-15	-2	-2	6	10	0	-2	14	14	10	2	2	33	3	3	18	20	-2	3	17	11
27130	24	4	-23	-18	75	33	-23	-9	-10	0	-16	-6	5	-4	-6	-8	-7	-16	-15	-17	-23	-23	-13	-26	-6	-6
	48	19	-22	-17	100	32	-12	-9	-8	-5	-24	-19	4	-7	-6	-5	-3	-20	-20	-20	-17	-27	-17	-33	-8	-8
	96	39	-10	3	220	49	-7	-16	-14	1	-21	-25	9	9	-5	15	2	-18	-11	-22	0	-20	5	-20	-3	-3
27132	24	23	109	96	167	108	4	6	-3	28	109	23	33	133	17	165	33	150	132	24	22	126	136	126	62	46
	48	21	133	103	223	194	1	3	-3	27	112	14	33	154	14	268	32	289	212	21	17	229	304	139	62	37
	96	24	188	124	278	343	0	0	2	29	184	12	26	273	10	565	27	695	530	15	16	592	540	169	62	33
27562	24	16	-5	1	103	89	-8	69	30	178	90	-7	-2	68	2	143	-5	237	64	-3	-4	-5	188	20	0	-2
	48	25	10	12	324	261	8	368	269	683	434	-6	205	286	19	499	-3	63	362	1	-4	4	522	206	6	11
	72	17	3	9	363	361	-6	614	524	782	748	-10	471	486	-13	786	-2	858	626	-21	-15	-20	685	321	-3	-2
	96	20	-5	11	367	445	-7	689	603	785	737	-22	539	594	-13	859	-11	857	731	-24	-16	-20	713	303	-7	-15
27593	24	14	104	22	133	114	66	196	193	114	246	78	140	144	47	118	154	112	184	41	6	102	145	113	146	61
	48	15	132	13	251	259	135	366	368	224	442	198	414	327	182	215	222	181	385	144	10	200	233	216	299	254
	72	17	132	14	261	490	473	514	597	526	540	386	642	576	390	548	510	331	543	303	21	521	304	506	645	489
	96	24	163	16	320	656	493	546	696	697	691	551	692	654	575	602	617	477	637	377	28	603	411	616	778	486
27950	24	139	116	24	86	59	4	6	6	32	-2	15	-2	15	11	-4	154	148	2	-3	-5	118	-10	154	3	11
	48	203	258	126	225	93	19	17	12	43	11	14	13	23	1	-13	270	237	2	-10	-13	222	2	249	-1	19
	72	221	340	167	240	114	21	16	5	36	4	4	20	26	5	-10	391	358	-5	-12	-10	356	17	333	-5	25
	96	240	382	186	250	114	22	18	8	43	6	12	26	27	9	-8	512	465	-4	-5	-3	389	23	419	1	25
	24	6	38	41	154	-12	-24	-8	-17	-12	-19	-15	-10	-8	-8	-20	-11	-3	-18	-19	-20	32	-17	-3	-12	-13

Strain	Time	A2 (a-cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 (D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)	B5 (gentiobiose)	B6 (a-D-glucose)	B7 (m-inositol)	B8 (a-D-lactose)	B9 (lactulose)	B10 (maltose)	B11 (D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (b-methyl D-glucoside)
29570	48	5	99	88	285	-2	-27	9	-25	-10	-21	-17	-18	-20	-25	-29	-21	-12	-25	-28	-26	42	-25	4	-23	-18
	72	16	168	115	303	-10	-28	22	-30	-15	-27	-27	-24	-25	-25	-31	-33	-15	-32	-26	-23	41	-29	-6	-19	-28
	96	20	175	99	288	-16	-33	14	-34	-18	-34	-31	-29	-26	-26	-30	-39	-18	-38	-26	-23	30	-33	-20	-21	-30
33127	24	21	71	22	43	28	-1	-8	0	-1	-4	0	7	18	13	1	5	74	-2	0	2	74	7	1	6	6
	48	49	164	81	85	115	20	13	17	22	17	14	16	57	23	6	29	146	13	2	-3	178	33	25	7	29
	72	74	255	127	114	151	19	18	22	38	31	14	6	48	12	-4	42	138	18	3	3	183	30	32	10	43
	96	81	262	146	124	126	14	20	19	40	30	11	2	66	14	-1	45	153	24	14	11	192	22	35	13	34
33539	24	38	380	215	224	35	267	671	7	36	-2	44	1	458	15	467	18	372	9	3	7	439	4	403	0	5
	48	42	433	295	207	40	707	870	4	31	-6	43	-8	541	5	514	22	442	10	-1	2	423	9	449	-3	13
	72	50	551	487	226	65	999	999	8	37	1	61	-13	665	13	651	45	570	19	9	17	529	3	556	9	36
	96	63	656	753	261	81	999	999	10	36	-1	59	-15	721	18	699	43	655	12	13	24	579	0	646	14	41
33653	24	48	321	228	38	47	9	338	49	193	30	203	35	333	45	99	56	415	227	2	2	282	203	78	30	211
	48	47	369	283	108	134	13	403	56	258	79	263	27	359	38	183	46	470	312	3	22	326	276	76	19	339
	72	45	440	298	221	267	13	432	58	278	85	253	27	345	31	237	46	475	340	4	15	293	276	69	12	394
	96	48	40	325	362	374	9	384	46	300	92	272	22	337	36	343	51	438	389	10	15	303	319	97	22	461
35016	24	344	492	227	237	145	257	410	49	116	35	322	39	362	49	28	50	533	40	46	45	412	348	498	27	44
	48	627	624	480	336	240	483	516	22	231	83	534	9	686	36	152	66	741	102	37	35	532	551	670	-7	164
	72	673	748	707	439	317	567	569	25	509	121	563	1	852	45	243	71	869	151	48	40	640	720	824	-4	203
	96	644	725	696	451	329	580	555	24	626	141	536	-3	881	39	289	53	870	133	48	41	625	781	849	-7	269
35084	24	183	321	266	83	72	185	320	36	52	-7	259	-3	234	49	284	72	271	21	37	51	251	230	192	87	194
	48	230	343	529	190	163	358	351	14	56	37	285	-16	279	29	433	76	298	16	59	25	261	276	318	42	269
	72	253	363	653	380	327	483	403	12	60	66	262	-20	296	20	503	73	320	9	55	20	284	306	348	55	326
	96	266	390	671	492	438	579	442	17	63	74	265	-20	315	24	584	72	338	6	69	27	295	324	370	61	322
35912	24	48	373	276	25	44	18	381	37	219	38	254	91	440	48	140	77	401	217	22	35	427	206	86	43	259
	48	39	437	352	25	68	16	498	30	302	36	321	70	510	48	194	68	421	329	-1	6	465	307	96	43	389
	72	34	470	376	36	65	18	513	24	326	34	347	56	505	49	270	60	420	421	-4	10	489	360	156	44	482
	96	44	485	448	42	68	16	546	15	319	34	335	49	536	52	443	55	423	506	5	18	501	396	302	46	521
51192	24	58	28	16	276	166	316	403	0	33	-5	-7	53	55	33	11	15	201	-4	4	4	-6	-14	-5	32	45
	48	66	28	26	383	274	470	461	0	32	-8	-9	32	36	22	8	11	209	-13	6	8	-5	-17	-14	24	45
	72	68	25	31	523	441	497	472	-3	28	-12	-15	29	34	22	8	2	483	-17	8	9	-9	-14	-17	25	19
	96	76	27	35	613	490	536	520	1	26	-14	-15	32	41	28	12	9	516	-9	11	15	-5	-8	-18	30	25
51288	24	59	267	259	84	76	2	578	68	317	-13	352	24	475	54	55	337	374	-8	25	8	376	315	23	48	493
	48	59	857	425	237	197	11	913	38	784	-3	822	23	810	80	206	706	596	-6	52	14	625	624	21	25	841
	72	80	962	664	314	369	8	999	48	999	-11	999	9	936	60	833	768	622	-16	52	54	736	798	4	23	894
	96	89	999	913	376	469	5	999	42	999	-16	999	7	997	76	999	890	659	-16	110	276	877	983	-2	32	987

Strain	Time	C3 (D-psicose)	C4 (D-raffinose)	C5 (L-rhamnose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	D1 (acetic acid)	D2 (cis-aconitic acid)	D3 (citric acid)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (a-hydroxybutyric acid)	D11 (b-hydroxybutyric acid)	D12 (g-hydroxybutyric acid)	E1 (r-hydroxy phenylacetic acid)	E2 (itaconic acid)	E3 (a-keto butyric acid)
3	24	4	11	20	18	17	13	5	1	0	12	60	4	15	-26	3	14	17	30	12	-1	-5	9	-18	3	36
	48	19	24	30	30	26	23	18	13	10	25	59	11	24	-28	14	25	28	36	23	13	12	5	-27	8	57
	96	28	-32	25	35	33	36	26	24	10	4	-39	3	67	32	6	29	22	81	29	24	-41	-1	-15	14	17
5	24	6	0	-7	-1	-5	-3	-5	-13	-29	-23	24	3	-8	-10	-9	-7	-13	-8	9	-21	-7	-3	-28	111	-19
	48	9	1	-5	0	-4	-1	-4	-12	-24	-24	26	4	-7	-3	-9	-7	-11	-7	9	-26	-2	1	-15	116	-20
	72	14	9	-1	5	1	5	0	-8	-18	-16	38	10	-3	5	-4	-5	-8	-3	17	-26	4	7	-6	131	-18
	96	28	17	5	13	8	11	7	-4	-8	-8	52	20	4	13	10	2	-4	3	32	-19	16	16	2	154	-10
7	24	16	0	1	-1	7	17	0	-1	8	-1	16	7	0	-7	-7	-2	0	-1	1	1	16	-6	9	52	2
	48	32	-2	25	7	28	36	12	13	34	22	30	31	16	2	11	10	15	7	13	24	41	10	12	74	18
	72	55	11	39	18	45	56	26	20	55	33	45	44	29	9	23	17	26	20	24	39	59	16	23	96	34
	96	64	17	43	20	47	71	23	20	66	43	53	51	36	18	28	21	30	20	41	50	69	24	25	109	40
9	24	20	4	25	4	14	2	1	-7	125	107	146	150	22	19	4	20	1	6	6	-16	10	-7	16	95	0
	48	15	-13	18	-2	17	12	5	2	161	159	147	134	17	16	5	7	2	7	-17	29	98	1	31	66	7
	72	16	-11	21	-1	17	13	6	5	165	159	165	159	20	23	5	9	3	6	-15	31	105	-3	28	68	9
	96	21	-10	24	-2	17	16	9	6	167	157	198	170	24	29	6	12	4	8	-13	33	111	-5	24	71	12
	120	10	-9	14	0	6	9	2	2	107	101	186	163	6	12	-4	11	2	-4	-5	25	61	-13	21	66	2
11	24	6	1	-2	-2	-2	-4	-3	-6	5	5	0	1	0	-11	-7	3	-5	-5	-2	-7	4	0	-5	44	7
	72	34	19	22	10	19	18	16	9	44	47	15	37	26	11	19	30	15	15	19	17	32	21	15	89	41
	96	29	25	17	20	14	6	11	6	38	45	21	32	17	11	17	25	9	8	30	9	23	16	12	85	29
12	24	10	0	19	9	8	7	1	4	9	12	1	7	-1	1	-2	17	8	3	0	0	11	3	25	49	0
	48	15	7	23	10	19	17	4	13	30	37	5	21	12	9	3	30	22	8	2	16	26	8	21	66	12
	72	14	11	28	12	23	22	4	16	35	43	7	25	16	17	13	34	30	10	3	16	23	5	31	73	17
	96	11	16	25	11	21	24	2	17	42	46	2	24	16	20	16	31	30	9	1	16	23	8	22	72	19
13	4	16	63	9	17	112	112	49	-4	-11	-8	22	-3	4	-21	-6	8	10	7	-6	-16	-16	-8	-34	2	-12
	24	26	176	63	16	233	226	117	-1	10	18	13	2	10	-7	-4	3	18	14	-4	-10	-10	-1	-26	5	18
	48	28	177	75	11	282	293	128	-1	14	32	20	6	12	-7	-4	0	19	13	-1	-5	-6	1	-26	6	24
	72	27	186	68	13	266	284	119	-3	7	48	25	3	8	-8	-8	-4	15	9	-1	-11	-10	2	-22	4	22
	96	32	230	75	17	369	373	181	1	34	55	32	10	19	-5	2	7	25	12	2	-7	-2	1	-19	18	30
14	24	5	0	-4	-10	-7	-4	-5	-8	0	-5	22	-9	-4	-9	-7	-6	-14	-3	4	-4	10	-10	-3	-1	-9
	48	7	4	-5	-13	-12	-6	-4	-13	-2	6	23	-12	-8	-13	-13	-11	-19	-16	-2	-11	4	-10	-3	-7	-13
	72	17	14	4	-5	-1	3	5	-6	11	17	26	-5	-2	-4	-2	-5	-12	-5	9	-4	17	-6	6	-2	-8
	96	13	10	-1	-13	-6	0	1	-11	6	8	23	-7	-6	-7	-5	-6	-16	-10	5	-13	14	-15	-3	-5	-11
18	24	35	2	10	19	11	44	21	5	26	16	20	10	4	-11	-2	7	25	4	2	6	13	5	9	22	26
	48	39	5	15	23	13	48	26	7	46	25	28	13	7	-11	-1	8	29	5	5	9	25	13	6	25	31
	72	42	6	17	26	16	51	33	8	52	35	34	14	8	-10	0	9	31	5	6	11	30	17	4	27	35
	96	44	7	17	27	17	53	34	8	58	41	34	12	8	-11	0	9	30	6	9	10	35	18	2	28	37
19	4	-10	4	-10	-12	-11	-14	-20	-22	-35	-28	11	-17	-19	-34	-23	-13	-12	-10	-24	-27	-19	-24	-30	15	-6
	24	-10	-5	-13	-13	-14	-12	-20	-22	-40	-25	10	-22	-20	-34	-24	-16	-12	-10	-24	-27	-22	-24	-28	6	-2
	48	-7	-8	-10	-10	-11	-10	-19	-20	-38	-22	20	-18	-19	-35	-23	-15	-10	-9	-23	-26	-22	-22	-25	5	-5
	96	-5	-5	-5	-6	-7	-7	-10	-11	-20	-20	25	-10	-12	-30	-20	-10	-5	-2	-15	-15	-10	-12	-12	6	0
24	24	1	1	-1	-3	4	-1	-1	5	16	-2	16	-2	-6	0	-6	2	-3	-4	5	-2	5	0	8	59	-1
	48	0	-4	-7	-7	1	-4	-2	-1	20	10	12	-4	-8	-2	-5	4	-5	-7	5	-5	5	-1	16	54	-4
	72	6	4	4	-4	4	0	2	1	24	11	14	3	-2	5	2	12	-3	-5	10	-7	6	-3	10	60	4

Strain	Time	C3 (D-psicose)	C4 (D-raffinose)	C5 (L-rhamnose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	D1 (acetic acid)	D2 (cis-aconitic acid)	D3 (citric acid)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (a-hydroxybutyric acid)	D11 (b-hydroxybutyric acid)	D12 (g-hydroxybutyric acid)	E1 (r-hydroxy phenylacetic acid)	E2 (itaconic acid)	E3 (a-keto butyric acid)
	96	11	5	6	-3	6	1	5	9	24	8	15	4	1	4	2	18	0	-4	13	-8	5	-8	4	62	2
	4	8	2	4	0	3	2	1	-3	22	3	40	14	6	1	-3	5	4	2	2	-12	5	-13	6	8	-16
	24	14	10	22	8	17	11	7	6	103	74	101	41	20	19	15	12	2	9	5	27	108	3	22	25	-7
26	48	16	6	35	8	27	13	11	12	114	118	106	47	21	19	20	19	2	10	1	47	154	13	25	31	1
	72	16	8	39	6	24	15	12	13	126	122	108	56	20	17	23	24	4	10	2	42	175	17	23	35	-12
	96	17	11	36	8	24	17	13	14	134	131	110	58	18	16	27	26	7	11	4	40	214	19	23	38	-13
	4	18	0	-6	3	21	7	3	-8	0	-2	15	0	-8	2	-4	9	-2	-2	9	-7	-7	-5	8	23	3
	24	26	-26	-28	-22	17	-12	-3	-25	-33	-2	0	-3	-26	-19	-22	-15	-17	-28	3	-30	-32	-21	-10	29	-30
32	48	19	-34	-20	-36	33	-8	-10	-30	-26	23	-2	-2	-35	-31	-26	-22	-24	-34	3	-35	-33	-16	-17	27	-41
	72	28	-26	-28	-34	42	3	-4	-23	-32	16	10	9	-34	-23	-18	-19	-27	-35	17	-35	-33	-24	-9	42	-38
	96	30	-11	-19	-15	109	61	-3	-8	-15	18	14	19	-6	-4	3	17	-12	-17	32	-21	-32	-16	-3	54	-24
	24	21	-5	-12	-11	-13	-11	-7	-13	-18	-20	67	-22	-17	-18	-19	-4	-16	-17	-11	-24	-22	-30	-27	-27	-6
36	48	21	-6	-13	-12	-14	-11	-7	-15	-13	-16	74	-23	-18	-17	-20	-5	-17	-15	-12	-23	-21	-29	-27	-30	-7
	72	21	-4	-11	-9	-11	-10	0	-14	-6	-15	87	-10	-17	-11	-19	-4	-15	-9	-11	-21	-19	-29	-27	-30	-4
	96	21	-2	-9	-8	-10	-6	4	-12	-2	-12	99	-2	-15	-5	-17	-2	-14	-4	-10	-19	-16	-28	-28	-29	-1
	24	-8	-8	-18	-16	1	-15	-9	-18	-10	0	-13	-13	-15	-15	-18	-12	-13	-1	-17	-10	-2	-14	-2	0	-11
38	48	-3	-3	-22	-16	5	-13	-6	-18	-7	14	-14	-9	-12	-13	-15	-8	-11	3	-15	-10	-1	-11	7	4	-11
	72	2	4	-20	-18	5	-11	-7	-17	-4	11	-18	-9	-11	-12	-13	-9	-13	1	-16	-13	-7	-14	9	5	-7
	96	2	4	-17	-17	4	-11	-6	-19	-4	1	-20	-6	-12	-12	-14	-8	-13	-1	-16	-16	-10	-17	6	5	-10
	24	32	6	22	8	21	15	1	-7	85	68	85	52	41	41	10	20	10	29	15	-5	104	-5	15	44	-12
39	48	46	2	44	14	38	29	2	5	143	128	87	73	61	40	21	36	14	43	13	11	181	20	14	62	-10
	72	25	8	26	8	19	28	0	2	149	155	98	68	50	31	12	19	9	29	8	8	198	8	5	70	-10
	96	3	-10	10	0	-2	30	-3	1	158	177	119	64	36	-9	0	-11	4	30	-7	0	214	-11	-7	74	-11
	24	2	-16	-19	9	26	34	10	-6	-15	10	5	-13	-8	-21	-15	-7	-11	-21	-17	-25	-24	-1	-3	47	-16
42	48	-9	-26	-28	0	100	77	10	-9	-22	0	4	-30	-22	-33	-22	-19	-17	-33	-29	-38	-37	-17	-21	17	-34
	72	0	-15	-16	21	96	89	35	9	-22	5	6	-27	-8	-29	-15	-10	-11	-28	-25	-37	-35	-28	-21	19	-32
	96	9	-9	-7	35	94	101	57	22	-21	10	9	-22	-6	-26	-6	-8	-3	-27	-23	-36	-33	-20	-21	21	-31
	120	11	-3	-12	63	101	107	77	44	-17	18	12	-15	2	-21	0	-8	1	-23	-21	-34	-31	-17	-16	26	-28
	24	30	30	3	69	209	179	24	-1	24	-1	7	-2	-5	9	-4	8	67	17	15	-8	-1	-4	-6	69	15
43	48	28	18	5	78	267	234	28	2	37	6	21	-2	-4	11	2	17	78	17	15	-6	2	1	-1	76	17
	72	29	24	5	67	237	275	27	4	41	5	23	-1	-4	13	2	19	81	12	20	-6	2	-2	7	79	16
	96	32	35	9	76	238	307	33	10	52	8	30	4	-2	23	4	29	88	11	30	-1	7	-1	12	93	18
	4	-1	1	-1	-1	16	-1	7	-2	-25	-2	4	-11	-7	-24	-11	3	-4	-3	9	-16	-19	-13	-17	-3	0
	24	10	8	21	10	47	17	-8	9	-13	29	7	-10	4	-37	1	37	10	10	41	1	-9	-9	-24	-26	23
46	48	3	4	17	5	41	15	-17	6	-9	42	6	-14	3	-43	4	45	9	5	45	1	-10	-14	-28	-31	16
	72	6	6	12	12	39	13	-19	2	-9	39	6	-19	2	-46	3	48	5	4	43	1	-11	-18	-30	-34	11
	96	3	9	11	9	40	10	-18	3	-6	48	7	-18	4	-45	7	53	11	-3	48	2	-10	-19	-32	-33	7
	24	6	1	5	5	5	4	3	0	-1	47	19	-9	-1	11	2	8	6	6	3	4	22	36	25	43	9
55	48	9	-7	3	-7	9	8	5	4	-6	45	12	-6	3	2	3	12	13	3	4	2	26	23	28	49	8
	72	16	-7	-1	-5	14	14	7	9	-2	45	17	1	6	4	3	17	21	4	11	2	30	15	16	56	4
	96	25	-1	6	1	15	18	10	15	6	49	18	8	16	11	10	29	28	6	15	7	29	17	10	61	1
	24	10	3	2	0	6	2	5	-7	9	-1	12	5	-1	-5	-3	6	-3	2	1	5	18	-1	4	67	1
57	72	20	11	4	3	7	3	6	-4	18	14	18	4	5	9	3	15	2	5	15	4	25	12	22	92	6

Strain	Time	C3 (D-psicose)	C4 (D-raffinose)	C5 (L-rhamnose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	D1 (acetic acid)	D2 (cis-aconitic acid)	D3 (citric acid)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (a-hydroxybutyric acid)	D11 (b-hydroxybutyric acid)	D12 (g-hydroxybutyric acid)	E1 (r-hydroxy phenylacetic acid)	E2 (itaconic acid)	E3 (a-keto butyric acid)
	96	27	18	11	13	16	11	13	4	30	20	24	13	14	21	13	25	12	14	27	13	35	20	30	110	19
	24	44	24	5	8	4	126	-9	-1	0	38	16	8	2	2	1	2	258	1	6	-6	-8	1	34	161	0
58	48	62	18	18	15	1	344	-8	-7	19	85	21	15	7	-1	5	7	510	-10	10	1	1	6	18	170	10
	72	57	23	24	20	3	750	-9	0	21	88	26	26	13	4	7	12	576	-9	18	8	3	7	23	183	10
	96	52	26	32	25	5	938	-10	0	24	91	31	26	17	6	9	17	619	-7	22	10	5	11	28	198	12
	120	56	29	31	30	6	999	2	4	18	90	38	30	17	10	9	15	622	-6	28	11	10	8	31	208	8
	24	11	-3	2	-4	-4	-1	-2	-22	3	1	16	8	-1	13	-5	1	-7	-9	2	-7	-6	-4	11	124	3
59	48	5	-16	3	-12	-1	-3	-8	-21	-10	11	24	-5	-21	-6	-21	-11	-16	-18	-6	-20	-11	2	2	137	-12
	72	14	-6	5	-1	4	1	-4	-19	-6	6	43	-6	-24	-1	-22	-9	-16	-14	4	-19	-6	6	20	160	-12
	96	20	4	7	8	9	6	-1	-18	-2	10	55	-2	-26	0	-20	-8	-15	-15	8	-19	-5	9	29	170	-12
	24	1	1	124	7	106	2	-30	-20	-22	-5	66	16	7	-47	-5	-24	-2	-9	92	0	-27	-21	-38	-27	-35
63	48	2	2	141	9	119	4	-31	-18	-9	23	73	18	9	-45	-3	-26	-1	-7	105	25	-25	-20	-38	-26	-17
	96	8	8	152	14	120	9	-30	-14	-2	43	82	23	14	-42	2	-27	4	-2	114	37	-22	-17	-39	-22	6
	24	-10	-6	-10	-10	-11	-10	-10	-12	4	6	3	-8	-10	-23	-16	-7	-9	2	-7	-16	-15	-27	-14	-23	-27
64	48	-10	-4	-8	-9	-10	-7	-7	-12	9	8	9	-14	-9	-22	-19	-5	-6	3	-2	-16	-12	-28	-12	-23	-26
	72	-7	1	-4	-4	-5	-3	24	-9	19	15	19	-13	-3	-18	-15	1	1	10	7	-10	-4	-22	15	-18	-21
	96	-7	1	-2	-3	-7	-4	-6	-13	22	20	19	-13	4	-19	-18	1	-2	10	6	-14	-7	-24	4	-17	-25
	24	0	4	1	4	5	2	-1	-6	-6	-3	19	4	0	-29	-2	10	-1	5	-2	-20	-17	-16	-16	10	1
66	48	8	9	7	10	9	8	5	-1	-5	6	14	6	5	-31	-2	14	5	12	4	-17	-12	-14	-23	9	11
	96	18	14	11	13	13	15	10	6	-7	15	15	3	6	-37	2	18	9	16	8	-16	-8	-10	-33	3	19
	4	1	-4	-3	-1	5	3	1	-3	1	-2	15	-14	-2	-8	-6	1	-2	2	5	-2	0	-3	0	33	-2
	24	-1	-9	-4	-5	3	4	-1	-6	-3	12	10	-7	-2	2	-3	6	-3	-6	-4	3	1	4	17	48	-7
67	48	-2	-15	-10	-12	-3	-1	-8	-12	-1	28	12	-9	-5	1	-8	3	-11	-12	-8	4	-4	7	16	50	-17
	72	3	11	-8	-7	-3	-1	-3	-10	-3	20	22	-9	-5	9	-7	4	-12	-15	1	-4	-10	7	19	58	-23
	96	10	-7	1	-2	6	10	4	-4	1	33	29	-7	-1	17	-4	12	-6	-7	7	-5	-10	8	16	72	-15
	24	21	1	4	2	4	2	0	1	15	11	6	5	3	7	4	7	2	0	11	1	2	14	18	66	11
70	48	25	6	12	0	13	13	0	9	32	46	14	21	16	24	19	19	15	4	29	13	13	15	36	88	21
	72	19	6	12	-4	6	9	-3	4	33	45	14	17	13	17	17	19	9	-9	25	10	9	10	33	83	14
	96	26	15	25	4	19	16	6	12	47	50	17	23	22	24	26	31	16	-1	35	16	17	10	26	98	24
	24	4	-4	4	4	-2	-2	-4	5	39	32	14	3	-2	-12	-6	2	-3	-5	-1	3	38	13	5	44	-1
72	48	6	-10	11	12	3	4	0	19	55	66	8	7	2	-5	6	5	1	-3	6	18	65	25	21	57	0
	72	1	-11	12	18	6	5	1	26	65	77	10	6	3	0	14	8	2	-4	4	24	77	36	23	61	-2
	96	1	-7	13	21	10	11	5	29	79	77	12	4	6	1	17	11	4	-1	8	16	83	32	23	67	0
	24	-17	-8	-14	-12	-11	-15	-16	-16	-34	-19	0	-14	-18	-26	-17	-8	-11	-16	-16	-17	-17	-16	-26	0	-13
74	48	-18	-11	-16	-15	-13	-18	-19	-19	-33	-13	5	-15	-20	-31	-19	-11	-14	-18	-18	-21	-19	-16	-23	-3	-14
	72	-13	-5	-12	-11	-11	-16	-17	-17	-31	-11	8	-11	-16	-30	-15	-7	-12	-16	-15	-19	-17	-14	-23	2	-10
	96	-13	-8	-10	-10	-12	-15	-18	-15	-30	-12	12	-12	-16	-30	-18	-9	-11	-16	-16	-20	-19	-16	-23	4	-12
	4	16	-2	-6	1	6	11	-1	2	125	13	116	61	8	14	-5	10	6	5	9	12	-10	-2	20	98	-2
	24	16	-2	-6	1	6	11	-1	2	125	13	116	61	8	14	-5	10	6	5	9	12	-10	-2	20	98	-2
76	48	31	-3	7	-3	27	28	13	22	157	54	124	124	26	20	1	19	13	14	9	102	8	19	40	116	8
	96	22	-3	7	-5	29	31	8	29	179	69	118	134	32	17	-5	31	11	15	20	117	8	10	25	122	10
	120	17	2	-5	-9	15	14	-1	13	162	52	113	118	17	7	-12	19	-3	7	0	75	-12	-10	23	101	-8
	4	6	0	-6	-4	-1	1	0	-8	44	27	61	21	3	-12	-8	2	0	1	0	-3	5	-10	3	26	-2

Strain	Time	C3 (D-psicose)	C4 (D-raffinose)	C5 (L-rhamnose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	D1 (acetic acid)	D2 (cis-aconitic acid)	D3 (citric acid)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (a-hydroxybutyric acid)	D11 (b-hydroxybutyric acid)	D12 (g-hydroxybutyric acid)	E1 (r-hydroxy phenylacetic acid)	E2 (itaconic acid)	E3 (a-keto butyric acid)
78	24	-6	-11	-6	-3	0	5	3	-12	190	95	109	66	2	-7	-14	4	-1	10	-4	32	62	4	3	64	45
	48	-2	-21	15	-3	12	13	10	3	154	164	112	68	-4	-6	-13	-6	-11	-4	-26	50	90	26	-3	61	49
	72	23	9	13	13	38	40	12	4	127	112	126	96	13	-17	7	17	1	5	-1	77	97	2	14	80	61
	96	33	18	26	28	43	58	26	15	166	169	151	111	24	-2	26	31	13	13	14	99	129	22	18	98	67
81	24	-4	-1	-4	2	-8	-9	1	-13	0	-22	57	-6	-5	-2	-7	2	2	33	2	-15	-11	-2	-23	44	-9
	48	6	11	-3	2	-4	-4	3	-12	3	-17	62	-8	-7	-1	-10	1	-1	39	0	-9	-6	0	-21	51	-6
	96	17	25	7	15	7	7	15	-1	18	-1	79	2	3	13	1	12	11	55	11	-2	2	8	-17	69	5
86	4	5	2	-3	-4	14	3	7	-6	-4	-11	46	-5	-3	-11	-1	2	-1	3	5	-7	-11	-4	-7	29	0
	24	3	3	-1	-1	20	5	10	-5	-3	0	63	-3	-6	-12	-8	-5	-4	4	3	-10	-16	2	-5	34	7
	48	16	4	10	2	29	12	17	2	7	15	77	6	1	-3	0	4	1	0	1	-2	-8	9	2	48	15
	72	19	6	16	-2	36	10	14	5	8	16	99	7	1	-4	5	6	7	-1	7	-3	-6	14	8	56	9
	96	38	20	35	16	58	31	39	27	28	28	142	21	16	9	22	25	23	12	22	19	13	31	11	82	27
88	4	25	3	6	30	11	92	11	10	-3	-6	4	1	3	10	3	9	3	-1	2	-3	-1	1	16	30	-8
	24	44	3	6	46	52	276	10	10	24	2	7	17	1	2	-1	7	90	1	5	-8	-7	0	27	46	-12
	48	43	-7	7	32	48	328	1	5	28	5	1	12	-5	-6	-3	7	111	-8	-8	-8	-9	-5	13	39	-17
	72	56	-3	17	39	65	342	9	14	35	17	9	9	-1	1	4	14	136	-7	5	7	5	0	20	59	-5
	96	74	8	20	54	70	381	19	19	48	28	19	20	9	14	19	28	197	1	15	20	15	-2	22	77	-2
89	24	9	-5	-11	-2	-1	13	-16	-10	-16	-10	4	1	-4	-24	-14	9	-4	7	10	-11	-20	-11	-14	20	3
	48	16	-4	-5	-2	4	21	-13	-5	-21	0	8	7	0	-22	-6	5	0	5	16	1	-17	-10	-18	25	23
	96	22	5	0	4	12	34	-11	1	-17	9	19	14	6	-21	0	9	5	9	21	18	-15	-9	-12	32	36
	120	28	13	6	13	15	42	-8	8	-12	14	31	21	11	-18	8	17	10	14	28	23	-12	-9	-8	40	36
92	4	-14	-13	-11	-13	-10	-15	-22	-23	-25	-22	86	-12	-17	-25	-16	-8	-13	-19	-16	-26	-24	-21	-27	45	-17
	24	-12	-14	-14	-15	-13	-16	-23	-24	-32	-20	96	-16	-22	-32	-22	-14	-15	-20	-16	-26	-24	-22	-24	44	-14
	48	-10	-13	-14	-15	-13	-17	-24	-24	-31	-19	119	-16	-23	-34	-22	-15	-17	-20	-16	-28	-26	-23	-23	46	-15
	72	-3	-6	-7	-11	-8	-15	-21	-22	-29	-17	134	-10	-18	-30	-16	-9	-14	-18	-13	-27	-25	-21	-22	53	-10
	96	-2	-3	-2	-11	-5	-16	-22	-22	-30	-15	145	-11	-20	-32	-18	-9	-15	-19	-15	-28	-26	-22	-23	56	-14
94	24	2	4	5	4	1	7	4	-6	-35	-19	14	-4	-3	-22	-14	-2	5	8	4	-15	-11	-14	-30	18	14
	48	4	-4	4	-4	0	4	1	-2	-40	-18	14	-4	-7	-26	-21	-7	4	3	-5	-13	-5	-14	-34	11	14
	72	9	0	15	-3	9	12	9	8	-36	-7	23	6	0	-25	-15	-1	13	11	-4	-5	5	-7	-33	20	25
	96	8	3	22	-1	15	19	6	15	-32	-3	27	12	4	-25	-12	3	18	11	-2	1	12	-5	-33	26	31
96	24	-8	-6	-16	-23	-20	6	-18	-19	-20	-12	-3	-9	-9	-2	-13	-20	-18	-13	-8	-22	-17	-21	14	74	6
	48	-7	-7	-14	-25	-20	7	-19	-19	-15	3	0	-34	-7	-3	-9	-18	-18	-13	-6	-22	-14	-17	3	83	9
	72	-2	1	-10	-22	-14	15	-18	-18	-7	6	6	-31	-1	5	-3	-13	-14	-10	3	-19	-7	-16	3	95	21
	96	0	5	-9	-19	-12	19	-16	-15	-3	6	8	-30	2	8	1	-10	-12	-8	9	-16	-5	-17	1	102	21
97	4	7	3	3	4	3	1	1	3	-2	-13	16	2	1	-10	-1	3	3	0	1	-6	3	-1	-4	30	-5
	24	3	-4	8	0	5	4	6	-6	4	4	19	3	-4	-11	-10	-3	-8	-4	-10	0	35	20	-6	33	-13
	48	12	2	18	5	16	17	17	7	17	21	31	14	5	-6	-6	8	-2	4	-6	6	50	34	1	44	-8
	72	12	8	22	12	22	23	16	12	16	9	41	11	0	-10	3	13	1	3	-2	1	44	29	4	45	-5
	96	27	20	31	26	29	34	29	24	33	19	58	24	14	5	13	21	11	17	13	16	67	40	12	60	7
99	24	12	1	-2	13	40	44	45	-4	22	14	48	1	-5	-7	-8	-1	8	2	-4	8	-6	-1	18	50	11
	48	14	4	-3	8	66	58	58	-6	47	26	54	0	-7	-9	-4	1	10	-1	-6	13	-3	0	17	53	16
	72	21	11	-4	9	76	57	60	-8	61	25	81	0	-6	-2	-2	3	5	-7	0	11	-4	1	21	60	7
	96	36	30	2	25	121	105	95	3	115	42	126	14	12	10	14	23	28	13	15	39	18	9	35	89	20

Strain	Time	C3 (D-psicose)	C4 (D-raffinose)	C5 (L-rhamnose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	D1 (acetic acid)	D2 (cis-aconitic acid)	D3 (citric acid)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (a-hydroxybutyric acid)	D11 (b-hydroxybutyric acid)	D12 (g-hydroxybutyric acid)	E1 (r-hydroxy phenylacetic acid)	E2 (itaconic acid)	E3 (a-keto butyric acid)
100	24	9	2	-3	-6	-6	6	-9	-8	2	-21	-1	-1	-8	5	-3	-3	-8	-9	1	-10	-9	-9	-3	131	-3
	48	17	19	2	8	-1	12	-5	-4	11	-11	17	4	-5	9	1	4	-3	-3	13	-5	-7	-3	1	169	14
	72	18	10	2	-1	-2	13	-6	-3	14	-9	22	5	-5	9	-1	5	-3	-3	10	-4	-6	-1	3	178	18
	96	22	17	4	2	1	16	-3	-1	15	-7	28	7	-3	12	-1	7	0	-2	15	-1	-4	0	6	189	17
101	4	25	1	1	1	1	61	0	-3	9	-6	9	1	0	-2	6	-1	-1	6	4	-4	-7	-5	2	27	3
	24	89	13	17	14	12	230	8	2	21	26	36	59	29	5	20	12	11	8	9	-1	-1	9	11	52	18
	48	86	2	14	1	7	283	5	-5	28	61	51	117	91	-1	18	1	0	1	9	-10	-7	12	9	52	11
	72	82	1	10	-9	6	303	-1	-4	78	69	66	169	212	-6	22	-3	-3	-2	52	-13	-9	10	3	54	3
	96	60	0	-4	-1	14	276	-2	2	161	82	67	262	210	-20	28	2	2	1	183	-8	-4	2	-3	41	-20
103	24	20	2	-1	-4	5	10	-1	9	66	13	158	23	-1	7	3	10	3	10	13	10	10	11	14	77	10
	48	19	-3	8	-10	11	16	-2	9	171	14	230	30	4	4	2	16	5	18	8	12	16	5	33	84	18
	96	25	-9	14	-10	14	19	-3	13	191	23	216	37	7	4	12	19	8	17	18	10	16	11	11	96	14
	120	32	-1	1	-4	9	15	5	10	99	14	259	37	2	11	21	16	1	19	26	-2	-2	-4	24	94	2
105	24	9	5	0	4	7	16	13	2	22	30	12	4	1	-18	-1	6	3	12	2	-11	-17	-5	-17	14	81
	48	10	4	5	8	13	24	20	0	56	54	6	6	5	-19	1	10	3	6	3	-8	-11	-2	-21	10	111
	72	10	8	7	8	15	29	22	1	63	63	9	9	8	-18	3	12	5	6	3	-8	-9	-2	-22	11	119
	96	10	9	9	9	18	32	25	2	73	70	15	11	9	-17	5	14	7	7	2	-7	-8	-2	-24	12	125
	120	17	20	14	13	28	43	34	13	83	92	26	20	14	-13	13	26	15	11	12	-1	-3	3	-23	16	118
106	24	120	-4	6	58	6	7	5	-9	139	9	0	-1	-4	-11	-3	1	54	-4	0	-2	-6	-8	-1	56	2
	48	138	-8	12	53	10	11	9	-8	159	-11	7	2	0	-8	0	3	76	-1	2	1	-4	-17	8	60	6
	96	169	14	28	84	25	25	28	2	193	5	23	8	10	7	17	18	100	5	12	14	15	-5	24	78	17
	120	128	18	22	81	14	13	15	-3	160	-1	28	7	1	4	14	17	78	-1	2	-1	3	-8	22	70	4
108	24	14	1	7	9	12	2	2	1	7	7	33	16	7	14	-4	9	7	14	14	11	18	21	11	45	18
	48	13	0	6	12	9	19	2	0	46	52	30	25	5	16	-5	6	6	13	14	15	52	33	8	46	14
	72	21	6	8	22	13	64	7	3	83	124	36	30	8	27	1	10	11	19	25	20	91	49	14	52	25
	96	21	5	8	23	11	124	6	3	90	184	31	30	8	31	-1	8	9	17	25	17	103	51	8	51	17
109	24	6	-2	-6	-2	-6	-2	0	-9	-4	1	0	-5	-5	-2	-6	-2	-9	-6	-3	-9	-10	-2	6	98	-13
	48	10	-2	1	0	0	4	1	-4	0	9	5	2	-1	-4	3	8	-5	-5	-2	-8	-1	1	3	114	-13
	72	4	-3	5	-1	3	2	-2	-2	-1	4	11	6	1	-8	0	8	-3	-7	-2	-11	0	1	-1	120	-11
	96	9	4	15	1	17	5	-1	6	-5	3	17	15	9	-2	-4	15	7	1	5	-11	8	-1	0	133	-9
113	24	14	38	4	11	54	51	11	-3	4	4	21	5	2	-6	-4	5	10	-4	-1	-3	0	11	6	53	8
	72	39	61	11	14	87	74	17	4	14	12	26	14	9	-6	2	12	19	0	4	7	12	20	11	67	10
	96	41	62	14	16	99	79	17	7	15	14	28	16	11	-3	3	16	24	2	7	10	14	20	12	72	13
116	4	1	1	-2	-2	0	4	-1	-6	-7	-13	13	3	-3	-11	-3	-2	-2	0	6	-12	-11	-13	-1	27	-11
	24	0	-5	2	-4	-3	0	-3	0	-3	-9	-18	-12	-7	1	-3	-14	-8	-9	-5	-9	0	-13	-12	-8	1
	48	5	-7	17	-2	8	4	3	1	-16	0	-1	8	3	-12	-1	1	0	-6	-3	-4	-4	5	3	36	-19
	72	-3	3	18	-4	4	-2	-6	-14	-15	-3	10	1	-7	-7	-9	0	-6	-13	5	-16	-11	4	2	39	-22
	96	5	16	26	6	14	11	5	-4	1	10	21	16	5	3	-1	17	9	0	15	-3	2	18	14	57	-17
121	24	14	-2	2	-4	13	8	7	0	3	1	16	7	5	2	1	6	1	3	-1	-2	9	2	2	72	-1
	48	10	-11	-7	-10	1	-4	-6	-9	-2	5	11	-2	-1	-4	-3	3	-7	-14	-1	-13	-5	4	4	69	-13
	72	21	-4	-1	-7	4	-3	-10	-9	4	15	21	-1	0	7	3	10	-9	-15	7	-11	-2	16	16	83	-15
	96	-6	-11	-3	-19	12	-1	1	-11	27	51	20	7	5	4	12	14	5	13	-2	-4	0	10	47	75	5
	120	-12	-18	-25	-25	-15	-25	-28	-32	-5	36	18	-13	-17	-1	5	-8	-14	-14	-13	-30	-29	-13	38	62	-19

Strain	Time	C3 (D-psicose)	C4 (D-raffinose)	C5 (L-rhamnose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	D1 (acetic acid)	D2 (cis-aconitic acid)	D3 (citric acid)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (a-hydroxybutyric acid)	D11 (b-hydroxybutyric acid)	D12 (g-hydroxybutyric acid)	E1 (r-hydrox. phenylacetic acid)	E2 (itaconic acid)	E3 (a-keto butyric acid)
125	24	-5	-7	-7	-8	-4	-8	-8	-12	-6	-5	11	-11	-10	-17	-14	-5	-12	-12	-11	-7	-4	-5	2	-9	-15
	48	-1	-4	-4	-7	-2	-5	-6	-11	-4	2	12	-7	-5	-14	-8	-2	-10	-8	-8	-4	-10	-5	6	-6	-18
	96	19	18	22	8	18	7	3	-1	10	27	30	10	18	0	19	20	8	6	8	11	4	6	20	13	-8
137	24	7	-15	-4	-12	-1	-7	-5	-3	4	10	3	8	-2	6	-9	8	-2	-1	12	-8	1	5	15	37	5
	48	13	-12	6	-10	9	5	4	5	17	21	10	21	10	25	-1	24	6	-4	29	2	9	17	22	52	13
	72	16	3	9	-2	11	2	7	8	22	22	14	28	16	32	8	28	9	-5	33	1	8	17	16	59	16
	96	12	6	3	1	8	-6	-6	1	16	10	7	15	8	30	5	28	6	-12	37	-3	3	12	8	54	10
138	24	21	9	14	13	19	26	6	6	-3	27	35	3	7	-3	0	15	17	16	3	-8	0	17	-20	77	30
	48	23	7	13	12	18	28	4	6	-2	25	32	2	7	-8	-1	14	17	15	-1	-8	-2	15	-26	67	29
	72	25	10	15	12	19	31	5	8	-3	22	32	4	10	-8	-1	17	22	15	0	-8	-1	15	-28	67	30
	96	22	9	14	10	17	32	5	7	-9	15	25	0	9	-11	-5	13	22	10	-1	-13	-5	10	-36	56	22
140	24	-7	-4	1	-6	-8	0	-1	-7	-11	-12	8	-3	-4	-20	-7	-2	0	3	-1	-6	-10	-5	-6	42	6
	48	-4	-2	3	-5	-5	3	2	-6	-10	-7	3	-4	-2	-20	-5	-2	0	1	-1	-6	-8	-4	-5	44	12
	96	2	5	7	-3	0	13	7	-2	-2	5	19	-2	1	-15	1	3	4	5	4	-1	-3	1	-2	57	17
143	24	19	6	-3	20	451	11	34	3	146	-19	163	25	7	-10	-4	-5	8	-2	-4	17	61	-19	-18	15	82
	72	29	0	7	21	760	23	43	12	440	1	144	56	18	-3	4	5	20	6	4	32	76	-17	-21	32	120
	96	30	6	8	25	748	26	37	13	424	-1	179	61	18	0	12	6	23	6	7	32	61	-17	-19	39	119
155	24	7	-5	2	-9	7	4	5	2	23	26	1	6	4	12	-3	9	-1	1	7	1	6	11	22	65	9
	48	18	-3	21	-2	26	19	21	19	45	41	15	27	19	32	13	32	15	13	21	16	20	14	33	92	26
	72	31	17	33	10	37	33	33	32	62	57	24	43	33	41	26	46	26	24	28	26	31	21	35	111	39
	96	34	29	35	19	39	35	25	32	59	43	23	41	34	48	28	44	30	23	35	26	34	14	31	99	39
158	24	8	0	-1	-1	7	3	-1	-3	21	6	26	13	0	-4	-6	1	-2	-2	-3	6	14	3	5	59	-6
	48	20	6	11	6	20	18	11	9	39	34	27	14	11	8	5	12	10	10	7	18	28	13	21	73	2
	72	34	8	24	8	32	26	19	19	57	49	38	23	22	20	13	25	21	21	16	28	41	25	28	88	13
	96	49	22	40	18	47	44	31	34	83	63	47	39	36	33	23	40	36	34	26	43	57	37	44	109	26
162	24	42	45	15	16	138	105	127	8	-34	45	8	11	10	-20	0	15	9	16	7	6	-1	1	-12	30	56
	48	35	53	17	11	160	124	174	15	-32	55	6	14	13	-18	-2	19	13	12	8	13	6	-2	-17	35	58
	72	43	71	22	14	172	152	201	26	-30	70	12	22	21	-17	2	27	19	13	11	22	14	0	-11	45	65
	96	42	80	25	14	165	168	209	31	-24	87	10	27	25	-15	5	32	24	20	13	28	17	-1	-15	52	75
200	24	11	1	-7	-8	8	43	10	6	7	5	13	-10	-1	1	2	-4	1	3	11	4	5	2	17	50	1
	48	9	4	-4	-6	15	48	12	8	17	17	17	-6	1	5	4	-4	5	2	9	11	12	1	25	59	4
	72	14	10	2	0	23	56	14	14	25	26	28	5	9	13	13	5	12	6	18	16	16	2	36	77	13
	96	17	12	2	-1	21	54	17	14	25	17	24	3	6	15	11	3	10	4	14	9	8	-6	24	77	10
201	24	-7	-10	-16	-9	-2	-1	-9	-10	-22	-40	-9	-9	-6	-30	-7	-9	-1	-1	2	-23	-27	-24	-31	-2	-10
	48	5	-3	-5	4	19	43	4	4	6	-36	5	10	7	-20	7	4	18	17	19	-11	-16	-13	-16	11	-2
	96	16	1	4	7	39	123	6	20	31	-35	18	19	18	-2	16	13	33	33	30	3	-5	-14	3	27	11
202	24	262	-7	-7	62	-10	631	-16	-7	362	5	29	8	-5	110	-5	-7	543	-7	-4	-1	-2	-2	2	44	-3
	48	206	-29	-16	26	-19	711	-31	-11	479	26	86	25	-11	84	-16	-16	782	-16	-14	-12	-16	-6	-14	34	-17
	96	210	-21	-14	27	-17	822	-28	-7	621	33	185	95	38	87	-10	-18	999	-14	-13	-18	-17	0	-19	44	-18
204	24	12	1	4	4	1	402	-6	-1	111	-12	19	9	12	6	3	12	-2	12	6	-13	-11	-3	14	66	4
	48	13	-1	8	9	5	525	-6	5	208	-4	8	12	18	4	5	17	1	13	9	-8	-2	2	18	68	10
	72	26	5	16	12	9	593	5	19	321	0	16	21	25	16	12	21	9	22	21	8	5	2	16	77	15
	96	43	12	24	14	16	635	11	24	383	3	20	30	36	22	18	34	14	30	36	19	11	1	17	99	20

Strain	Time	C3 (D-psicose)	C4 (D-raffinose)	C5 (L-rhamnose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	D1 (acetic acid)	D2 (cis-aconitic acid)	D3 (citric acid)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (a-hydroxybutyric acid)	D11 (b-hydroxybutyric acid)	D12 (g-hydroxybutyric acid)	E1 (r-hydroxy phenylacetic acid)	E2 (taconic acid)	E3 (a-keto butyric acid)
205	24	8	1	1	-9	5	2	-1	-6	-8	0	14	-4	-3	8	-1	1	1	1	8	-3	-5	-3	3	76	6
	48	15	0	13	-1	19	15	7	2	1	10	32	-1	3	13	3	12	13	12	13	6	7	10	19	99	9
	96	14	16	32	12	28	26	3	13	8	12	47	8	18	24	24	31	22	21	27	18	18	22	30	124	10
207	24	-25	-31	-29	-26	12	6	0	-38	-23	-9	-36	-35	-28	-21	-27	-14	-21	-20	-18	-21	-16	-25	-22	-23	-26
	48	-24	-25	-27	-23	20	11	2	-34	-18	-3	-23	-30	-29	-16	-27	-16	-21	-18	-14	-14	-16	-19	-15	-21	-15
	72	-22	-21	-25	-21	24	14	4	-34	-16	1	-18	-29	-28	-15	-24	-14	-19	-17	-12	-15	-15	-17	-25	-19	-8
	96	-21	-19	-24	-19	26	16	4	-33	-14	0	-15	-28	-27	-14	-23	-12	-18	-16	-11	-14	-13	-16	-23	-18	0
209	24	253	-7	3	104	0	581	-10	1	292	29	44	22	9	13	2	12	346	-3	9	0	-1	1	20	50	8
	48	247	-4	7	93	-5	668	-28	-3	413	59	84	56	9	21	-2	10	587	-4	13	-11	-13	1	7	53	1
	72	255	0	11	100	0	720	-27	2	500	60	120	98	46	28	2	15	734	-2	26	-6	-10	5	8	60	1
	96	264	6	19	106	5	811	-27	7	601	62	169	145	89	35	8	18	999	1	38	-2	-8	8	8	66	1
210	24	14	-7	8	-1	5	7	8	1	76	67	132	52	38	6	-5	6	8	10	6	13	80	4	21	53	7
	48	-2	-18	14	-4	10	9	17	3	101	77	157	60	42	-1	-6	13	3	5	-2	15	121	9	29	64	21
	72	3	-15	10	-11	6	6	9	0	109	67	163	51	43	-2	-4	11	0	7	-5	14	128	9	25	55	9
	96	5	-11	7	-19	1	3	7	-5	118	55	176	46	42	-4	-1	9	-10	10	-9	13	139	8	24	50	5
211	24	20	9	8	-3	-3	16	26	-13	175	-10	150	51	20	-14	-7	-4	-9	-6	-9	-11	-11	-12	-10	35	50
	48	25	8	11	-1	2	22	50	-7	422	2	136	64	23	-10	2	9	-2	-2	-5	-4	0	-6	-3	50	62
	72	25	11	10	-1	2	24	60	-7	688	2	162	63	23	-11	5	10	-3	-3	-5	-7	1	-6	1	57	66
	96	25	13	9	-1	2	25	69	-7	954	2	187	61	22	-12	7	11	-4	-4	-5	-10	1	-5	4	63	70
212	24	258	-11	-6	68	-1	370	-12	-10	252	71	67	22	-8	-3	-3	0	272	-7	99	12	-11	-5	6	43	-4
	48	187	-16	-7	22	-2	395	-22	-15	323	104	125	45	-10	-5	-5	-10	290	-12	185	-5	-17	-3	-6	47	1
	72	191	-11	-3	35	3	407	-21	-10	415	107	170	69	-6	-2	1	-6	347	-9	308	-4	-14	-2	-2	48	2
	96	194	-5	2	48	8	419	-20	-4	507	110	214	93	-2	2	3	-2	404	-6	430	-2	-10	0	2	49	2
216	24	-1	-10	-5	8	38	46	19	45	104	6	11	-5	-11	-13	-15	-10	-5	-11	-13	5	-10	-10	148	6	1
	48	8	-7	20	19	154	144	126	156	237	23	16	-2	-8	-9	-11	-4	4	-9	-11	17	-10	-9	226	7	14
	72	12	-8	49	23	256	224	190	249	317	34	24	0	-5	-8	-7	2	12	-7	-12	24	-10	-12	316	10	26
	96	12	-8	101	28	394	315	309	355	422	39	33	-2	-7	-7	-7	2	29	-8	-12	26	-10	-12	456	7	30
218	24	-9	-9	-10	-14	34	55	9	-13	2	0	50	-21	-20	-9	-15	15	0	9	-10	-15	-13	-2	-2	20	-17
	48	-11	-10	-13	-18	32	52	6	-15	2	2	50	-28	-21	-11	-18	12	-5	6	-17	-16	-14	-6	-3	17	-17
	72	-10	-8	-13	-17	32	52	6	-15	2	5	52	-29	-20	-11	-17	8	-5	8	-16	-15	-13	-5	-2	17	-15
	96	-9	-5	-12	-17	34	52	6	-14	1	7	54	-27	-18	-9	-16	5	-5	0	-19	-13	-11	-4	-3	19	-14
219	24	16	8	7	7	9	8	9	7	82	-3	28	14	11	18	7	15	5	11	8	-1	6	20	10	50	82
	48	16	11	7	7	10	9	10	9	122	4	37	18	11	17	6	19	10	8	12	1	8	32	21	51	104
	96	19	22	15	13	18	16	18	17	179	11	45	28	21	27	21	30	20	18	23	7	14	43	32	60	130
220	24	-10	-8	-17	-12	7	0	-15	-26	-32	-7	99	-17	-23	-11	-22	-10	-8	31	-9	-26	-28	-15	-26	-22	-4
	48	-9	-9	-17	-9	7	1	-14	-23	-30	-1	116	-12	-23	-9	-21	-9	-8	-2	-8	-25	-28	-15	-19	-23	-7
	72	-8	-6	-15	-5	9	4	-11	-19	-25	6	133	-14	-23	-6	-18	-6	-5	1	-5	-21	-24	-11	-14	-21	-5
	96	-5	-3	-12	26	13	8	-8	-16	-21	9	151	-13	-21	-4	-16	-3	-3	4	-2	-19	-21	-8	-11	-19	-3
221	24	-9	-11	-12	3	3	13	-6	-17	-13	-6	54	-23	-4	-24	-20	-15	-12	-19	-19	-29	-21	-14	-17	-17	-14
	48	-10	-13	-13	-6	3	12	-10	-18	-11	-7	55	-26	-9	-25	-21	-16	-13	-21	-18	-30	-22	-16	-16	-21	-16
	96	-6	-9	-11	-3	8	17	-7	-15	-6	-1	72	-26	-5	-22	-18	-14	-11	-19	-16	-27	-19	-12	-14	-18	-11
223	24	21	21	15	16	12	16	16	7	2	-7	61	13	12	-5	15	23	13	19	15	1	10	-1	14	23	0
	48	23	26	19	18	16	18	16	11	4	0	73	15	13	3	18	22	15	24	15	5	15	6	8	28	-2

Strain	Time	C3 (D-psicose)	C4 (D-raffinose)	C5 (L-rhamnose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	D1 (acetic acid)	D2 (cis-aconitic acid)	D3 (citric acid)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (a-hydroxybutyric acid)	D11 (b-hydroxybutyric acid)	D12 (g-hydroxybutyric acid)	E1 (r-hydroxy phenylacetic acid)	E2 (itaconic acid)	E3 (a-keto butyric acid)
	72	23	27	19	16	16	17	16	11	5	4	80	14	12	4	18	22	16	24	14	5	15	5	7	28	-3
	96	21	24	17	14	14	15	14	9	2	3	88	12	10	3	16	18	14	22	11	4	13	2	5	26	-5
	24	-11	-16	-20	-21	-21	-13	-15	-19	-17	-15	-17	-17	-17	-23	-18	-21	-18	-17	-16	-17	-13	-23	-4	-3	-19
224	48	-5	-12	-20	-23	-18	-7	-12	-21	-9	3	-20	-16	-14	-20	-17	-13	-22	-18	-16	-19	-5	-24	9	-1	-17
	72	-10	-16	-27	-29	-26	-12	-18	-27	-12	7	-25	-21	-20	-27	-21	-20	-22	-26	-23	-27	-12	-37	6	-5	-27
	96	-11	-15	-30	-36	-28	-13	-4	-30	-12	6	-26	-21	-19	-31	-23	-19	-26	-27	-25	-34	-14	-42	-7	-11	-33
	24	12	11	7	5	4	16	5	6	-9	-13	0	-1	-1	-8	-3	-7	3	7	12	3	4	9	-15	20	2
226	48	13	15	9	7	6	16	5	7	-7	-9	9	2	2	-3	0	-6	6	7	10	1	9	12	-8	22	3
	96	16	20	11	10	10	20	9	9	-5	-7	13	5	5	4	3	-2	8	13	13	4	7	13	-6	27	7
	24	4	1	-3	-3	-3	-6	-2	-6	500	-9	121	6	-5	2	-4	2	-3	-6	-3	-8	-8	-2	-2	38	5
227	48	1	-5	-5	-5	-7	-9	0	-6	837	-2	157	-1	-8	-15	-6	1	-4	-9	-3	-15	-6	-1	0	35	-6
	96	12	10	8	4	1	-7	13	2	999	4	230	20	1	7	4	13	4	-10	5	-20	1	6	10	58	-2
	24	-11	-12	-13	-1	-1	0	-15	-20	-12	-9	5	-5	-13	-23	-10	-4	-15	-15	-17	-11	-10	3	-12	44	-7
228	48	-3	-6	-8	23	30	26	-3	-11	-1	26	29	3	-6	-20	-5	4	-7	-6	-7	0	6	28	-1	58	3
	72	-7	-8	-10	24	36	29	-5	-13	-4	29	27	-2	-9	-24	-7	0	-10	-9	-10	-3	2	24	-4	53	0
	96	-5	-7	-10	26	57	36	-5	-12	-4	31	27	-1	-9	-23	-7	0	-10	-9	-10	-2	2	25	-5	55	0
	24	-23	-32	-36	-35	-35	-20	-24	-34	-28	-6	46	-28	-35	-29	-20	-18	-13	-2	-19	-15	-21	-33	-16	54	-30
230	48	-17	-24	-32	-28	-29	-16	-21	-30	-28	-8	58	-21	-28	-23	-15	-21	-8	1	-14	-9	-17	-27	-29	65	-27
	72	-18	-20	-29	-27	-25	-15	-19	-26	-27	-7	71	-17	-25	-19	-14	-15	-4	3	-12	-7	-17	-21	-19	74	-22
	96	-13	-14	-23	-22	-18	-10	-14	-20	-24	-3	93	-12	-19	-13	-7	-8	3	9	-6	-2	-11	-14	-18	86	-17
	24	24	85	14	7	112	102	85	-12	-7	-1	30	11	5	-1	-7	3	26	5	-1	-6	-15	-8	-33	112	31
231	48	35	86	44	2	128	120	96	2	24	9	31	18	6	-8	-9	2	39	1	-2	-8	-14	-6	-32	129	54
	96	45	90	84	7	135	122	98	8	31	15	39	17	7	1	-10	-2	54	-2	-7	-12	-19	-11	-32	145	70
	24	8	-1	4	0	7	290	2	-1	92	12	55	10	6	3	-1	1	4	6	-5	15	-8	-7	-1	207	1
232	48	7	-6	3	-2	6	391	-2	1	144	21	23	14	11	-11	-1	1	2	1	-11	44	-10	-12	-4	236	22
	96	20	3	25	0	29	542	9	25	234	38	56	47	38	12	22	25	32	13	-1	80	11	-2	10	378	69
	24	27	81	13	10	59	70	55	2	-7	38	28	9	6	7	2	15	7	13	9	6	-2	3	-13	28	48
234	48	39	103	29	17	97	110	117	0	1	55	36	19	14	3	7	17	12	20	20	6	-2	8	-8	36	68
	72	41	127	59	20	103	129	147	-4	-2	54	44	20	10	4	7	15	10	22	35	1	-5	6	-9	31	66
	96	42	150	88	22	109	147	176	-8	-5	53	52	21	6	5	6	12	7	23	49	-4	-7	3	-10	26	64
	24	26	10	7	18	5	3	10	10	15	-1	10	3	3	10	5	7	12	4	3	1	3	3	15	18	9
236	48	22	12	11	15	7	8	9	16	24	18	17	8	8	7	8	13	15	7	3	9	14	15	25	24	12
	96	25	17	31	11	8	6	31	22	38	24	27	19	21	16	2	28	20	19	10	22	26	17	23	43	16
	24	1	-6	-8	-9	-8	255	-9	-10	35	-17	3	-9	-9	-19	-15	-5	-10	-6	-7	-13	-21	-14	-7	20	-8
237	48	2	-3	-4	-7	-5	366	-8	-8	65	-11	-4	-3	-4	-13	-14	1	-8	-7	0	-2	-18	-11	-15	26	-4
	96	4	1	13	-7	-3	403	-7	2	93	-2	10	19	12	-4	-2	20	2	-1	19	21	-7	-2	-5	48	10
	24	275	-3	-11	39	0	547	-9	-4	376	62	4	10	-8	84	-9	5	390	-3	3	3	-3	0	0	81	-8
238	48	249	-5	-3	20	-3	679	-14	-2	649	95	25	11	3	76	-7	8	697	-5	0	0	-7	-4	-5	90	-12
	96	213	4	-7	17	-8	769	-17	-4	735	93	162	271	158	90	4	3	999	-12	-4	-1	-11	-9	-9	102	-19
	24	15	-4	-2	-5	-5	259	0	-4	71	-5	20	4	2	-10	-7	-3	-1	2	8	4	-9	-14	0	114	1
239	48	23	-7	0	-6	-1	360	-1	-2	127	-2	17	7	8	-17	-5	0	4	7	14	20	-6	-7	-3	131	9
	96	7	-3	3	-12	2	361	2	-1	138	-9	28	15	10	-13	-2	2	8	-7	6	28	-9	-10	-11	157	2
	24	7	-9	-10	-12	0	-9	-6	-13	-13	-4	5	-10	-12	-10	-15	-3	-7	-10	-6	-9	-13	-7	-7	44	-4

Strain	Time	C3 (D-psicose)	C4 (D-raffinose)	C5 (L-rhamnose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	D1 (acetic acid)	D2 (cis-aconitic acid)	D3 (citric acid)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (a-hydroxybutyric acid)	D11 (b-hydroxybutyric acid)	D12 (g-hydroxybutyric acid)	E1 (r-hydroxy phenylacetic acid)	E2 (itaconic acid)	E3 (a-keto butyric acid)
241	48	12	-9	0	-11	-3	-8	-3	-8	-5	-1	24	-5	-12	-6	-10	1	-7	-10	-2	-7	-11	-4	0	54	-7
	96	11	6	17	0	16	8	16	2	-2	9	46	8	5	8	9	19	6	4	21	7	7	12	22	80	4
242	24	19	13	7	11	25	251	17	3	62	1	26	19	11	-16	-4	13	13	16	12	-10	-3	-10	-25	2	-9
	48	19	1	7	-1	31	313	13	4	89	9	15	23	12	-25	-6	13	16	15	12	-9	4	-9	-24	20	1
	96	14	7	6	7	38	323	13	4	99	13	19	22	9	-23	-9	11	13	9	16	-11	1	-8	-27	19	5
243	24	15	-2	16	22	3	17	-1	-19	4	-20	49	6	-4	82	-6	-1	-2	-6	23	-4	60	29	-19	48	-13
	48	31	1	38	48	31	41	12	-16	25	-11	70	10	-2	179	-1	0	1	-5	43	25	82	43	-14	51	-6
	72	36	2	55	67	49	56	31	-15	39	-6	90	12	-1	274	0	2	2	-5	58	40	100	52	-10	54	3
	96	37	2	74	85	80	77	55	-14	58	-3	103	13	0	287	1	3	5	-5	78	62	123	69	-3	56	31
244	24	12	10	6	3	9	22	37	-3	274	-16	85	29	15	177	-4	5	11	12	-9	-30	-17	-14	-50	-6	131
	48	22	12	17	14	20	35	50	6	451	-14	106	46	25	180	7	14	18	25	5	-26	-7	-8	-43	7	210
	96	21	15	26	12	28	41	38	13	489	-16	129	57	33	201	7	14	22	21	2	-27	-4	-12	-36	12	231
245	24	12	-2	0	-3	1	5	11	-3	-15	6	32	1	-1	1	-1	15	-1	3	9	-7	0	0	0	76	9
	48	8	-4	8	-7	4	7	-1	4	-19	10	25	2	0	4	4	22	-1	6	10	-4	6	4	6	88	0
	96	1	8	26	0	19	16	3	17	-21	-4	34	14	11	13	23	31	4	9	34	0	12	4	12	116	3
246	24	3	3	-6	-6	0	-10	-11	-14	-8	1	18	-1	-4	-12	-8	-13	-9	-12	-11	-12	-6	-9	0	5	-4
	48	7	8	-4	-4	9	-6	-7	-11	-2	18	20	-2	-1	-9	-7	-10	-7	-4	-6	-18	-7	-9	14	9	1
	72	3	3	-15	-10	2	-17	-14	-17	-7	23	10	-13	-12	-15	-17	-18	-12	-15	-16	-25	-14	-22	13	1	-4
	96	3	3	-14	-16	1	-18	-14	-17	-5	23	11	-14	-12	-16	-18	-19	-14	-13	-17	-28	-23	-25	14	1	-4
250	24	6	0	-7	-10	-4	-2	-9	-10	173	-10	53	32	7	-32	-9	-4	-10	-7	-25	-15	-13	-16	-24	-20	19
	48	13	8	-5	-6	-1	5	-1	-7	507	-6	82	56	18	-25	-4	2	-6	-3	-20	-5	-1	-10	-13	-6	27
	72	16	13	-1	-5	4	11	4	-4	932	-5	112	68	26	-20	-1	6	-3	3	-17	-3	5	-7	-5	5	35
	96	19	14	0	-1	1	12	11	-3	999	-10	143	79	34	-16	-1	7	-3	6	-16	-9	6	-11	2	13	45
251	24	23	0	-11	-3	146	-21	-13	-19	40	-14	-17	-5	-10	-19	-20	-15	-3	-23	-26	-19	-18	-22	-14	29	-18
	48	33	-1	-12	-10	137	-35	-36	-34	-23	-27	-21	34	-35	-22	-39	25	-37	-31	-31	-33	-48	10	-21	34	-35
	96	39	12	-7	5	293	-11	-4	-14	141	-19	-21	54	12	-36	-20	-14	110	-29	-29	-31	58	-22	-20	34	-28
254	24	-13	-7	-24	-23	-20	-25	-30	-25	-18	-34	56	-29	-29	-24	-24	-25	-26	-28	-26	-28	-20	-29	-19	-5	-20
	48	-14	-10	-27	-26	-22	-28	-31	-28	-8	-26	79	-27	-31	-27	-25	-29	-26	-29	-27	-30	-25	-27	-13	0	-20
	96	-5	-2	-23	-20	-16	-23	-26	-23	1	-17	116	-21	-25	-22	-20	-24	-22	-24	-22	-25	-16	-21	-2	10	-15
256	24	-14	-17	-23	-25	-22	-17	-17	-20	-23	-21	2	-15	-22	-11	-28	-20	-23	-18	-21	-14	-19	-19	-12	-3	-16
	48	-8	-19	-26	-28	-27	-24	-27	-24	-20	-17	-13	-20	-23	-8	-22	-25	-22	-24	-26	-24	-27	-24	-10	3	-27
	96	-7	-8	-11	-19	-18	-19	-13	-11	-17	-8	-9	-17	-20	-6	-21	-21	-15	-21	-23	-17	-20	-14	-2	8	-26
257	24	6	5	-1	-7	-6	1	1	-2	12	26	16	4	-1	-16	-5	-4	-6	2	-6	-7	-10	-5	-13	18	10
	48	22	13	3	4	0	5	10	10	39	46	33	15	5	-7	0	-1	-2	9	0	0	4	-5	-7	31	15
	72	32	20	10	10	5	12	18	19	60	56	52	24	11	0	8	9	4	15	7	5	9	-3	-1	40	18
	96	43	29	18	18	13	19	26	26	73	55	69	34	21	6	17	16	12	25	15	10	8	-6	0	50	26
258	24	42	-11	-27	-28	379	351	-39	-27	-26	-1	5	-14	-27	-39	-26	-20	-14	-17	-26	-34	-37	-34	-39	-36	-36
	48	43	-12	-28	-28	431	400	-39	-26	-25	4	6	-14	-27	-40	-26	-20	-17	-18	-26	-40	-40	-35	-36	-36	-37
	72	47	-10	-27	-26	454	433	-36	-23	-23	9	11	-12	-25	-37	-24	-18	-14	-15	-22	-40	-39	-37	-35	-33	-34
	96	50	-9	-26	-26	470	451	-35	-23	-23	12	9	-10	-23	-35	-23	-17	-9	-14	-22	-40	-41	-39	-35	-32	-35
259	24	106	52	67	103	35	76	50	13	54	-56	53	37	28	-48	22	24	-25	50	44	-1	-52	-54	-54	-40	-45
	72	121	65	75	104	42	83	58	17	57	-44	45	79	38	-46	30	35	-20	61	51	4	-51	-51	-45	-42	-42
	96	123	65	79	102	44	85	64	15	55	-51	43	87	38	-49	28	38	-19	62	51	2	-52	-57	-47	-44	-48

Strain	Time	C3 (D-psicose)	C4 (D-raffinose)	C5 (L-rhamnose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	D1 (acetic acid)	D2 (cis-aconitic acid)	D3 (citric acid)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (a-hydroxybutyric acid)	D11 (b-hydroxybutyric acid)	D12 (g-hydroxybutyric acid)	E1 (r-hydroxy phenylacetic acid)	E2 (tiaconic acid)	E3 (a-keto butyric acid)
261	24	14	28	5	-1	-8	-4	-6	-5	347	-10	61	14	32	-13	6	4	-2	-2	-9	-2	-12	-15	-17	12	3
	48	17	29	6	-2	-5	-1	-5	1	551	-1	156	9	35	-20	8	9	-3	-2	-9	-11	-6	-12	-26	7	-13
	72	25	39	10	-4	-3	4	-2	7	727	4	227	13	44	-20	13	13	0	1	-8	-13	-9	-12	-24	12	-3
	96	35	50	17	1	1	12	2	12	882	8	314	27	55	-14	19	16	3	4	-5	-10	-8	-17	-20	22	12
262	24	-4	0	-8	-9	-17	-10	-10	-11	123	204	184	82	-2	-6	-11	-9	-11	-11	-11	-10	-20	-9	-8	10	-16
	48	-4	-19	-21	-21	-15	-31	-21	-24	209	305	185	91	-15	-17	-17	-15	-24	-5	-19	-22	-28	-19	-5	2	-11
	96	-3	12	0	2	-5	-12	-2	-3	188	489	215	124	8	5	-3	-1	-8	0	-4	2	0	3	13	16	-9
263	24	14	-2	-4	-3	-2	-3	6	-8	180	-15	-2	-3	-6	-2	-4	1	-2	-2	5	-17	-12	-8	-25	394	-5
	48	9	-8	-13	-9	-9	-7	2	-14	442	-12	-3	-2	-9	-6	-3	-1	-5	-9	2	-17	-13	-12	-20	415	-2
	96	22	-4	-1	-5	5	9	27	1	999	-2	16	13	3	1	14	6	7	0	11	-1	7	-1	-7	497	18
265	24	-1	-21	-28	-17	-42	353	-35	-22	-35	99	63	-9	-20	-44	-35	-20	251	-28	61	-35	-25	-24	-44	-36	-40
	48	14	-11	-18	-6	-40	468	-28	-13	-24	143	87	9	-8	-40	-27	-4	392	-22	177	-26	-14	-19	-31	-30	-37
	72	12	-4	-20	-8	-43	476	-26	-15	-27	134	80	7	-11	-40	-30	-7	396	-24	218	-29	-16	-14	-36	-32	-41
	96	19	-10	-17	-8	-39	522	-22	-10	-26	141	91	11	-7	-38	-27	-2	435	-22	271	-35	-26	-21	-38	-28	-40
271	24	40	-3	-15	13	110	-11	-3	-15	45	-12	-5	26	12	-25	-15	-11	42	-17	-8	-22	17	-16	-10	-6	-11
	48	53	0	-13	22	116	22	28	-13	78	-12	-3	48	28	-30	-12	-12	111	-21	1	-21	51	-14	-4	-9	-12
	72	67	7	-6	33	303	58	72	-4	121	-8	4	85	59	-28	-8	-4	268	-16	9	-18	88	-12	0	-5	-9
	96	71	10	-5	35	399	94	104	-4	158	-5	3	130	97	-28	-11	-4	448	-16	18	-23	142	-17	-5	-5	-10
278	24	-2	2	-7	-6	-6	-1	3	-5	18	2	-1	-7	-11	-14	-1	-2	5	-6	-1	0	-3	-10	-17	-1	-1
	48	-2	3	-9	-1	-12	-6	4	-2	37	7	-4	-10	-14	-12	-5	-1	3	-7	-2	-5	-3	-10	-4	-1	-3
	72	7	11	-5	6	-6	-1	14	4	53	16	1	-4	-9	-5	1	6	12	-3	4	1	5	-8	-2	6	7
	96	15	19	0	-6	-1	5	22	11	67	20	3	2	-5	1	10	13	21	1	9	7	9	-11	-2	11	14
283	24	-11	-11	-19	-20	-21	-7	-16	-17	-12	-13	-19	-2	-20	-18	-17	-16	-14	-21	-19	-13	-23	-17	-8	-1	-11
	48	-2	-5	-15	-23	-14	-1	-8	-12	-5	3	-10	2	-15	-13	-12	-11	-11	-17	-17	-9	-21	-7	2	6	-2
	96	7	6	4	-11	-2	12	0	0	3	18	6	21	-2	-5	-4	3	0	-6	-3	-4	-5	-5	14	18	8
289	24	19	-11	-4	4	15	10	24	-9	3	4	15	-14	-15	-14	-16	-13	35	-9	-14	0	-9	-10	-18	1	-3
	48	20	-9	-4	8	42	13	47	-9	59	7	17	-15	-14	-12	-16	-14	133	-9	-15	1	-9	-9	-17	-2	-3
	72	20	-7	-4	12	68	16	70	-8	114	10	18	-15	-13	-9	-15	-15	231	-9	-16	1	-9	-8	-17	-4	-2
	96	30	-8	3	12	94	20	104	-12	159	0	26	-15	-15	-15	-16	-13	321	-12	-19	-5	-14	-13	-18	-6	-8
7708	24	31	54	19	42	81	47	41	7	20	71	18	27	49	35	34	49	25	18	17	29	19	25	-17	24	15
	48	58	81	38	65	117	90	57	41	44	74	22	58	75	51	61	81	61	46	36	44	46	37	-5	42	35
	72	51	66	38	28	70	80	55	18	39	54	12	50	56	14	46	69	58	41	27	43	3	19	-13	26	18
	96	54	73	45	38	75	88	64	26	41	57	18	53	68	8	53	77	66	48	33	51	13	17	-13	28	19
8071	24	30	11	23	12	22	31	28	13	645	67	167	124	32	499	-3	11	17	27	19	305	66	-5	11	37	339
	48	38	14	31	19	28	38	36	17	771	95	175	135	39	604	1	14	26	34	25	578	78	-13	9	40	601
	72	34	13	30	14	27	36	35	15	729	73	174	135	37	591	-2	12	24	28	45	597	64	-15	-1	41	683
	96	29	11	28	8	25	33	34	12	686	51	173	135	35	577	-5	10	21	22	64	615	49	-17	-10	41	764
10144	24	-4	-8	7	-5	-6	4	-3	-9	-7	-2	6	-10	-10	-6	-9	-7	-1	6	-6	-2	-10	-8	-9	44	-7
	48	-5	-5	10	-1	-3	11	-4	-9	-3	3	8	-5	-6	-10	-4	-2	5	17	-5	2	-9	-3	-3	53	-6
	96	-4	-5	22	-8	-4	25	1	-3	13	4	3	-11	-5	-11	-4	7	12	31	-4	14	-9	-4	-10	60	-16
11040	24	26	72	40	82	135	161	-8	-13	70	36	38	155	144	45	62	120	122	-12	112	-7	45	-11	-5	10	-4
	48	54	216	172	224	233	233	17	24	276	77	48	368	493	83	337	320	341	3	290	-3	118	-11	-2	12	-8
	72	72	325	324	441	427	448	29	62	311	122	44	486	526	105	493	475	476	64	408	-10	174	-1	52	8	-1

Strain	Time	C3 (D-psicose)	C4 (D-raffinose)	C5 (L-rhamnose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	D1 (acetic acid)	D2 (cis-aconitic acid)	D3 (citric acid)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (a-hydroxybutyric acid)	D11 (b-hydroxybutyric acid)	D12 (g-hydroxybutyric acid)	E1 (r-hydroxy phenylacetic acid)	E2 (itaconic acid)	E3 (a-keto butyric acid)
	96	89	434	476	658	621	662	40	100	345	166	40	603	558	127	649	629	611	125	525	-17	230	10	105	3	6
14393	24	58	5	7	86	106	104	109	6	106	141	125	152	127	353	-6	4	113	95	5	34	135	-4	42	7	49
	48	66	11	14	156	218	205	222	7	161	185	120	328	276	406	-2	6	263	166	8	57	231	-6	127	12	68
	72	72	13	16	303	383	337	390	9	242	194	117	419	308	391	1	7	337	290	11	51	274	-13	282	13	70
	96	77	14	17	449	548	468	557	11	323	203	114	510	340	375	4	8	410	413	14	45	316	-19	437	13	71
17749	24	22	20	15	5	11	21	15	6	175	115	126	124	118	40	5	6	31	39	22	33	146	4	-8	53	0
	48	27	56	29	7	31	32	31	13	339	183	264	249	232	63	24	36	64	66	42	53	239	26	2	84	35
	72	20	60	41	-6	31	35	35	20	511	221	286	368	319	54	4	22	77	75	50	60	344	25	13	92	43
	96	18	47	55	-2	9	35	33	20	438	226	267	455	374	57	11	13	70	72	45	64	393	-4	23	84	11
19260	24	61	17	2	27	78	85	99	-2	51	7	20	7	3	14	-2	3	8	21	10	31	5	0	116	60	15
	48	118	25	4	16	111	115	171	0	250	12	25	14	8	13	4	8	11	29	13	40	8	8	236	72	20
	72	195	24	8	13	183	137	274	1	430	5	24	7	7	8	0	4	17	30	15	55	9	1	385	61	25
	96	256	24	9	15	248	178	364	0	610	6	25	8	8	9	3	5	25	30	16	65	9	5	450	70	22
19323	24	70	50	2	148	100	142	85	0	49	4	130	238	239	137	-7	5	148	5	2	15	-14	-12	86	47	-2
	48	68	99	0	241	216	526	180	-2	267	6	144	525	410	153	-10	1	422	-2	1	15	-17	-14	190	44	-8
	72	64	227	-1	700	842	830	445	-8	411	14	129	721	533	144	-11	13	546	-3	0	21	-13	-16	427	43	-13
	96	59	348	2	889	999	935	692	-5	391	16	130	746	520	158	-11	36	550	2	2	24	-11	-17	478	41	-16
19326	24	25	459	207	3	559	489	400	-3	8	12	40	1	1	15	-3	372	24	21	69	13	-4	-5	2	56	7
	48	28	668	383	0	578	512	525	-2	13	9	46	3	6	20	2	606	25	25	230	20	-10	-5	-1	55	12
	72	23	683	522	-5	598	542	567	-10	9	-1	41	0	1	15	-3	729	30	17	325	22	-14	-12	-7	47	12
	96	22	711	580	-6	637	630	614	-9	6	-5	36	-4	0	17	-3	787	32	17	396	27	-13	-16	-14	41	13
23597	24	33	7	21	13	95	19	89	13	173	163	132	149	165	15	4	13	77	18	9	70	208	180	-2	61	21
	48	64	9	23	15	164	31	157	16	197	181	102	204	199	13	2	9	95	17	6	99	214	201	-4	58	28
	72	78	18	34	13	199	37	197	22	194	183	104	240	257	22	10	17	118	25	12	115	210	221	3	74	40
	96	91	27	44	10	233	42	237	28	191	184	105	275	315	30	18	24	140	33	17	130	206	240	9	90	52
25374	24	100	18	9	28	131	117	143	7	123	178	149	282	249	154	89	26	143	36	21	54	196	136	0	43	53
	48	94	22	16	9	275	220	283	6	219	184	189	610	405	215	178	34	243	44	32	70	328	305	13	59	78
	72	119	27	19	9	434	285	424	8	216	190	189	617	408	208	228	38	300	48	37	72	464	367	17	63	91
	96	109	29	25	13	607	389	600	11	239	199	189	661	411	216	250	35	309	54	46	81	457	364	23	70	89
25521	24	99	3	-4	-4	-16	-11	-11	-19	135	66	70	37	9	-21	-16	-13	304	-8	-9	-4	-18	-9	-12	3	-12
	48	111	12	6	3	-6	-5	1	-18	148	100	78	63	17	-19	-10	-10	448	-4	-4	4	-20	-8	1	10	-8
	72	145	26	12	17	3	6	16	-17	184	141	105	72	27	-11	-4	-5	521	5	4	15	-9	0	9	24	7
	96	178	40	17	30	12	16	31	-18	219	181	131	80	36	-3	3	1	594	13	12	26	2	6	17	38	21
25915	24	129	3	-1	3	262	-1	15	-8	226	26	-4	1	-3	-14	-10	-3	311	-2	190	-5	2	-10	-4	6	-6
	48	122	1	-7	-22	360	-7	4	-17	323	33	-13	-2	-8	-19	-16	-7	475	-14	227	-18	-23	-22	-8	-3	-14
	72	126	6	-9	-17	569	-3	-4	-21	338	45	-4	-2	-8	-17	-14	-8	607	-17	296	-21	-20	-22	-3	1	-19
	96	129	11	-11	-11	777	2	-11	-25	353	57	5	-2	-7	-14	-11	-8	738	-20	365	-24	-17	-21	2	5	-23
27118	24	40	22	29	10	14	15	-3	-6	54	52	40	369	295	106	27	24	262	10	46	2	137	14	16	30	24
	48	46	29	40	18	26	25	3	-2	131	59	56	522	411	115	36	182	498	8	241	-13	322	31	10	36	7
	72	49	39	53	34	22	42	3	3	204	80	81	601	453	225	49	357	568	21	350	3	530	94	19	52	32
	96	51	48	66	49	18	58	2	8	277	101	106	679	494	334	61	531	634	35	458	19	737	157	27	68	56
27119	24	77	22	73	53	119	92	122	16	67	74	41	109	179	-6	10	16	65	8	7	2	-7	-7	0	34	-8
	48	92	44	128	73	224	162	220	22	74	102	65	134	220	-3	14	20	143	16	9	4	-7	-10	-4	36	-7

Strain	Time	C3 (D-psicose)	C4 (D-raffinose)	C5 (L-rhamnose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	D1 (acetic acid)	D2 (cis-aconitic acid)	D3 (citric acid)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (a-hydroxybutyric acid)	D11 (b-hydroxybutyric acid)	D12 (g-hydroxybutyric acid)	E1 (r-hydroxy phenylacetic acid)	E2 (tiaconic acid)	E3 (a-keto butyric acid)
	96	111	44	339	132	489	333	470	32	128	124	73	235	282	6	19	18	333	25	15	12	-3	-9	4	49	5
27122	24	65	24	27	11	116	89	119	10	68	95	62	129	159	399	10	7	117	11	24	26	80	-15	71	26	9
	48	69	34	44	-10	252	195	251	-2	118	131	109	552	340	588	19	4	359	6	12	21	300	-21	328	37	2
	72	82	40	53	-9	389	336	384	0	135	141	118	529	381	600	26	15	460	14	19	16	472	-17	550	46	17
	96	87	57	55	8	573	534	559	8	175	175	144	628	462	716	46	27	558	32	43	34	658	-5	756	67	40
27123	24	33	9	3	-1	2	3	3	-2	274	48	145	827	535	26	3	3	0	-2	1	1	162	-5	25	52	1
	48	29	15	7	-12	-4	-2	-3	1	300	32	123	999	618	17	0	3	7	-3	2	-1	374	-9	38	101	5
	72	32	26	16	-7	5	2	8	16	306	45	127	999	665	24	13	12	21	12	10	1	500	-7	32	170	14
	96	35	51	15	4	14	8	3	29	324	62	96	999	767	3	25	23	25	6	12	30	556	7	22	399	48
27124	24	113	186	19	154	262	217	271	107	167	138	119	353	416	234	278	161	245	20	178	39	298	-6	7	55	27
	48	113	639	19	522	685	550	709	310	465	236	125	830	664	221	881	487	786	31	685	111	706	0	18	89	78
	72	113	840	24	740	872	694	868	442	414	197	103	686	628	201	853	701	873	25	706	94	615	-9	10	87	68
	96	84	999	12	999	999	948	999	626	434	244	106	674	625	216	886	817	913	18	746	67	620	-8	1	90	40
27125	24	57	12	2	2	75	60	86	-6	60	92	105	148	197	292	1	4	85	2	-1	-2	100	-12	33	22	-6
	48	65	11	0	-4	274	229	309	-4	132	152	104	490	332	426	-1	1	432	-4	-3	6	296	-6	286	23	-5
	72	99	33	21	7	525	451	573	12	176	181	165	661	457	510	16	18	598	11	10	12	503	-9	582	49	10
	96	118	50	38	6	700	637	770	22	242	223	243	695	499	564	28	38	645	31	15	25	578	1	679	71	25
27126	24	7	2	-3	-10	-7	-5	-7	-11	-7	10	35	1	-3	3	-11	-3	-9	-3	-9	5	10	-11	58	43	13
	48	15	10	4	-2	-1	2	-1	-4	-6	25	42	11	4	5	-4	4	-2	2	-1	9	21	-4	26	47	15
	72	20	14	4	-5	-2	-1	-1	0	-4	28	47	13	5	8	-4	7	-2	2	-1	11	19	4	23	48	15
	96	30	23	13	6	8	13	8	9	3	34	55	20	11	16	4	17	7	11	8	26	35	8	14	56	28
27128	24	-2	-2	4	-2	3	10	7	-5	26	10	54	15	3	-22	-8	-5	12	15	4	11	48	-11	-33	40	-16
	48	-2	1	4	-2	3	12	3	-5	32	8	55	9	1	-25	-7	-4	13	18	3	10	51	-12	-33	38	-16
	96	2	9	13	3	11	26	30	-1	43	11	68	18	6	-24	-1	4	24	35	13	22	61	-10	-34	46	-6
27130	24	-5	-2	-6	-9	-15	-16	-14	-15	14	114	27	36	88	-6	-13	-12	-13	-17	-12	7	101	3	203	23	-6
	48	-8	-3	-3	-12	-6	-18	-10	-22	20	90	55	197	314	-10	-13	-18	-19	-18	-17	-6	209	-6	430	18	-16
	96	-1	20	6	-1	-15	-14	-8	-18	62	127	74	580	452	5	0	-4	-1	-1	-11	8	485	9	484	39	-8
27132	24	93	13	15	13	181	122	194	14	101	166	131	218	206	192	105	16	161	16	4	61	161	123	12	14	72
	48	96	13	14	7	336	272	366	10	119	168	135	356	268	214	132	14	250	11	1	69	203	219	13	12	83
	96	104	12	15	5	565	582	578	3	123	183	136	396	273	210	215	205	320	10	8	65	317	249	13	14	88
27582	24	0	-1	1	137	1	138	4	-3	13	49	57	263	215	39	48	112	214	69	74	-7	120	-7	123	98	-5
	48	21	13	12	460	90	312	9	7	158	87	80	734	549	80	389	556	517	370	414	-5	409	24	616	363	13
	72	-6	3	3	773	275	509	-6	13	142	65	51	775	473	123	652	622	425	558	437	-9	557	10	927	576	1
	96	-9	0	0	839	456	612	-12	40	133	46	44	754	433	112	595	568	381	649	411	-9	576	3	849	468	-6
27593	24	55	114	4	16	124	165	118	2	71	134	119	87	321	186	5	125	184	32	98	16	-12	-7	91	57	1
	48	40	239	-1	7	225	444	188	12	215	140	61	285	477	136	-12	281	346	29	249	-4	-22	-17	188	27	-20
	72	30	528	8	14	539	594	294	30	375	120	35	511	386	122	-22	493	531	27	446	-8	-23	-21	505	7	-38
	96	28	688	11	24	681	656	372	35	374	117	30	501	378	124	-24	472	518	30	429	-8	-22	-24	626	0	-37
27950	24	11	4	8	1	1	-4	40	-15	131	133	61	0	1	-1	-2	62	0	4	-4	1	1	-9	-13	18	162
	48	10	15	62	-3	13	-6	104	-22	266	139	99	8	9	5	6	171	-4	4	-18	-6	0	13	-19	28	262
	72	20	24	205	4	29	-1	179	-18	338	138	110	10	17	6	14	258	-3	12	-14	6	13	10	-20	34	319
	96	12	21	322	3	30	8	189	-14	403	152	142	11	14	5	8	340	5	20	-8	12	14	21	-16	38	387
	24	-7	-15	-23	-18	-9	-24	-8	-25	-17	-19	23	-13	-13	-12	-17	-13	2	-4	-10	-4	-17	-26	-30	63	-22

Strain	Time	C3 (D-psicose)	C4 (D-raffinose)	C5 (L-mannose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	D1 (acetic acid)	D2 (cis-aconitic acid)	D3 (citric acid)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (a-hydroxybutyric acid)	D11 (b-hydroxybutyric acid)	D12 (g-hydroxybutyric acid)	E1 (r-hydroxy phenylacetic acid)	E2 (itaconic acid)	E3 (a-keto butyric acid)
29570	48	-25	-20	-21	-28	-18	-27	-14	-27	-19	-26	11	-19	-20	-19	-23	-23	10	0	-18	5	-26	-31	-32	41	-26
	72	-29	-24	-16	-40	-25	-26	-12	-25	-23	-32	22	-23	-23	-22	-26	-29	28	10	-10	29	-28	-31	-31	102	-27
	96	-30	-28	-15	-41	-27	-32	-13	-26	-28	-36	21	-30	-27	-28	-26	-38	32	11	-10	34	-32	-38	-34	95	-32
33127	24	18	10	-4	-5	11	4	33	2	150	142	108	48	16	-12	-5	2	8	5	-7	7	135	117	-16	56	-9
	48	55	33	2	10	97	20	89	25	258	172	136	131	45	1	18	21	58	15	4	53	212	171	-14	97	27
	72	51	48	14	20	148	44	115	10	300	229	155	176	72	6	27	30	84	28	19	47	264	276	-9	135	37
	96	47	53	21	26	206	168	163	7	311	270	168	181	79	10	30	29	113	38	27	46	262	312	-7	162	37
33539	24	234	15	2	19	6	15	146	-6	196	140	93	8	-1	24	0	5	14	22	10	87	0	-11	18	52	0
	48	244	21	3	22	4	17	148	-12	275	179	100	8	-3	25	-3	5	17	29	8	76	8	8	24	49	-5
	72	310	43	20	23	11	39	189	-1	341	237	137	21	7	35	9	15	37	49	22	99	21	9	25	56	7
	96	337	36	27	18	1	50	215	-4	351	234	149	20	5	24	7	8	43	54	21	100	11	-7	10	57	14
33653	24	267	36	34	156	282	462	272	47	143	170	181	116	155	4	11	22	244	22	11	0	15	0	-18	21	-14
	48	246	33	7	159	336	486	272	45	239	169	149	337	310	7	16	85	295	0	70	-7	118	0	-20	19	-14
	72	219	20	16	148	378	490	248	25	237	154	109	506	351	8	17	201	342	6	136	-16	181	5	-20	16	-14
	96	228	24	17	139	392	474	264	39	234	157	93	507	344	-1	9	240	394	0	159	-17	191	7	-19	10	-18
35016	24	125	48	42	312	419	476	104	37	113	137	78	72	110	52	41	71	263	31	63	37	67	12	-4	64	21
	48	105	33	40	492	636	650	66	12	193	152	102	296	306	91	38	310	403	17	146	4	205	-13	-11	47	10
	72	102	37	50	615	729	733	56	15	303	154	123	414	353	165	25	520	419	26	170	11	210	-8	-12	43	23
	96	93	29	44	661	692	718	48	16	337	155	101	456	321	156	27	581	398	23	179	10	209	-9	-15	33	15
35084	24	136	50	6	151	304	267	115	13	102	108	118	99	118	-16	23	87	286	13	17	18	19	-30	-34	-3	-25
	48	152	47	-1	125	285	317	92	-4	372	174	120	350	424	-22	21	222	398	6	87	-9	246	-23	-37	-7	-28
	72	170	47	2	120	300	339	84	-7	394	230	132	461	531	-18	23	367	528	11	87	-7	396	-26	-42	-12	-20
	96	175	46	4	106	314	360	86	-1	396	267	137	489	557	-16	23	402	517	17	92	3	431	-25	-43	-14	-8
35912	24	237	41	18	189	393	568	287	30	160	173	158	164	170	5	12	24	339	21	26	12	13	4	-19	20	-6
	48	251	37	14	186	396	636	213	8	230	180	152	219	276	6	12	24	413	11	1	6	12	0	-16	18	-8
	72	257	31	16	175	395	614	210	8	259	181	165	294	319	8	17	21	430	18	4	11	9	1	-12	16	-9
	96	278	34	30	165	437	655	203	24	286	200	175	341	416	8	20	22	481	30	11	18	10	0	-7	15	-10
51192	24	46	25	12	13	16	5	12	14	640	89	219	61	34	354	-3	19	17	16	7	375	150	48	21	69	468
	48	30	27	18	13	20	12	15	18	673	119	268	64	38	384	-1	24	24	24	13	434	164	43	16	75	602
	72	27	21	19	9	32	11	17	20	632	124	243	51	28	450	-6	13	24	23	12	413	212	33	18	62	553
	96	35	26	25	11	9	14	24	27	713	136	263	58	33	493	-2	15	30	33	21	468	263	36	23	69	583
51288	24	214	110	-3	136	411	319	229	-1	251	196	120	148	25	67	7	17	340	4	6	-1	-22	-15	-18	32	2
	48	233	162	4	124	605	897	237	17	443	343	163	433	70	121	23	35	542	19	20	7	-21	0	-8	55	31
	72	190	177	6	87	675	999	282	8	563	346	158	699	136	68	10	23	802	22	19	11	-27	-9	-11	48	20
	96	190	217	8	88	706	999	323	16	622	374	162	829	194	71	21	19	864	25	22	14	-26	-15	-9	52	21

Strain	Time	E4 (a-keto gluctaric acid)	E5 (a-keto valeric acid)	E6 (D,L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 (quinic acid)	E10 (D-saccharic acid)	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alaninamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-aspartic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)
3	24	18	-1	12	3	62	10	10	-28	9	-17	-5	10	6	-18	18	5	-15	24	45	18	39	-3	-19	-12	18
	48	27	5	21	15	66	19	23	-33	3	-16	5	17	19	-26	39	18	-21	33	56	31	46	-4	-27	-14	27
	96	34	-35	56	39	-30	41	56	41	52	-12	-36	-22	33	9	38	24	-34	41	56	41	52	-12	-36	-22	33
5	24	3	-24	-13	-6	4	4	-10	-22	-1	-3	2	9	2	-9	-9	-7	-6	-2	8	-10	-2	-2	-2	-10	-8
	48	2	-22	-11	-5	7	7	-9	-20	2	-4	4	7	1	-8	-9	-7	-11	-3	11	-12	-1	0	-2	-12	-6
	72	7	-14	-7	0	15	16	-5	-18	8	-1	8	11	5	-5	-5	-5	-9	0	15	-12	1	7	4	-7	-2
	96	16	-1	2	6	21	28	0	-13	11	3	20	17	10	2	2	2	-1	6	24	-8	2	19	13	2	7
7	24	3	-6	18	2	17	-2	6	-23	4	0	6	3	1	3	-1	6	3	4	3	-3	2	-3	-8	-9	-1
	48	22	-3	41	17	23	5	21	-8	11	15	25	24	14	13	11	10	9	15	5	11	9	4	14	9	17
	72	38	5	66	34	50	15	38	9	17	31	43	42	26	25	20	17	28	26	18	23	18	15	24	21	33
	96	46	14	68	50	64	21	51	20	24	28	51	49	45	36	30	34	43	34	25	30	22	28	31	34	39
9	24	13	1	196	12	45	-2	10	-13	148	75	59	15	24	138	208	18	82	18	189	-6	-8	142	4	189	71
	48	22	-6	264	11	41	1	5	-6	184	91	65	-3	28	126	293	16	105	-2	225	-2	5	138	-16	253	100
	72	23	0	305	15	55	2	2	-8	230	95	73	-2	35	149	329	13	106	0	228	-3	5	128	-11	289	100
	96	25	2	334	19	64	4	-7	-9	268	98	82	-3	38	186	363	12	104	-1	232	-8	5	105	-10	312	100
	120	0	7	316	0	41	-22	-8	-17	260	93	43	-13	-3	144	225	-27	51	-8	152	-13	0	131	-15	79	44
11	24	5	-11	8	13	-5	-4	2	-19	5	0	10	11	0	2	4	3	10	9	40	44	1	2	-1	-3	-2
	72	41	22	48	48	13	5	23	14	28	15	41	38	23	34	36	28	28	30	79	76	23	15	7	17	18
	96	27	26	41	31	13	15	8	4	20	12	29	31	11	41	27	15	25	22	69	60	17	19	11	6	7
12	24	8	-4	6	9	7	9	7	-6	6	1	13	4	2	10	9	0	7	14	9	3	0	6	0	-7	1
	48	17	7	21	21	5	18	9	10	12	10	27	9	2	13	22	14	6	26	16	9	3	9	-6	-1	11
	72	22	13	24	29	14	17	6	14	13	14	32	13	-1	14	24	22	2	27	11	8	0	14	1	4	14
	96	26	15	27	31	14	14	4	18	16	11	32	18	7	16	24	26	4	30	4	11	-4	16	1	4	18
13	4	12	-24	-4	4	34	-10	-4	-46	8	-3	1	-4	8	-1	4	10	-26	-26	21	6	33	6	-11	-10	25
	24	14	-16	25	8	28	-8	-1	-50	17	-3	14	-3	24	-2	11	29	-37	-33	99	59	80	4	-9	-12	40
	48	15	-12	34	12	34	-11	0	-50	23	-6	22	-8	30	-8	15	22	-38	-36	81	55	92	22	-8	-5	60
	72	13	-9	27	10	40	-17	-6	-51	24	0	24	-6	32	-4	18	20	-38	-39	72	50	97	64	-2	-5	64
	96	17	-4	44	15	50	-13	4	-47	26	6	31	-6	34	0	16	26	-36	-34	73	63	101	106	2	1	75
14	24	-2	-10	12	-11	27	1	-5	-14	1	-10	0	1	-5	-5	-6	-5	1	7	2	2	7	0	7	-5	-7
	48	-6	-14	8	-18	20	-4	-13	-19	-9	-15	-5	-6	-10	-15	-13	-11	-7	2	-3	-5	1	-7	2	-13	-13
	72	2	-5	19	-7	41	4	-3	-10	-11	-7	4	2	-5	-10	-8	-3	-4	13	5	12	0	-9	11	-6	-4
	96	-3	-9	12	-10	44	-1	-8	-11	-22	-10	2	-3	-10	-6	-10	-9	-8	8	-1	8	-12	-12	7	-11	-7
18	24	4	16	6	-4	11	9	2	-29	4	-2	4	9	6	11	13	10	11	10	6	6	16	15	1	13	6
	48	6	22	13	-4	20	10	2	-29	5	-2	5	12	8	13	17	12	15	13	10	8	21	19	3	16	7
	72	7	27	18	-4	23	13	3	-30	7	-1	6	14	10	15	19	14	17	14	14	9	23	23	5	19	9
	96	7	28	20	-3	28	12	5	-30	9	-4	7	14	10	15	17	14	18	14	14	11	21	20	4	18	7
19	4	2	-7	-14	-16	8	-28	-15	-36	-10	-12	-12	-11	-7	-27	15	1	-10	-9	8	-5	-15	0	-31	-13	1
	24	0	-10	-15	-17	13	-28	-13	-43	-8	-15	-10	-16	-4	-32	7	1	-15	-11	8	-6	-15	-3	-35	-18	-6
	48	4	-7	-18	-17	20	-24	-12	-44	-6	-16	-10	-9	-2	-31	14	8	-14	-9	10	-5	-12	7	-34	-16	-2
	96	6	-8	-16	-16	23	-20	-10	-30	-1	-14	-10	-8	-1	-20	20	9	-12	-7	15	-4	-10	10	-25	-15	-1
24	24	9	-4	2	-4	10	-3	-4	-10	4	-1	5	-1	-1	4	-1	-1	0	9	-1	-1	-2	3	-4	-4	-5
	48	9	-1	9	-1	8	1	-5	-4	11	2	4	-3	-4	1	-4	-3	0	-5	-3	-4	1	5	-7	-4	-7
	72	16	5	10	0	7	2	-4	-2	11	0	10	2	0	7	-3	-2	3	-3	-2	-2	4	9	-2	-1	-3

Strain	Time	E4 (a-keto gluctaric acid)	E5 (a-keto valeric acid)	E6 (D L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 (quinic acid)	E10 (D-saccharic acid)	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alaninamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-aspartic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)
	96	15	5	11	0	4	4	-3	-4	7	0	11	4	1	10	-2	-2	1	-1	-2	-2	5	10	-2	0	-3
26	4	26	8	-8	-2	35	3	1	-25	21	12	13	-3	12	26	24	7	15	23	43	-8	4	21	3	23	13
	24	115	23	13	8	57	8	10	-19	120	55	44	12	32	74	121	13	69	58	104	1	20	68	38	155	59
	48	182	21	20	10	52	5	11	-14	136	63	50	20	37	59	128	3	73	55	106	3	15	64	35	190	86
	72	188	23	20	15	56	4	15	-8	156	68	38	10	31	57	121	2	68	57	111	9	10	59	32	177	73
	96	217	24	23	18	58	5	20	-5	177	73	40	10	31	60	120	3	70	59	213	11	9	57	34	165	74
32	4	-1	11	-3	-2	10	3	-6	-5	-2	-4	-3	1	-5	3	-4	7	-1	6	5	-9	5	10	0	6	1
	24	-22	-15	-30	-11	-7	-21	-16	-19	-8	-20	-23	-16	-17	-13	-16	-4	-12	-17	-15	-36	6	-10	-24	-13	-16
	48	-32	-21	-38	-12	1	-26	-22	-26	-8	-33	-33	-28	-19	-21	-19	-10	-15	-27	-22	-44	3	-18	-33	-11	-23
	72	-28	-11	-38	-4	18	-20	-23	-24	-3	-29	-27	-28	-13	-12	-9	-1	-4	-23	-13	-42	15	-13	-26	-3	-15
	96	-19	3	-21	2	25	3	-21	-8	-8	-7	-17	-10	-15	5	-1	1	-7	-8	-1	-26	13	8	-11	6	-17
36	24	-7	4	4	-18	36	-19	-21	-35	-9	-21	-19	-16	47	-40	19	81	-12	47	50	32	57	-17	-41	-17	-11
	48	-8	19	2	-18	43	-17	-20	-36	-7	-22	-17	-19	55	-44	67	109	-7	71	55	41	63	-20	-43	-15	-15
	72	-5	26	5	-16	52	-15	-18	-37	-7	-21	-16	-16	61	-44	89	129	0	81	61	43	68	-20	-43	-11	-16
	96	-2	36	8	-14	59	-11	-16	-38	-7	-21	-14	-16	69	-45	128	147	7	91	68	47	72	-19	-43	-9	-12
38	24	-14	-10	-10	-16	-6	2	-17	-12	-11	-11	0	-13	-14	-9	-14	-15	-8	0	-11	-15	-6	-8	3	-16	-11
	48	-14	-9	-9	-13	-3	-10	-11	-7	-3	-7	-2	-13	-11	-7	-13	-15	-4	7	-4	-9	0	-6	6	-13	-2
	72	-8	-8	-10	-9	7	5	-10	-7	-9	-6	-3	-11	-8	-4	-13	-15	-4	1	-6	-9	-4	-7	3	-13	-3
	96	-10	-15	-15	-10	13	3	-11	-7	-13	-6	-8	-12	-11	-5	-14	-16	-3	2	-5	-10	-8	-3	2	-13	-5
39	24	81	47	74	39	83	29	17	42	83	47	63	20	34	79	107	71	45	70	104	19	98	26	33	94	13
	48	108	50	89	58	102	34	28	78	99	66	98	23	51	77	133	76	55	89	96	32	130	33	48	104	20
	72	154	45	95	38	85	23	23	51	99	67	87	15	29	75	89	85	54	95	125	3	105	36	16	115	12
	96	195	40	108	18	56	14	19	43	100	68	78	3	16	71	65	92	53	112	154	-25	81	40	-8	121	-10
42	24	-6	-9	7	-21	-17	-23	-21	-21	17	0	-6	-5	-18	-15	-9	-12	-5	-6	-1	-21	-8	-2	-12	-19	-12
	48	-17	-21	0	-34	-33	-39	-38	-37	12	-4	-19	-22	-37	-26	-21	-26	-14	-20	-14	-39	-24	-16	-29	-33	-28
	72	-6	-18	12	-33	-30	-39	-38	-37	10	16	-8	-22	-38	-20	-18	-22	10	-7	11	-38	-24	-8	-26	-28	-25
	96	3	-11	22	-31	-29	-38	-36	-35	11	20	0	-20	-37	-12	-5	-16	22	-2	33	-37	-23	-2	-22	-25	-20
	120	12	-6	31	-29	-24	-34	-31	-31	17	25	12	-17	-34	-6	6	-11	43	11	58	-34	-23	5	-17	-23	-13
43	24	46	9	-7	26	21	3	7	-3	3	-2	-2	28	9	25	28	23	26	6	42	4	-1	10	5	12	18
	48	37	16	-3	33	23	-2	8	0	2	1	-3	28	10	26	23	26	22	6	36	3	3	12	6	11	15
	72	31	22	-1	35	30	-3	-3	3	2	-5	-3	28	13	25	23	26	16	4	34	4	9	17	10	2	14
	96	46	35	4	43	41	4	2	12	3	-7	-1	41	14	33	28	32	22	10	42	9	13	24	20	12	20
46	4	2	-19	0	-9	7	-11	-3	-28	2	-7	-1	5	-10	-24	-13	2	-22	-2	30	9	22	-6	-26	-22	2
	24	22	-17	23	-9	8	-26	10	-47	13	-2	18	12	11	-46	12	15	-49	9	55	23	39	-35	-51	-42	10
	48	17	-30	27	-13	-2	-32	11	-51	8	-7	9	-1	8	-49	24	6	-52	-1	56	19	35	-40	-55	-47	-4
	72	15	-33	29	-15	1	-34	12	-51	5	-7	3	-2	5	-49	28	8	-51	-6	54	18	37	-41	-55	-46	-10
	96	18	-35	34	-14	2	-32	13	-50	7	-2	5	2	6	-48	34	7	-51	-2	59	17	34	-40	-54	-46	-3
55	24	0	14	0	0	52	13	-7	-9	-2	-8	-6	6	-8	3	0	-5	-3	18	-4	-2	12	10	-5	1	0
	48	3	7	0	4	38	12	-6	-13	-8	-3	-3	4	-5	3	-1	-4	-4	19	-10	2	-3	1	-10	-5	-3
	72	4	13	-4	12	46	20	-2	-11	-7	-3	2	3	2	10	-8	3	4	19	-8	7	-7	0	-2	-15	-5
	96	1	19	-5	14	59	23	-1	-10	-7	-6	-1	9	5	16	-11	5	6	17	-7	1	-11	-3	3	-18	-9
57	24	8	-6	8	6	6	-3	-3	-9	4	7	9	7	5	21	6	1	-13	3	4	-5	8	8	0	-6	0
	72	18	8	18	2	13	4	9	1	13	10	7	16	7	34	7	7	-8	6	6	-1	18	19	8	-6	4

Strain	Time	E4 (a-keto gluctanc acid)	E5 (a-keto valeric acid)	E6 (D,L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 (quinic acid)	E10 (D-saccharic acid)	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alanmamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-aspartic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)
	96	30	20	29	34	24	13	20	13	23	20	18	28	20	46	20	20	2	20	15	11	32	37	21	7	20
	24	15	-6	3	-3	154	2	12	-7	128	55	33	14	2	1	23	80	74	158	100	49	78	19	20	6	4
58	48	15	-2	5	1	170	-1	15	-2	227	75	45	18	8	-1	82	80	87	301	215	102	148	16	18	8	11
	72	16	-2	4	6	178	0	20	1	231	71	52	21	13	3	156	100	120	445	356	127	225	21	21	11	16
	96	19	-1	2	11	189	1	24	4	235	68	62	26	19	8	183	121	180	536	470	146	261	30	25	15	21
	120	17	3	6	12	201	4	26	0	230	83	53	23	19	13	207	161	249	640	618	168	283	32	27	10	15
	24	7	3	-1	9	20	-1	-5	-10	4	-3	6	-14	-1	-6	-17	12	-6	12	8	-6	0	-4	-1	-3	2
59	48	-13	3	-16	4	14	-19	-12	-16	-1	-8	-6	-22	-17	-4	-35	-6	0	-4	-1	-12	-2	11	-9	-14	-19
	72	-9	14	-17	11	40	-17	-6	-12	6	4	-3	-9	-16	5	-36	0	17	-9	2	-10	7	24	1	-15	-19
	96	-5	29	-15	20	56	-16	-8	-11	9	9	-2	0	-15	10	-36	6	25	-9	5	-11	14	34	8	-16	-19
	24	12	-40	61	-15	81	-14	-13	-42	-7	-21	2	36	45	-42	-6	5	4	72	84	45	66	-30	-38	-22	52
63	48	12	-36	71	-14	71	-11	-10	-42	-4	-20	3	41	53	-42	4	10	26	97	109	74	73	-25	-39	-20	73
	96	19	-28	83	-8	84	-5	-6	-42	2	-16	9	54	61	-43	10	16	69	125	129	102	80	-18	-40	-15	92
	24	-4	10	-15	-15	19	-11	-8	-34	-23	-21	-16	-8	-3	-24	7	2	-1	16	11	17	-4	4	-28	-14	4
64	48	3	18	-12	-11	34	-7	-4	-33	-20	-21	-13	-7	2	-25	18	10	5	24	21	25	-5	6	-26	-10	12
	72	15	32	-4	-2	56	1	4	-29	-15	-16	-5	2	16	-19	39	28	20	40	38	39	3	15	-18	1	28
	96	15	36	-6	-5	53	-4	0	-35	-17	-22	-8	-1	17	-23	47	30	23	38	40	35	1	13	-21	0	29
	24	9	-10	7	-5	34	-11	-2	-33	-3	8	-4	-4	11	-11	2	7	13	7	17	9	11	0	-10	-6	6
66	48	14	-6	11	-1	33	-4	3	-42	-1	3	0	-1	21	-19	8	11	10	21	20	22	26	-1	-18	-8	14
	96	18	-8	19	4	32	3	8	-49	3	2	2	2	36	-27	16	22	4	37	17	43	34	-2	-25	-13	30
	4	4	-6	3	2	9	-2	0	-15	5	4	2	0	-1	6	1	3	2	10	-6	0	0	5	-6	-4	-5
	24	-2	-10	4	5	5	-7	3	-7	6	2	-3	1	1	4	-1	1	6	12	-7	0	2	7	-5	-3	-5
67	48	-11	-13	2	2	2	-12	1	-8	-1	-5	-18	-14	-6	0	-10	-13	-1	7	-15	-12	-7	4	-7	-16	-17
	72	-12	-7	10	2	8	-8	1	-7	1	4	-12	-11	-8	7	-10	-11	3	9	-11	-11	-5	9	-1	-14	-14
	96	-7	-2	16	12	19	-1	8	0	7	7	-8	-4	1	15	-7	-6	12	18	-4	-6	-3	15	5	-9	-9
	24	7	3	2	5	77	3	4	2	5	7	3	12	2	7	6	8	-1	8	3	6	9	3	0	4	3
70	48	11	18	16	23	121	8	21	22	13	18	16	26	15	16	19	21	7	31	6	21	13	18	11	16	19
	72	3	18	15	13	104	-2	6	19	4	14	7	10	1	13	13	-1	-3	21	-2	17	12	12	2	9	10
	96	9	32	29	17	122	6	9	33	6	18	11	15	-2	26	20	-2	3	31	3	21	17	18	12	19	19
	24	7	0	-35	-4	3	-7	-6	-13	13	9	20	-1	9	8	-2	-3	3	3	3	-7	-2	4	-5	-9	-3
72	48	23	-5	-32	1	-5	-5	-5	-2	19	14	36	5	20	9	4	6	11	3	7	-4	5	-2	-13	-7	1
	72	23	-2	-39	-1	-3	-6	-7	7	29	23	41	4	21	11	2	5	7	2	9	-3	10	7	-16	-6	2
	96	24	4	-41	5	8	-1	-8	14	29	27	39	5	17	11	2	4	8	2	13	3	12	15	-11	-2	7
	24	-8	-5	-10	-18	3	-11	-15	-42	-14	-15	-12	-9	-17	-15	-4	-7	-4	-13	-7	-12	-9	-2	-23	-6	-9
74	48	-9	-2	-13	-19	1	-13	-17	-43	-13	-16	-15	-9	-18	-18	-3	-8	-5	-16	-7	-12	-8	1	-26	-5	-9
	72	-5	4	-11	-17	5	-9	-15	-42	-13	-15	-12	-2	-15	-13	1	-5	-2	-14	-5	-10	-5	5	-22	-3	-5
	96	-5	8	-10	-18	6	-12	-15	-42	-12	-15	-15	0	-16	-16	3	-7	-4	-15	-6	-11	-6	9	-24	-5	-6
	4	14	0	134	13	43	3	7	-1	25	15	35	4	19	94	140	5	102	16	153	-4	7	84	-4	129	73
	24	14	0	134	13	43	3	7	-1	25	15	35	4	19	94	140	5	102	16	153	-4	7	84	-4	129	73
76	48	42	4	225	29	44	14	12	14	59	30	63	5	46	112	253	24	132	30	230	13	14	75	-10	211	110
	96	52	0	260	32	66	0	17	15	62	31	78	1	58	104	316	21	103	32	230	9	-6	71	-11	261	112
	120	28	-8	240	9	56	-6	-3	-11	53	28	69	-12	27	89	289	3	77	17	209	-11	-19	70	-18	158	56
	4	18	11	22	-1	30	-2	-3	-14	48	27	27	-1	0	18	56	1	23	4	45	-7	6	16	-1	71	16

Strain	Time	E4 (a-keto glutaric acid)	E5 (a-keto valeric acid)	E6 (D,L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 (quinic acid)	E10 (D-saccharic acid)	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alaninamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-aspartic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)
78	24	67	26	85	0	38	-2	11	-11	114	54	47	1	7	69	133	-2	96	16	158	-15	2	12	-7	120	23
	48	98	12	90	-1	46	-7	2	-12	125	54	44	-5	21	61	132	-3	90	20	174	-7	10	-4	-16	131	20
	72	123	25	126	18	73	1	29	7	132	83	42	1	-5	70	115	-16	106	52	134	-9	15	35	-5	99	36
	96	133	32	154	26	93	12	38	23	146	105	60	13	1	86	123	-13	121	66	147	3	38	44	1	99	40
81	24	16	-23	1	1	35	-9	-2	-24	6	-13	-9	13	-8	-21	25	37	-26	16	24	23	32	29	-22	19	20
	48	19	-15	-1	4	37	-6	-3	-19	6	-17	-14	19	-8	-16	41	46	-20	20	30	31	35	37	-18	20	27
	96	32	-12	11	18	63	5	10	-5	21	-4	-5	32	2	-10	56	64	-12	36	46	52	55	46	-10	33	42
86	4	5	0	0	4	22	2	-1	-14	-2	0	-5	1	-7	-2	1	13	-1	9	11	5	14	0	-4	12	25
	24	5	2	-4	0	37	-4	-2	-16	-2	-6	-7	1	-8	-16	4	17	-8	12	27	0	37	-6	-9	12	55
	48	11	6	3	8	31	0	4	-9	-3	-3	1	1	0	-14	9	24	-4	15	32	5	36	-3	-9	15	61
	72	10	19	4	14	42	4	14	-4	6	2	4	1	3	-6	7	20	4	24	35	10	51	3	-2	18	65
	96	28	54	23	32	61	23	33	14	16	13	20	12	9	8	23	35	19	47	59	30	63	13	9	43	87
88	4	-1	14	0	16	16	8	7	-8	1	8	-7	5	-6	10	7	0	2	17	0	0	3	6	0	-5	-6
	24	60	9	-11	18	31	17	9	-9	21	2	-2	15	4	17	42	19	22	19	24	1	14	3	5	-2	3
	48	57	9	-14	12	16	3	0	-11	9	-7	-8	-1	-3	7	28	1	5	9	2	-9	-2	-3	-10	-9	-9
	72	34	23	1	24	33	13	7	-1	8	2	-13	-1	-12	14	30	9	21	25	10	2	4	9	0	-4	-14
	96	35	37	9	33	44	22	17	8	7	6	-15	4	-12	31	34	11	28	36	18	9	7	17	7	-6	-12
89	24	2	-14	-16	0	7	-2	-6	-29	8	-11	1	2	16	-26	-13	-15	-3	56	59	27	28	-14	-30	-23	34
	48	8	-11	-11	6	6	3	-4	-34	8	-10	9	12	36	-22	-5	-10	2	71	74	34	29	-13	-30	-2	47
	96	18	-14	-5	14	17	8	0	-34	17	-9	17	24	63	-21	5	-10	4	80	87	42	44	-9	-26	-19	60
	120	22	-13	0	17	26	14	2	-32	18	-10	19	32	73	-14	9	-10	7	91	100	48	51	-3	-19	-19	64
92	4	-5	-6	-16	-15	-1	-19	-24	-36	-15	-12	-8	-10	-13	-10	-6	-8	-3	-13	-7	-16	-16	4	-26	-11	-13
	24	-7	-4	-23	-20	6	-19	-24	-42	-14	-18	-11	-10	-11	-16	-5	-5	-5	-6	-11	-18	-12	3	-30	-13	-12
	48	-7	-1	-23	-20	7	-18	-25	-44	-15	-19	-15	-9	-11	-15	-1	-3	-5	-7	-12	-19	-14	4	-31	-14	-11
	72	-3	5	-21	-18	12	-16	-23	-44	-16	-17	-11	-5	-6	-11	3	0	-2	-6	-9	-17	-13	6	-28	-11	-5
	96	-5	8	-22	-19	16	-16	-24	-44	-15	-18	-15	-6	-6	-12	5	2	-3	-6	-9	-18	-13	7	-29	-13	-5
94	24	15	-10	-19	1	33	6	5	-38	12	-17	-2	4	-6	-13	-3	5	-7	6	20	3	18	-8	-26	-14	5
	48	12	-18	-25	4	20	-1	5	-43	4	-23	-5	5	-1	-19	1	7	-14	7	8	2	14	-12	-34	-17	2
	72	20	-17	-20	14	27	-1	13	-40	9	-22	2	18	10	-16	12	16	-12	18	10	10	20	-8	-31	-12	8
	96	25	-15	-17	22	36	0	20	-37	9	-21	2	23	15	-11	16	8	-11	24	12	17	23	-5	-28	-15	3
96	24	-10	0	-20	-11	7	-9	-11	-15	-17	-16	-15	-2	-2	23	-7	-10	-4	-8	-19	-22	-16	-8	-4	0	-2
	48	-34	-1	-16	-9	3	-6	-9	-10	-19	-15	-17	1	-3	27	-20	-14	-2	-10	-35	-23	-16	-6	-2	-1	-3
	72	-27	4	-10	-3	15	3	-5	-5	-13	-10	-13	6	1	31	-34	-14	6	-5	-30	-21	-9	-1	6	0	1
	96	-24	10	-6	-1	22	9	-4	-5	-12	-9	-13	7	1	25	-32	-12	11	-2	-25	-18	-8	1	10	-1	1
97	4	2	1	22	4	11	2	3	-14	1	4	5	3	11	7		6	1	6	3	-4	0	9	-3	-5	-2
	24	7	-13	41	-2	2	-4	-4	-24	-1	-2	12	-2	19	4	-6	10	0	5	0	-11	-6	-1	-14	-9	-7
	48	14	-10	60	10	19	13	2	-16	6	3	23	7	33	8	2	13	6	13	2	-4	6	2	-15	-3	2
	72	5	0	57	15	29	0	1	-10	6	8	23	8	27	9	1	8	6	15	4	-2	11	11	-11	-5	-1
	96	28	11	76	33	59	27	16	6	57	17	39	25	48	33	18	29	29	32	23	16	20	22	4	11	15
99	24	2	-9	5	2	0	0	-4	-5	1	-5	0	2	4	5	4	3	14	14	10	-4	-3	5	-7	-8	-8
	48	5	-4	13	6	9	-6	-4	2	3	-9	0	-10	8	5	11	10	20	16	6	-3	2	10	-7	-8	-10
	72	7	1	13	4	11	-3	-2	0	5	-3	-3	-2	5	14	9	15	18	9	4	-5	8	17	-2	-11	-11
	96	39	16	38	32	42	18	14	31	23	11	15	15	32	30	42	37	46	35	23	22	25	38	14	9	13

Strain	Time	E4 (a-keto gluctanc acid)	E5 (a-keto valenc acid)	E6 (D L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 (quinic acid)	E10 (D-saccharic acid)	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alaninamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-aspartic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)
100	24	-3	-8	-7	-4	-5	8	-4	-6	-6	-2	-1	3	-8	-6	-3	-10	-11	-9	-3	-12	-10	1	1	-10	-8
	48	3	3	-3	4	11	29	5	-1	9	1	4	15	-3	-1	13	5	3	-3	14	-4	10	19	9	-3	-2
	72	2	4	-1	5	14	29	5	0	6	-1	5	17	-2	-1	14	6	5	-2	7	-3	13	13	8	-4	-1
	96	3	9	-1	9	23	36	10	4	8	1	10	18	-1	3	15	7	11	1	11	-1	15	18	14	-3	1
101	4	3	3	13	4	2	2	7	-12	0	6	0	3	0	5	3	16	4	10	2	-2	0	3	-7	-1	0
	24	19	12	121	17	11	12	5	-3	73	76	41	101	19	34	55	123	198	167	94	144	62	6	-4	10	14
	48	17	9	172	21	20	1	11	-4	186	88	38	104	22	58	71	179	285	242	126	188	77	15	-10	5	8
	72	11	3	213	17	17	-8	11	-6	332	85	35	94	15	94	90	224	399	357	150	276	90	6	-18	3	3
	96	15	-5	221	15	9	-14	-1	-13	258	86	23	66	8	153	91	258	531	463	175	363	141	9	-25	-14	-5
103	24	8	30	8	10	136	-1	14	-12	5	7	10	2	23	9	141	268	151	133	101	294	153	14	12	40	-5
	48	16	22	13	16	135	-4	15	-9	-5	9	16	9	35	4	260	405	256	223	142	419	169	12	5	97	4
	96	8	19	16	22	156	-10	8	0	-8	0	20	-3	42	17	293	489	486	319	194	473	233	18	10	161	3
	120	21	27	5	23	168	-4	21	-3	-5	12	6	0	20	29	413	569	692	293	252	496	380	29	20	141	-9
105	24	9	43	3	-3	9	15	6	-34	19	-5	23	-2	47	-11	26	83	-6	18	118	85	89	5	-17	16	38
	48	18	63	10	-1	11	14	4	-37	25	-6	38	-2	87	-19	59	131	-4	36	150	156	122	-1	-20	32	73
	72	22	86	13	0	13	13	5	-36	25	-3	46	-1	106	-16	71	165	-6	59	185	215	135	2	-23	36	100
	96	26	98	16	2	16	11	6	-36	26	-2	52	0	134	-12	84	195	-7	71	199	230	153	6	-27	40	119
	120	28	108	19	6	30	23	8	-30	39	-10	54	2	153	5	98	221	5	85	235	241	187	17	-15	39	138
106	24	0	-6	-5	-3	-3	0	-3	-9	-3	-5	-5	-4	0	-6	-6	1	34	10	32	-2	14	-7	-3	-7	-4
	48	4	-8	4	2	-3	-1	-6	-9	-18	-2	0	-2	5	-7	-2	7	33	16	22	-4	-3	-1	-6	-4	-1
	96	20	7	21	13	24	18	9	15	-8	3	11	18	19	15	7	20	43	32	47	21	10	18	14	5	10
	120	15	10	20	5	29	19	3	-2	-8	-3	0	19	4	17	-4	14	23	18	46	6	4	20	16	-7	-6
108	24	10	16	7	13	19	15	-1	-4	13	-1	25	12	22	18	10	15	22	17	12	0	7	11	4	6	5
	48	10	17	15	12	18	33	-2	8	14	-4	32	12	45	17	10	13	35	20	14	-1	7	6	1	2	3
	72	17	25	28	19	27	53	4	40	23	3	42	20	57	27	15	22	46	27	22	6	16	15	8	8	10
	96	16	23	30	16	23	53	1	88	14	-3	44	18	52	26	11	17	38	23	20	2	6	8	5	4	5
109	24	5	-7	-2	-1	-4	-2	-5	-22	2	-2	-9	7	4	-8	5	-2	17	-5	9	9	65	5	-8	2	7
	48	16	-9	2	5	-9	1	0	-25	8	8	-6	12	19	-8	22	8	61	5	31	77	115	18	-9	10	20
	72	16	-13	1	7	1	-2	-5	-29	2	7	-5	11	20	-11	21	5	60	10	36	113	243	13	-12	4	12
	96	17	-9	5	17	12	6	0	-28	2	6	1	17	28	-8	22	12	66	24	50	158	318	18	-7	6	20
113	24	5	2	-4	-3	13	-2	-10	-13	-4	-2	3	10	1	7	0	-2	-4	-2	2	-6	1	4	0	0	1
	72	12	10	5	4	15	5	-10	-5	4	2	9	11	6	20	6	2	-2	3	8	-4	10	7	4	4	6
	96	15	15	8	8	21	9	-8	-2	7	4	12	11	7	26	8	3	3	5	10	3	13	8	8	7	9
116	4	-1	-3	-12	-7	9	2	-2	-21	1	-4	-4	-2	-1	2	11	1	0	7	3	-6	4	-1	1	-6	0
	24	29	-18	-4	-13	-20	-7	-6	-1	-1	-29	3	-11	-7	-3	0	1	-7	8	-5	-15	-4	-17	-8	-11	-7
	48	0	-16	-14	-4	-8	-5	8	-25	5	-11	0	-9	10	-6	4	-2	-13	9	-9	-10	-11	-14	-9	-7	-5
	72	-6	-5	-22	-1	5	4	0	-23	5	2	-5	-9	-2	4	-3	-21	-9	3	-11	-16	1	-6	1	-20	-13
	96	9	7	-9	12	21	14	6	-10	13	17	0	-1	2	14	10	-14	0	13	-4	3	10	2	10	-7	-1
121	24	11	-1	12	2	8	-3	7	-5	13	3	15	5	11	13	5	-2	2	13	6	4	1	-9	1	-6	0
	48	-7	-6	7	0	7	-5	8	-5	8	-1	-4	-6	-3	2	-15	-14	-6	8	-1	2	-5	-3	-8	-22	-15
	72	-10	3	10	4	25	2	26	3	13	10	-1	-1	4	18	-18	-18	7	16	3	7	8	13	7	-20	-12
	96	22	-1	24	19	-1	-3	3	20	14	22	5	9	-4	1	10	4	9	7	13	10	12	12	-13	5	12
	120	-14	-5	-12	-6	-8	-9	-16	-17	-10	3	-22	-21	-27	-1	-23	-28	-27	-22	-25	-22	-14	8	-16	-28	-21

Strain	Time	E4 (a-keto gluctanc acid)	E5 (a-keto valenc acid)	E6 (D L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 (quinic acid)	E10 (D-sacchanc acid)	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alaninamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-aspartic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)
125	24	-3	-2	1	-9	-6	-11	-13	-14	-5	-10	-6	-6	-5	-11	-7	-4	3	-11	2	-6	-3	0	-21	-17	-7
	48	0	0	3	-5	1	-7	-9	-6	-8	-12	-4	-3	1	-7	-5	0	6	-6	2	-3	-4	-1	-21	-11	0
	96	20	27	26	22	33	14	14	12	7	-4	6	11	12	15	5	12	30	18	24	15	7	15	-9	9	28
137	24	-5	-6	-1	-3	3	-12	2	-6	1	0	3	1	-3	-12	0	-5	-7	-3	1	-8	-2	2	-10	-2	-8
	48	14	-4	15	8	20	-7	5	11	10	10	15	3	8	1	10	-11	4	6	-11	4	11	18	-4	8	5
	72	18	7	18	6	27	-4	5	12	4	13	18	17	8	3	10	-1	7	4	-9	9	10	26	9	14	7
	96	13	10	15	1	18	-6	-9	6	5	9	8	-1	-3	6	7	-1	5	-3	-10	2	8	31	3	8	3
138	24	9	-14	0	15	61	8	11	-34	12	-9	-5	15	8	-15	10	18	2	18	33	16	33	0	-21	-7	10
	48	9	-21	-2	13	54	6	9	-39	15	-11	-6	10	12	-19	13	23	-1	27	34	21	37	-4	-28	-14	10
	72	12	-22	-2	15	53	7	10	-42	19	-8	0	15	20	-18	16	33	-2	36	36	28	40	-3	-27	-15	15
	96	10	-28	-4	13	48	4	8	-45	18	-10	-3	12	17	-21	12	32	-8	32	30	27	34	-9	-35	-22	10
140	24	4	-1	5	-10	16	-2	-3	-17	4	-8	-11	2	-2	-14	4	11	-6	10	6	1	28	-3	-5	-5	8
	48	4	2	8	-11	8	0	-3	-19	5	-9	-8	1	1	-18	6	15	-14	13	14	3	38	-6	-5	-4	1
	96	15	12	21	-6	27	10	3	-16	18	-3	-1	7	10	-15	16	27	-13	24	34	16	66	-2	-1	-3	4
143	24	58	22	397	-4	26	-5	-10	-34	28	20	36	0	47	2	89	55	22	10	20	64	85	6	-2	49	0
	72	99	43	748	9	28	-1	1	-25	102	28	45	10	66	10	227	136	38	26	41	146	421	9	-1	69	2
	96	114	42	589	9	33	6	4	-33	149	36	50	11	64	17	253	131	34	29	45	158	475	13	2	107	9
155	24	4	-5	14	9	-1	-10	-1	2	8	6	4	13	3	1	0	-9	2	2	-4	0	3	-4	-8	-1	3
	48	16	7	32	28	4	-4	15	21	10	17	18	27	18	13	13	-8	4	16	-3	14	6	10	-2	11	18
	72	30	17	60	41	30	-2	24	33	16	32	35	37	29	20	24	2	5	28	3	25	12	18	14	24	29
	96	31	29	47	41	45	10	30	39	12	29	37	34	30	28	27	12	14	35	14	30	15	19	23	23	32
158	24	6	-7	17	0	17	0	-3	-27	3	-1	11	-1	7	0	2	5	9	1	2	-6	1	5	-1	-3	2
	48	18	-8	29	12	17	10	6	-15	5	6	24	11	19	14	13	18	16	14	11	6	5	4	-4	6	13
	72	29	-8	42	21	24	18	13	-5	13	11	38	22	30	27	25	28	31	23	16	16	14	14	-3	17	23
	96	43	2	49	32	41	32	25	7	16	18	53	33	43	39	40	40	46	34	26	32	26	26	7	29	35
162	24	17	3	33	12	30	20	5	-27	22	15	37	17	12	-1	19	21	31	89	95	72	96	28	-14	8	38
	48	23	6	47	14	37	17	3	-26	20	14	47	14	25	-6	28	19	29	137	108	110	106	45	-22	14	60
	72	27	6	62	20	48	18	6	-27	25	17	60	10	40	-1	40	26	31	177	118	141	128	58	-19	22	85
	96	24	13	74	23	55	14	7	-22	28	17	58	8	50	2	47	29	43	194	122	159	153	65	-16	24	102
200	24	-3	-4	-7	7	85	1	9	-7	6	3	-10	4	-5	-5	2	2	2	16	-1	22	6	7	-9	-1	-7
	48	2	-2	1	13	103	15	15	-1	7	6	-7	10	-1	-7	6	6	10	15	0	24	10	10	-5	1	-2
	72	11	8	9	23	141	18	23	4	13	13	2	20	6	4	15	15	17	25	10	34	18	25	8	9	7
	96	5	8	5	17	133	17	18	-1	7	6	-3	19	1	1	9	11	13	17	4	30	6	17	3	3	1
201	24	0	-42	8	-10	14	-7	-3	-49	2	-27	-13	-8	21	-35	-13	35	-17	32	49	47	61	11	-40	-29	43
	48	20	-16	56	14	48	3	15	-41	15	-24	-1	3	97	-2	50	85	34	109	130	115	147	73	-10	-21	128
	96	38	-1	87	33	65	12	27	-23	9	-19	9	20	168	19	163	208	223	227	354	327	440	110	-1	-5	190
202	24	134	2	303	-4	94	-9	-5	-10	173	104	44	-4	24	103	252	331	294	156	277	391	194	44	-13	-5	-2
	48	265	-14	513	-12	80	-22	-12	-16	344	71	39	-15	28	158	427	473	492	301	493	600	389	25	-25	-10	-15
	96	765	-8	540	-7	124	-27	-22	-18	385	97	58	-11	43	365	999	999	999	863	999	771	842	102	-15	-2	-12
204	24	11	6	128	7	22	-2	0	-16	30	4	52	8	17	85	280	171	391	195	323	28	120	24	11	9	64
	48	17	6	282	18	20	-2	4	-9	73	6	67	1	22	164	472	345	633	528	538	156	369	18	4	18	133
	72	24	17	489	31	24	5	6	-3	275	10	77	9	30	302	650	525	874	850	862	286	652	31	17	26	225
	96	30	28	638	41	27	13	8	5	382	17	88	17	36	423	999	708	999	998	999	499	868	45	23	38	307

Strain	Time	E4 (a-keto gluctanic acid)	E5 (a-keto valeric acid)	E6 (D L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 (quinic acid)	E10 (D-saccharic acid)	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alaninamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-aspartic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)
205	24	2	3	-9	-2	20	10	-2	-3	-4	-5	1	8	-1	1	11	14	0	3	12	-13	4	4	-3	-4	-4
	48	9	6	0	8	27	19	4	13	9	9	9	10	10	6	17	-1	-6	5	6	-10	16	19	-4	1	4
	96	14	33	11	16	48	31	11	14	8	13	20	20	19	23	26	3	0	8	11	-14	9	33	5	3	9
207	24	-12	-21	-16	-14	-15	-30	-33	-23	-1	-28	-29	-34	-28	-26	-15	-20	-29	4	-24	-14	-7	-16	-26	-19	-16
	48	-7	-20	-12	-12	-10	-26	-32	-18	6	-26	-27	-30	-22	-27	-11	-11	-25	7	-19	-11	-2	-12	-23	-18	-12
	72	-6	-18	-11	-11	-8	-24	-32	-15	10	-22	-25	-28	-20	-26	-9	-8	-24	10	-15	-9	1	-9	-22	-17	-10
	96	-5	-17	-10	-9	-6	-23	-31	-14	11	-23	-25	-28	-19	-26	-8	-6	-23	12	-15	-8	2	-8	-21	-17	-10
209	24	9	1	278	7	31	9	1	-4	186	146	71	13	53	124	236	256	361	210	237	234	184	34	-6	-4	3
	48	179	-5	570	8	71	2	4	-9	358	142	82	13	69	233	449	482	632	442	429	387	247	81	-1	2	3
	72	435	-8	634	16	104	6	8	-10	389	155	94	12	73	378	735	756	845	705	654	600	460	234	8	9	3
	96	598	-11	689	23	119	9	12	-11	415	189	110	10	85	524	915	891	999	999	891	873	652	410	15	15	3
210	24	76	89	48	8	95	11	1	48	29	18	33	14	21	61	98	67	77	22	108	3	71	16	11	138	47
	48	118	55	60	14	133	12	4	91	48	34	58	11	29	112	162	99	83	26	123	7	128	6	15	166	71
	72	134	54	70	10	142	13	0	105	54	53	64	13	17	173	187	102	81	30	156	10	245	7	76	153	71
	96	141	53	79	7	149	14	-10	115	67	60	70	15	10	215	209	106	78	32	174	14	439	9	94	144	72
211	24	52	44	-7	13	129	5	-6	-26	-8	3	25	0	55	-7	91	60	110	30	78	63	83	15	9	61	7
	48	55	46	1	24	111	12	3	-17	1	14	28	6	75	6	173	113	166	39	124	126	166	20	7	94	12
	72	53	48	2	24	117	10	3	-16	0	16	27	6	79	11	403	218	192	41	216	210	347	23	9	167	10
	96	51	50	2	24	122	7	2	-15	-1	17	25	6	82	16	632	323	218	43	308	294	527	25	10	240	8
212	24	199	-8	322	-1	123	6	-11	-17	197	137	51	98	56	155	288	350	311	145	276	233	225	63	-13	-10	4
	48	392	-10	577	1	192	9	-12	-15	369	133	62	107	61	270	482	556	565	321	470	433	352	89	-20	4	7
	72	578	-9	600	-1	227	9	-11	-15	394	150	74	115	68	467	682	771	782	632	731	590	595	189	-17	12	9
	96	763	-7	623	-2	262	8	-10	-14	419	166	85	123	75	663	882	985	999	943	991	747	838	288	-14	19	10
216	24	-10	-15	-2	-7	21	-8	-14	-22	-9	-16	-6	0	0	-7	5	11	21	51	51	-6	7	8	-6	3	-7
	48	-4	-11	9	-1	25	-3	-10	-18	-9	-15	-5	3	10	1	21	27	27	79	75	4	9	6	-5	11	-2
	72	-2	-10	14	-1	39	-3	-8	-16	-10	-13	-5	1	17	3	26	34	31	95	118	8	15	17	-5	18	1
	96	-3	-10	13	-1	50	-4	-9	-17	-12	-14	-7	-2	17	6	32	39	28	122	156	12	19	21	-4	19	0
218	24	-2	-7	-8	-13	15	-22	-5	-5	19	-15	-18	-18	-13	-24	-14	0	-4	1	-3	7	-13	-10	-15	-2	-10
	48	-5	-9	-11	-17	12	-24	-17	-7	20	-23	-23	-19	-16	-26	-16	2	-8	4	-4	3	-11	-13	-18	-5	-10
	72	-5	-7	-11	-17	14	-22	-17	-6	22	-20	-24	-18	-18	-25	-16	5	-8	5	0	11	-9	-11	-18	-5	-10
	96	-4	-6	-10	-15	17	-22	-16	-5	23	-19	-23	-17	-14	-24	-15	8	-7	9	0	10	-8	-10	-17	-5	-9
219	24	12	36	10	11	18	14	10	-10	6	2	11	11	55	5	47	47	25	23	21	17	35	11	7	22	15
	48	11	39	18	16	22	19	9	-6	7	3	11	10	74	8	69	59	27	24	23	19	43	11	9	24	16
	96	21	37	29	24	23	23	19	0	12	9	13	19	109	21	113	78	28	35	38	28	58	14	12	37	21
220	24	-5	-24	-19	-7	-3	-14	-24	-29	2	-34	-20	-10	-16	-28	-1	-6	-18	1	-7	-14	4	-8	-17	-11	-15
	48	-6	-24	-18	-9	-1	-15	-24	-29	7	-31	-22	-9	-16	-26	-2	-7	-17	6	-5	-12	8	-8	-18	-12	-11
	72	-1	-20	-16	-6	4	-12	-19	-20	13	-29	-20	-7	-12	-22	1	-2	-13	10	0	-4	11	-4	-17	-10	-8
	96	2	-18	-13	-4	9	-10	-16	-16	17	-27	-19	-5	-11	-18	5	1	-10	15	4	0	14	-2	-14	-7	-5
221	24	-18	-25	-24	-20	1	-14	-18	-9	18	-28	-23	-22	-11	-35	-19	-19	-22	-3	-10	-11	-9	1	-22	-12	-22
	48	-18	-30	-24	-22	-4	-14	-20	-13	14	-25	-25	-23	-13	-39	-22	-20	-27	-6	-11	-9	-5	-7	-24	-15	-21
	96	-16	-27	-21	-19	3	-11	-17	-10	16	-22	-22	-19	-13	-38	-19	-17	-23	-1	-9	-4	-1	-1	-20	-13	-17
223	24	34	-2	8	8	86	11	12	-20	8	7	20	19	41	13	16	26	14	26	7	14	10	14	26	16	21
	48	28	-3	9	8	95	15	12	-19	13	8	22	22	36	14	17	30	15	26	9	16	18	17	29	20	25

Strain	Time	E4 (a-keto gluctanic acid)	E5 (a-keto valeric acid)	E6 (D,L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 (quinic acid)	E10 (D-saccharic acid)	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alaninamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-aspartic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)
	72	30	-3	7	8	102	15	10	-19	15	8	22	22	36	14	16	30	15	24	8	17	2	19	28	21	25
	96	29	-7	4	6	103	13	8	-21	14	6	17	20	33	12	13	27	12	21	7	16	20	17	26	18	23
	24	-16	-21	-16	-17	-16	-10	-20	-24	-11	-8	-14	-16	-19	-12	-19	-17	-17	5	-16	-15	-17	-18	-10	-19	-19
224	48	-15	-16	-14	-11	-17	-2	-17	-16	-11	-9	-12	-19	-19	-19	-22	-19	-21	5	-15	-15	-23	-22	-15	-22	-18
	72	-22	-22	-23	-16	-18	-7	-20	-22	-22	-6	-19	-28	-27	-25	-35	-31	-30	2	-19	-18	-22	-28	-21	-29	-24
	96	-25	-29	-26	-16	-20	-7	-21	-23	-24	-8	-21	-33	-32	-32	-40	-37	-33	3	-20	-21	-22	-27	-22	-29	-25
	24	5	7	-9	12	9	1	14	-33	3	0	-2	2	11	13	11	10	9	16	1	1	0	3	-3	0	-4
226	48	8	13	-5	16	16	4	20	-29	6	-2	1	7	15	17	13	15	10	17	5	6	3	13	3	-1	1
	96	10	21	3	19	22	8	27	-28	7	-1	4	13	20	25	18	23	14	18	11	9	4	20	9	4	6
	24	4	7	0	-1	30	9	-5	-33	-1	-2	-1	0	6	-2	145	132	42	4	4	113	153	5	1	89	-2
227	48	7	2	5	-1	36	12	-2	-36	2	-4	-9	-4	8	-11	279	440	68	9	32	336	503	6	-9	106	-4
	96	24	1	7	10	59	23	4	-23	8	-3	4	7	18	-7	652	857	127	13	103	918	762	11	-1	194	0
	24	-11	-7	-7	-13	2	-7	-8	-12	0	-10	-7	2	0	-9	-7	-9	-2	0	-2	-14	-1	-12	-13	0	-8
228	48	-4	2	2	-2	17	9	3	10	10	2	3	13	16	0	4	2	14	18	17	-1	14	1	-3	12	4
	72	-8	-1	-2	-6	12	7	-2	11	4	-2	-1	7	12	-4	0	-2	9	14	12	-6	5	-6	-9	6	-1
	96	-7	0	-2	-5	13	9	-2	21	3	-2	0	6	13	-3	1	0	10	14	13	-5	5	-5	-7	7	1
	24	-31	-31	-34	-28	-27	-32	-33	-18	-31	-14	-33	-34	-34	-29	-10	-27	-38	-2	-30	-20	-9	-26	-32	-27	-27
230	48	-24	-28	-26	-23	-20	-25	-25	-13	-22	-13	-26	-27	-25	-22	6	-21	-32	-7	-23	-16	-7	-18	-27	-22	-18
	72	-21	-25	-22	-16	-16	-21	-21	-11	-13	-15	-21	-25	-25	-20	-1	-18	-32	-2	-18	-14	-6	-11	-23	-20	-12
	96	-14	-20	-15	-9	-9	-14	-14	-5	-3	-11	-15	-21	-21	-14	7	-12	-26	5	-10	-6	-2	-3	-16	-15	-5
	24	15	-13	7	0	43	5	-1	-43	18	-2	-3	5	-2	-30	-4	25	-45	-28	51	11	59	-9	-39	-5	32
231	48	25	10	17	3	43	-3	-2	-36	25	-8	21	5	10	-39	6	26	-48	-18	55	28	67	-13	-48	3	54
	96	44	-4	25	5	63	-7	-13	-41	38	5	33	7	17	-40	12	31	-49	-8	60	58	89	-11	-44	9	79
	24	5	10	80	1	53	0	1	-20	67	16	41	10	0	2	183	136	296	93	231	57	78	13	4	11	57
232	48	8	18	201	2	48	-6	4	-20	75	11	48	11	6	11	305	270	438	178	428	134	106	1	0	35	98
	96	36	46	532	36	61	14	34	-5	258	49	81	34	40	51	823	773	997	620	999	464	486	28	16	84	205
	24	20	17	20	9	62	11	6	-30	17	7	17	7	29	-9	26	32	-3	35	44	3	51	0	-24	8	37
234	48	26	17	31	20	76	9	5	-29	23	13	29	10	36	-10	32	46	20	45	81	18	66	2	-17	16	63
	72	27	19	32	14	71	4	0	-31	22	13	30	7	35	-8	31	46	20	51	90	22	71	15	-20	12	100
	96	27	20	33	8	66	-2	-5	-33	21	12	30	3	34	-6	30	45	20	56	98	25	76	28	-23	7	137
	24	7	9	3	2	43	6	0	-39	8	2	8	7	13	17	24	13	16	16	16	1	4	10	4	-1	4
236	48	13	15	5	7	48	6	5	-33	8	6	13	9	18	16	27	11	21	17	8	6	9	9	2	3	8
	96	23	35	-1	19	72	2	0	-28	3	11	21	12	19	27	29	8	14	15	7	16	5	16	1	17	21
	24	-6	-8	63	-9	18	-1	-8	-23	11	-7	11	-7	-2	16	127	89	206	70	131	-8	22	4	-11	-16	-5
237	48	-3	-1	133	-6	14	0	0	-25	26	-6	25	-6	3	91	261	228	383	217	268	47	58	2	-17	-13	19
	96	10	4	270	8	21	6	3	-17	173	4	53	4	11	192	538	393	763	548	575	271	399	18	-8	2	92
	24	133	-9	283	-3	118	-5	-2	-14	213	148	62	0	12	131	332	275	341	195	264	238	175	69	-6	-12	28
238	48	345	-12	604	1	138	-9	4	-14	407	151	76	0	21	252	605	570	630	426	535	461	364	147	-19	-6	33
	96	749	-14	641	0	196	-19	7	-20	456	166	80	-1	25	693	999	999	999	999	999	852	849	421	-9	-4	34
	24	7	4	74	-2	-16	0	-6	-8	62	7	57	5	14	88	180	175	323	199	232	111	158	15	8	9	102
239	48	10	10	161	3	-19	4	0	-8	85	12	61	9	17	178	327	315	505	400	384	202	294	18	5	38	140
	96	5	19	354	3	-27	-10	11	-12	275	14	66	9	17	323	683	578	830	718	679	396	626	16	2	74	247
	24	-6	-4	-15	-9	-6	-11	-4	-12	-9	-12	-9	-6	-7	-9	-6	2	-14	-9	-12	-22	-4	1	-12	-12	-12

Strain	Time	E4 (a-keto gluctanic acid)	E5 (a-keto valeric acid)	E6 (D,L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 (quinic acid)	E10 (D-saccharic acid)	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alaninamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-aspartic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)
241	48	-7	-5	-9	-7	-11	-7	3	-8	-4	-14	-8	-5	-5	-10	-16	-12	-11	-7	-18	-25	-5	-3	-17	-15	-14
	96	4	7	8	9	31	4	6	6	11	4	8	15	11	12	-1	-3	-16	-2	-18	-20	-3	25	-7	-4	3
242	24	13	13	53	12	31	9	4	-35	17	4	21	13	74	50	162	131	215	83	162	50	74	9	-18	18	34
	48	8	-1	85	18	36	9	2	-38	10	0	33	4	120	79	271	166	305	141	172	97	101	2	-26	33	44
	96	0	-2	147	16	24	3	-3	-42	66	1	39	0	206	126	383	264	402	230	274	194	287	-4	-32	45	70
243	24	-1	-16	35	7	53	-4	-13	-22	8	-6	33	0	80	-16	47	33	30	43	38	12	45	-11	17	-7	0
	48	4	-20	55	7	63	0	-10	-26	13	-6	64	14	123	-23	68	51	51	63	59	14	55	8	29	1	20
	72	7	-20	67	9	67	1	-9	-26	16	-5	93	19	155	-25	84	67	67	76	70	16	59	20	36	5	35
	96	8	-20	85	9	72	1	-8	-27	20	-5	131	22	190	-27	104	82	86	96	94	18	65	38	47	12	47
244	24	29	15	-31	10	48	5	3	-64	8	-10	11	-2	37	-14	70	36	44	19	48	62	65	4	3	11	1
	48	42	27	-27	23	69	11	14	-59	12	-2	22	2	59	-6	170	80	88	31	109	143	165	10	8	38	11
	96	46	32	-25	28	77	5	8	-61	7	3	28	6	70	-4	580	339	95	38	111	528	507	18	8	94	9
245	24	4	11	-8	7	36	6	16	-11	-1	-8	1	10	9	1	29	23	4	27	25	6	-7	-1	-3	11	3
	48	-1	7	-2	13	7	4	19	-10	-1	-5	-2	7	7	6	-7	-5	-7	7	-10	-16	-10	2	-10	-7	2
	96	8	26	11	28	21	15	30	-8	-3	4	11	13	21	25	-4	-10	-1	13	-10	-14	-13	8	3	-1	13
246	24	-1	-18	-9	-2	-7	-11	-10	-18	2	-9	-3	-8	-2	-9	-8	1	0	0	-7	-5	-1	-8	-11	-9	-4
	48	-3	-18	-4	-1	-18	-1	-7	-12	10	-9	-1	-9	-1	-14	-10	-1	5	4	-5	-4	1	-16	-14	-8	-2
	72	-11	-29	-15	-8	-20	-15	-16	-16	5	-9	-16	-21	-8	-28	-24	-11	1	-2	-14	1	-7	-18	-27	-19	-10
	96	-14	-30	-17	-9	-20	-15	-18	-18	2	-2	-18	-23	-11	-31	-26	-15	-3	-5	-16	1	-7	-18	-32	-20	-13
250	24	37	42	-10	-1	36	-14	-15	-40	5	-2	7	-12	19	-9	72	38	85	0	64	40	43	7	-5	29	2
	48	54	56	-6	3	54	-6	-13	-35	14	6	16	-10	36	4	169	88	139	9	109	74	7	12	0	81	7
	72	66	59	-4	10	80	-3	-13	-28	22	15	18	-7	46	8	335	162	209	30	190	145	169	18	5	137	11
	96	72	53	-2	14	121	1	-11	-23	24	15	24	-4	51	11	659	280	238	44	304	240	341	23	8	228	16
251	24	-6	-21	21	-26	-23	-19	-22	-32	30	2	7	-15	2	16	57	64	63	53	72	-4	24	1	-25	-15	-3
	48	-22	-39	25	-37	-31	-31	-33	-48	10	-7	-9	-28	-6	19	74	89	59	47	102	-8	7	4	-36	-32	-4
	96	-3	-39	84	-30	-30	-23	-25	-49	69	18	23	-13	14	76	167	189	237	116	211	88	81	6	-28	-12	49
254	24	-21	-26	-20	-25	-16	-28	-26	-34	-24	-29	-28	-23	-23	-20	-11	-14	-9	-18	-20	-17	-20	-20	-24	-24	-24
	48	-25	-29	-25	-27	-19	-27	-28	-25	-19	-25	-30	-25	-25	-28	-21	-21	-12	-18	-22	-16	-19	-17	-26	-29	-25
	96	-19	-23	-20	-21	-8	-22	-23	-18	-13	-14	-25	-20	-19	-24	-16	-15	-1	-10	-16	-8	-8	1	-21	-24	-19
256	24	-16	-20	-20	-17	6	-27	-25	-24	-23	-28	-25	-11	8	-22	-12	14	-16	-15	-10	-23	-11	-13	-11	-10	-19
	48	-24	-31	-28	-21	-8	-32	-32	-29	-24	-28	-27	-19	11	-31	-31	-20	-31	-19	-24	-33	-17	-18	-12	-27	-28
	96	-20	-25	-22	-16	-1	-24	-31	-29	-22	-21	-24	-6	11	-23	-23	-16	-26	-24	-23	-36	-21	-13	-11	-23	-25
257	24	4	12	5	-7	9	3	-7	-35	5	-7	122	-5	9	-32	6	48	-27	27	62	22	45	0	-25	-3	28
	48	14	32	9	2	18	9	-3	-38	4	3	27	-2	35	-37	34	91	-26	52	111	47	76	-5	-25	1	45
	72	23	34	17	9	26	16	3	-34	5	11	37	4	52	-33	48	121	-23	65	136	66	102	-1	-22	6	62
	96	32	40	27	18	39	26	10	-30	12	16	46	13	67	-33	63	159	-18	73	163	76	109	3	-17	12	80
258	24	39	-23	-27	-34	14	-22	-26	-43	115	49	47	-19	-19	-21	20	27	127	61	81	76	77	-9	-31	-21	-15
	48	43	-23	-28	-34	19	-21	-27	-43	133	52	50	-19	-17	-22	22	30	263	108	94	152	99	2	-31	-21	-14
	72	48	-22	-26	-31	21	-18	-25	-42	142	58	55	-16	-13	-19	27	35	386	148	108	211	121	8	-29	-19	-11
	96	52	-24	-27	-30	22	-18	-26	-43	145	62	58	-17	-12	-21	29	36	468	200	126	227	138	8	-29	-18	-10
259	24	76	1	69	-44	39	48	44	-54	75	67	55	40	63	35	44	75	94	79	69	61	84	-50	18	-42	-10
	72	103	12	126	-46	30	51	53	-50	150	97	68	52	78	44	94	149	103	88	109	71	85	-50	17	-41	-12
	96	120	9	188	-48	38	53	55	-55	201	99	71	48	73	41	132	187	110	87	139	74	76	-53	13	-43	-13

Strain	Time	E4 (a-keto gluctanc acid)	E5 (a-keto valeric acid)	E6 (D,L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 (quinic acid)	E10 (D-saccharic acid)	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alaninamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-asparnic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)
261	24	49	2	672	-1	65	0	-8	-28	-5	-8	9	-6	24	-11	169	149	98	14	34	89	95	16	2	42	-2
	48	59	-8	861	-2	134	1	-6	-29	-4	-6	7	-3	28	-12	433	411	112	27	71	283	214	17	3	128	2
	72	76	-5	999	0	226	5	-5	-29	-4	-2	9	3	38	-14	651	659	146	43	131	426	355	29	4	220	7
	96	98	-1	999	6	325	10	-2	-23	-2	-1	14	12	53	-6	999	999	206	68	229	676	470	32	14	383	13
262	24	52	-5	175	-12	13	-6	-9	25	184	76	27	-4	-1	44	77	-4	41	-8	219	-21	5	44	-7	90	29
	48	126	-31	190	-14	-3	-22	-17	41	250	125	3	-20	-22	89	158	-21	59	-19	291	-19	-2	19	-18	45	7
	96	171	-5	386	-1	33	0	1	47	260	121	33	0	2	116	226	5	86	-4	753	-3	3	71	-7	186	58
263	24	5	-9	-6	1	-5	-7	-7	-27	0	-3	-1	5	15	1	99	56	99	7	63	54	63	22	-1	59	-2
	48	-1	-13	-9	-2	-15	-9	-9	-31	0	1	-5	-8	11	5	162	115	122	5	88	129	102	15	-8	81	-5
	96	13	-7	7	15	-4	5	5	-15	9	11	13	3	28	21	479	384	316	21	345	421	593	27	0	145	3
265	24	-2	-44	-30	-28	-13	-13	-35	-51	131	37	50	-3	-19	-22	48	33	135	85	124	85	104	-8	-25	-19	-10
	48	11	-37	-21	-20	-11	-5	-26	-47	202	57	71	13	-5	-15	70	56	252	213	241	203	159	16	-15	-9	1
	72	8	-38	-23	-22	-13	-8	-29	-49	192	53	66	11	-6	-18	64	59	334	256	285	362	168	19	-13	-12	-2
	96	11	-43	-20	-19	-10	-4	-26	-47	184	61	74	17	-3	-14	71	68	439	355	346	380	195	21	-4	-9	2
271	24	2	-16	64	-20	78	-13	-18	-27	68	0	17	-13	14	58	84	78	68	64	77	6	84	1	-19	-16	5
	48	3	-21	94	-21	88	-14	-18	-35	83	7	19	-10	24	86	112	127	90	101	116	38	142	-5	-24	-18	23
	72	11	-22	143	-15	106	-5	-11	-34	160	26	30	-2	38	130	160	189	136	189	164	85	243	8	-18	-13	49
	96	22	-27	237	-15	115	-5	-10	-36	297	42	37	7	45	177	198	231	236	306	252	158	321	22	-10	-10	72
278	24	8	-14	-9	-7	-2	-5	3	-20	4	-3	5	-5	-5	-2	3	7	-3	13	33	13	7	4	2	3	3
	48	6	-8	-12	-9	5	-7	0	-11	0	-5	-1	-8	-5	-5	-2	5	-3	16	36	10	10	8	2	1	-2
	72	7	-1	-8	-3	16	0	5	-1	0	-1	5	-4	3	0	4	8	0	21	43	12	14	11	7	6	4
	96	12	1	-6	2	24	4	10	7	-3	-3	12	-5	7	3	9	11	2	17	49	15	10	5	10	14	10
283	24	-16	-11	-17	-8	-20	-11	-16	-16	-11	-12	-16	3	-6	-12	-13	-14	-28	-10	-16	-19	-8	-14	-16	-18	-17
	48	-9	-4	-12	-3	-8	-5	-11	-13	-7	-4	-8	12	-3	-8	-4	-5	-19	2	-7	-9	1	-12	-8	-12	-10
	96	6	1	-1	14	17	5	3	7	-2	5	3	28	19	1	15	7	-9	14	14	4	20	-5	3	1	5
289	24	-12	-3	-6	-14	-5	-10	-8	-21	-4	-4	0	-3	-2	-7	-12	-3	-1	8	18	-10	-3	-5	1	-17	-3
	48	-11	-4	-6	-13	1	-13	-9	-19	-4	-5	0	-3	-1	-11	-12	-3	-3	9	17	-10	-3	-5	-10	-16	-4
	72	-9	-4	-6	-12	7	-15	-9	-17	-4	-5	0	-3	0	-14	-11	-3	-4	9	16	-9	-2	-4	-21	-15	-4
	96	-11	-14	-10	-17	0	-21	-15	-23	-9	-2	-4	-13	-8	-14	-12	-8	-8	5	15	-14	-4	-2	-23	-17	-6
7708	24	46	4	57	32	1	35	34	-8	73	67	29	17	32	27	19	52	55	72	72	49	72	20	26	12	27
	48	72	14	90	59	35	47	61	2	95	105	57	26	57	47	43	80	87	107	97	80	81	56	49	37	56
	72	54	-1	77	47	32	36	30	-10	84	93	47	17	46	31	9	63	56	86	46	46	61	42	16	11	40
	96	36	-6	82	46	37	43	33	-5	89	102	48	23	42	16	14	66	63	92	57	39	67	43	15	14	37
8071	24	311	84	593	30	332	73	11	-17	204	186	74	5	64	6	38	78	166	82	59	198	161	-3	7	139	1
	48	514	98	603	40	370	51	17	-14	356	257	81	10	99	6	72	109	210	65	78	439	222	-1	6	178	3
	72	622	90	630	40	405	48	17	-15	341	271	75	4	107	2	81	154	292	78	79	572	379	2	4	205	3
	96	729	82	657	39	440	45	16	-15	326	285	69	-2	115	-2	90	198	374	91	80	705	535	5	2	232	3
10144	24	-3	-9	-5	-9	3	-2	-10	7	-2	-11	-11	-10	-4	-7	1	1	-2	-5	-6	-12	0	-4	-11	-5	-9
	48	3	-9	0	-3	18	3	-5	20	3	-6	-6	-8	0	-6	6	2	-1	-3	-4	-4	2	5	-6	-5	-8
	96	-5	-15	1	1	31	16	-4	23	4	-11	-6	-13	0	-14	9	-7	0	-1	-10	2	-6	4	-6	-14	-13
11040	24	43	-14	78	66	6	-10	28	-11	68	48	9	31	14	39	44	69	78	29	46	28	100	11	-15	-10	-3
	48	125	-14	217	180	40	-8	491	-12	131	58	5	54	20	66	100	142	150	57	89	58	138	21	-24	4	-2
	72	218	-15	247	175	60	28	403	-9	107	51	3	44	12	77	159	199	227	64	196	76	150	76	-4	28	-6

Strain	Time	E4 (a-keto gluctanic acid)	E5 (a-keto valeric acid)	E6 (D,L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 (quinic acid)	E10 (D-saccharic acid)	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alaninamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-aspartic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)
	96	310	-16	276	169	79	63	315	-6	82	44	0	33	4	88	217	256	304	71	303	93	161	131	17	52	-9
	24	176	82	116	13	129	86	1	-34	134	108	55	14	44	107	113	101	155	69	123	0	64	130	23	88	57
14393	48	332	104	218	18	154	247	5	-29	191	132	64	20	50	192	200	172	369	84	334	19	88	275	72	117	82
	72	431	107	239	22	179	371	8	-26	182	128	66	16	57	313	269	292	574	148	630	35	221	318	202	170	96
	96	530	109	259	26	204	495	11	-23	172	123	68	12	63	434	337	412	779	212	925	51	354	361	332	223	109
	24	131	56	157	21	122	29	11	4	72	74	38	2	36	129	136	35	65	158	203	7	59	75	40	115	12
17749	48	275	162	314	47	246	51	39	27	154	132	88	3	80	234	234	64	107	265	355	24	114	218	140	216	35
	72	352	172	454	59	336	57	51	49	254	11	87	12	102	280	347	46	135	293	430	12	180	314	167	277	43
	96	482	181	501	30	318	39	36	44	229	121	57	8	49	267	382	49	141	262	529	14	201	392	150	189	10
	24	7	-2	5	10	28	13	9	-5	2	16	11	21	20	5	5	20	34	33	41	8	21	1	8	11	9
19260	48	15	4	7	16	37	17	7	4	4	18	18	19	31	7	7	30	30	34	34	8	17	9	7	10	17
	72	10	7	3	8	38	21	2	0	-2	13	9	16	28	-1	-8	34	22	24	14	-6	6	5	-5	7	6
	96	13	8	6	9	38	20	5	3	0	15	11	15	29	5	5	30	26	30	25	0	10	6	5	6	6
	24	47	-3	192	1	68	3	-1	15	26	45	16	1	42	171	127	152	114	105	201	128	170	157	15	-5	11
19323	48	106	-8	366	0	77	6	-6	13	36	52	9	-1	45	274	219	282	217	179	375	245	310	410	9	-14	12
	72	285	-15	477	2	84	0	-11	22	53	55	3	-6	47	424	489	464	418	348	660	440	633	598	5	-15	18
	96	426	-17	467	-6	91	2	-10	27	61	51	4	-6	46	612	690	604	621	515	887	554	685	629	15	-14	24
	24	2	4	1	7	30	5	3	8	5	1	3	6	-5	1	4	4	3	14	297	181	237	10	8	-1	30
19326	48	5	10	4	11	34	12	6	6	1	-1	2	8	-4	-2	0	8	-4	10	429	227	230	8	33	-6	31
	72	5	12	5	9	27	7	-2	-1	-1	-1	1	2	-9	-15	-3	3	-12	5	572	252	210	2	66	-12	84
	96	-1	13	5	5	23	7	-6	-2	-1	-5	-3	0	-9	-17	0	3	-13	6	676	233	207	2	54	-11	100
	24	27	112	166	13	124	25	13	-8	156	179	70	19	97	130	148	80	61	23	158	12	23	13	18	151	19
23597	48	27	119	188	11	94	21	12	17	157	185	66	19	155	117	174	125	73	18	198	12	17	-7	18	164	17
	72	43	121	230	22	111	30	23	30	161	212	81	16	192	134	212	150	103	26	234	21	24	-7	17	197	28
	96	59	123	272	32	128	39	33	43	164	238	96	13	228	150	249	175	133	33	270	30	31	-7	15	230	39
	24	147	55	147	141	243	19	14	-11	194	173	138	9	45	150	148	141	207	169	210	14	154	10	24	116	93
25374	48	278	95	269	199	310	22	19	-10	262	200	263	9	53	329	373	253	430	261	410	10	362	10	12	160	166
	72	346	86	267	200	360	27	24	-4	262	202	440	12	60	493	476	386	539	367	637	3	326	10	11	195	278
	96	340	89	290	214	409	31	28	0	268	214	468	17	71	473	444	396	634	447	773	6	329	10	15	279	359
	24	36	-6	157	-21	6	-19	-14	-27	129	67	59	0	22	-11	238	217	187	185	54	124	123	-7	-7	-7	3
25521	48	56	4	277	-11	13	-11	-6	-22	175	79	72	1	40	-13	362	267	220	253	80	210	167	-12	1	-2	17
	72	95	7	351	-2	34	-2	8	-7	219	102	89	7	61	-4	475	347	371	376	126	249	206	0	17	5	41
	96	134	10	424	7	54	8	21	9	263	124	106	12	81	6	588	427	522	498	172	287	244	12	32	12	65
	24	23	0	262	-10	15	0	-2	-12	118	60	46	7	-2	-1	367	177	386	401	162	418	184	11	-2	-4	0
25915	48	10	-10	583	-17	1	-14	-9	-20	172	54	35	-7	-2	-11	403	176	450	439	237	424	175	-12	-21	-8	-11
	72	14	-16	710	-13	10	-11	-8	-21	243	70	46	-12	2	-10	421	345	725	660	434	525	393	-4	-15	-1	-9
	96	17	-22	837	-8	19	-8	-6	-21	314	85	56	-16	5	-8	439	514	999	881	631	626	610	4	-9	7	-6
	24	272	26	254	18	111	215	264	7	155	104	76	42	56	84	81	63	476	274	296	6	53	251	320	78	45
27118	48	456	37	283	27	137	415	379	13	160	122	99	34	71	142	173	63	882	484	675	13	63	314	631	139	158
	72	586	93	318	40	202	523	442	34	179	162	189	71	158	370	456	237	941	592	837	37	171	352	815	375	272
	96	715	148	353	53	267	630	505	54	197	201	279	107	245	598	739	411	999	699	999	60	279	389	999	610	386
	24	149	-26	68	2	10	138	145	-39	121	98	90	16	44	127	121	78	218	101	196	41	91	52	39	-11	90
27119	48	229	-25	75	6	29	230	196	-36	148	100	106	14	52	173	194	126	246	90	287	61	10	92	47	-10	104

Strain	Time	E4 (a-keto glutaric acid)	E5 (a-keto valeric acid)	E6 (D,L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 (quinic acid)	E10 (D-saccharic acid)	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alaninamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-aspartic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)
	96	335	-24	96	23	85	390	244	-30	192	130	151	16	64	337	343	254	442	201	376	99	124	218	121	1	185
	24	110	30	130	18	80	22	2	-37	111	81	46	14	42	97	85	57	145	29	137	7	41	52	81	85	18
27122	48	330	63	305	23	118	28	10	-32	187	125	58	16	51	242	236	183	426	46	443	16	53	327	295	151	9
	72	564	76	351	38	133	39	20	-29	201	154	66	25	65	474	433	310	426	46	896	31	105	585	482	224	19
	96	634	89	431	71	199	56	40	-17	220	201	93	24	98	655	606	632	505	73	999	49	450	607	664	410	38
	24	494	1	608	3	13	-1	1	2	209	150	32	6	15	290	436	20	219	472	192	5	19	185	1	1	17
27123	48	605	9	716	13	18	6	8	11	236	145	28	-7	6	602	645	76	482	703	437	6	6	424	-12	3	112
	72	845	23	756	29	32	16	19	15	220	160	26	-6	10	792	875	75	626	792	603	3	12	469	-9	14	208
	96	999	43	899	57	146	46	43	78	183	178	37	23	-14	864	999	120	999	999	837	62	2	481	15	30	455
	24	107	40	281	184	82	20	287	7	333	281	103	74	46	143	274	158	298	107	540	22	232	79	27	101	18
27124	48	334	107	746	265	102	37	999	32	362	375	220	130	40	447	699	372	780	309	999	44	490	595	93	263	97
	72	405	87	685	239	92	33	944	26	318	358	196	139	34	549	934	370	815	404	999	34	404	528	171	282	91
	96	584	47	698	249	103	39	972	26	308	375	209	144	36	590	999	520	991	371	999	31	398	521	543	381	98
	24	114	10	129	-1	21	0	2	-26	111	66	34	3	20	100	103	58	183	17	213	-5	42	37	57	77	6
27125	48	410	50	329	-8	9	0	-4	-19	236	130	30	-8	22	264	377	177	510	22	677	-4	170	262	210	135	-1
	72	640	73	453	8	42	18	19	-4	255	181	63	12	50	543	702	394	744	30	999	13	252	462	430	219	21
	96	634	107	517	18	69	33	38	9	259	214	91	4	67	764	816	580	923	115	999	21	525	437	669	442	47
	24	50	30	-1	-8	193	-1	-9	-1	5	-10	9	-3	2	5	13	20	13	17	28	-7	15	12	-3	6	7
27126	48	62	-4	7	-1	241	8	-4	-21	18	-7	16	4	8	11	19	32	20	26	32	2	24	23	4	10	14
	72	53	-8	8	2	256	11	-1	-23	16	-5	20	6	9	14	18	36	23	21	34	-2	23	27	8	14	15
	96	70	1	16	16	300	19	11	-16	25	2	27	13	19	25	27	50	30	33	42	10	33	30	15	21	23
	24	14	3	23	-4	25	0	-3	-26	21	35	4	-2	12	10	14	12	10	6	13	-4	6	-1	-2	11	-4
27128	48	8	6	17	-4	27	1	-5	-23	18	29	2	-3	4	15	13	9	11	8	12	-7	0	-2	-3	24	-5
	96	14	22	26	6	44	14	4	-17	25	49	9	7	13	26	23	22	23	22	23	1	3	8	8	41	6
	24	6	8	140	-9	6	14	-10	-12	99	25	55	-9	18	-4	13	-2	-19	7	86	-9	16	-8	-7	-5	65
27130	48	-2	-8	341	-14	42	107	-12	-17	95	15	51	-17	30	11	93	-1	-24	-4	139	-14	6	-16	-16	-4	115
	96	72	-7	825	-1	116	243	-11	-5	247	31	92	-15	90	76	233	10	-15	43	370	11	41	-5	-9	43	343
	24	133	57	113	125	100	21	-3	-1	144	130	124	8	51	126	142	124	245	122	183	8	141	21	23	94	88
27132	48	194	59	158	147	108	87	52	-3	156	134	180	12	46	306	338	175	612	181	322	5	285	13	35	107	100
	96	280	62	176	170	115	355	441	-4	163	138	423	42	40	447	351	362	828	374	612	3	287	250	213	167	225
	24	206	-27	189	52	55	172	212	4	186	85	22	-2	7	81	101	102	144	145	186	-2	71	134	194	23	36
27562	48	614	-21	389	232	53	511	614	30	265	167	106	47	30	339	387	336	418	577	633	94	298	430	777	181	304
	72	598	-23	317	158	41	518	502	16	218	138	111	39	24	531	601	486	679	562	858	205	504	361	865	323	535
	96	518	-17	282	110	41	475	461	13	199	132	123	35	19	600	548	495	646	583	874	308	448	367	815	445	513
	24	15	-1	182	6	9	77	98	12	207	127	18	107	22	141	190	160	87	14	170	154	171	105	2	-2	13
27593	48	1	-24	340	14	0	47	252	-11	244	73	-7	109	2	184	280	233	140	-5	300	295	317	366	-22	-19	-5
	72	10	-41	307	63	-8	277	261	-18	195	53	-25	127	-10	227	454	328	281	-7	460	255	391	479	-42	-34	-23
	96	174	-39	305	81	-7	455	249	-15	179	49	-23	154	-4	492	597	333	472	91	601	229	372	501	-39	-31	-26
	24	-1	98	8	-1	19	-3	-5	-7	6	-1	5	-2	4	-7	0	64	119	104	144	113	138	-10	0	57	117
27950	48	6	191	14	10	36	13	-4	-12	-3	3	13	-12	13	-8	28	52	151	158	253	218	271	-9	-3	127	205
	72	8	231	14	18	57	29	-3	-6	-4	11	23	-7	18	-7	49	54	229	224	340	294	271	-3	4	150	264
	96	14	252	23	25	72	31	1	-1	5	12	32	0	25	-8	81	77	316	283	408	366	302	10	10	252	335
	24	-9	-10	-14	-2	5	0	-10	-26	-6	-11	-12	-20	0	-16	45	36	16	-6	-5	32	122	57	-11	46	26

Strain	Time	E4 (a-keto gluctanc acid)	E5 (a-keto valeric acid)	E6 (D L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 (quinic acid)	E10 (D-saccharic acid)	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alaninamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-aspartic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)
29570	48	-18	-21	-20	-12	19	2	-17	-26	-15	-20	-17	-28	-13	-22	48	74	-1	-10	-9	92	182	49	-23	23	21
	72	-16	-21	-22	-11	40	23	-13	-19	-4	-16	-23	-23	-15	-22	109	174	2	-3	-15	216	423	72	-30	20	22
	96	-22	-29	-26	-15	36	28	-21	-22	-4	-22	-30	-24	-19	-22	109	216	0	-3	-17	257	437	74	-36	13	12
33127	24	27	64	117	-1	77	-8	-2	-30	131	191	33	-2	56	58	88	46	56	36	44	2	10	-3	-2	50	0
	48	48	121	236	22	93	8	19	-16	179	299	75	-10	154	119	185	132	118	74	162	27	38	-2	12	86	25
	72	70	138	301	39	99	17	31	-6	224	345	105	-3	202	153	238	161	151	106	272	43	58	3	-2	104	28
	96	76	133	313	46	149	16	36	-5	236	355	131	6	200	162	256	159	146	114	303	50	61	4	-1	113	22
33539	24	15	3	258	0	12	3	1	-6	108	132	48	5	5	9	10	1	201	174	105	170	132	-4	1	-2	2
	48	22	9	483	9	13	7	5	4	259	157	54	1	8	-1	20	5	338	279	138	311	238	-2	1	-2	5
	72	48	21	859	27	39	23	21	19	362	185	87	5	20	-9	27	20	50	493	198	432	516	5	5	-1	20
	96	53	4	999	18	47	10	7	7	360	207	79	10	13	-16	10	3	781	727	268	460	728	8	-2	-4	4
33653	24	47	-11	153	11	123	15	-1	-22	165	96	53	24	1	1	2	26	298	179	102	5	34	9	-1	12	5
	48	129	-15	287	169	110	9	9	-19	233	116	55	32	3	4	5	31	463	345	169	6	30	4	-4	14	1
	72	216	-18	317	173	58	5	409	-18	243	135	55	32	3	14	21	58	610	481	258	11	24	5	-2	16	1
	96	246	-22	314	155	31	4	451	-15	261	123	47	25	-1	39	31	110	633	474	366	8	27	10	-7	27	-7
35016	24	137	8	151	77	20	20	23	12	227	181	50	62	40	21	23	55	114	27	141	31	80	10	12	20	7
	48	394	-14	352	181	55	-17	141	-13	327	247	27	29	23	7	4	35	153	7	239	11	53	-11	-6	0	0
	72	520	-26	346	147	96	-4	221	-13	314	228	18	30	16	25	16	86	230	26	301	0	41	-6	-14	0	21
	96	512	-34	307	135	92	-6	197	-12	288	219	10	23	11	33	20	101	274	27	348	5	39	-12	-18	3	40
35084	24	76	-18	188	21	78	23	7	-34	192	179	102	22	34	121	213	206	287	235	250	166	101	23	17	3	102
	48	200	-26	384	182	60	15	175	-41	304	230	109	37	40	189	278	273	481	452	366	293	108	11	-1	-3	124
	72	277	-35	398	211	73	11	376	-51	291	238	120	41	47	287	399	322	675	518	484	477	145	101	-9	0	147
	96	276	-37	402	230	90	7	386	-53	270	252	125	43	46	370	500	365	737	593	605	510	178	232	-12	15	143
35912	24	48	-13	149	9	156	24	35	-19	157	125	60	22	17	22	19	14	345	270	136	32	6	3	11	22	14
	48	50	-12	229	9	126	5	33	-15	188	139	59	2	11	8	11	6	422	365	200	35	20	-5	10	7	11
	72	45	-13	293	8	146	13	35	-12	249	144	61	4	15	3	19	6	498	430	308	38	19	-2	5	-1	11
	96	49	-13	371	9	145	21	36	-9	267	161	62	10	14	8	17	5	540	547	472	46	32	8	5	8	13
51192	24	51	77	404	13	158	23	-3	-9	115	92	56	1	79	30	99	109	44	56	32	287	136	0	4	144	8
	48	61	113	387	16	224	27	-1	-8	194	112	65	1	104	25	82	110	47	51	28	454	308	8	8	179	11
	72	46	99	559	12	232	27	-8	-6	20	118	42	-2	98	17	186	275	47	52	27	482	432	11	4	252	3
	96	63	115	647	19	253	33	-2	2	214	131	53	4	111	28	311	407	62	69	39	533	477	22	12	342	15
51288	24	58	-15	272	8	122	10	-4	-21	191	119	72	-8	60	90	171	144	291	76	161	209	163	113	6	2	37
	48	88	-6	655	26	252	11	0	-16	519	185	102	-5	93	205	372	351	575	86	346	529	408	343	7	12	75
	72	72	-13	834	11	274	12	-10	-12	544	202	82	-11	87	345	615	595	999	95	477	856	685	523	-14	-8	82
	96	86	-21	938	4	276	17	-10	-6	548	210	98	-10	69	448	808	744	999	126	630	926	730	561	-14	-10	108

Strain	Time	G5 (L-phenylalanine)	G6 (L-proline)	G7 (L-pyroglutamic acid)	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D L-carnitine)	G12 (g-amino butyric acid)	H1 (urocanic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D L-a-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
3	24	16	24	6	-18	20	13	-3	3	-13	9	42	7	-8	-9	-13	4	-9	-3	3	19
	48	17	39	19	-24	33	16	8	-1	-7	8	42	14	-16	-1	-8	17	0	5	12	13
	96	9	38	24	-34	37	7	19	-14	9	9	37	16	-22	-5	-4	20	8	8	16	9
5	24	-6	-6	-6	-7	1	-9	-9	-3	-9	18	14	13	-6	3	-4	-3	3	-2	0	-2
	48	-7	-5	-5	-5	2	-9	-8	0	-7	20	15	14	-1	7	-3	1	3	0	2	0
	72	-1	-3	0	-1	6	-5	-5	6	-1	27	20	25	6	16	0	6	11	4	6	-1
	96	11	6	5	8	13	1	-1	12	5	43	33	43	17	27	4	13	23	12	8	-2
7	24	-14	5	-3	-3	1	-7	-8	-6	-14	-3	-6	-8	-20	-2	-11	10	3	-8	-10	0
	48	-8	29	17	-3	18	10	8	5	0	10	4	5	-8	10	-2	20	22	4	3	4
	72	3	47	34	9	33	23	23	10	11	21	14	22	2	27	12	35	48	19	9	9
	96	14	66	52	25	45	29	34	19	21	36	26	45	14	43	32	63	72	37	20	21
9	24	55	170	86	18	175	-1	-11	-1	12	6	1	16	-2	4	0	33	-8	-15	-14	-2
	48	47	196	146	2	210	5	-5	-5	19	11	-1	-11	12	-14	-1	32	-1	-8	-15	-7
	72	49	212	172	0	215	10	-6	-9	19	11	-2	0	10	2	0	25	0	-5	-15	-6
	96	55	254	209	-2	220	15	-7	-13	20	11	-3	1	14	4	0	19	4	-5	-16	-4
	120	24	186	133	6	169	11	-11	-14	33	1	-8	14	-3	8	-5	4	-1	-9	-17	0
11	24	4	11	2	4	12	15	7	77	-10	2	9	0	-13	-1	-4	-7	4	-5	-1	9
	72	28	42	27	19	40	40	36	151	2	24	17	32	9	28	7	17	30	9	13	30
	96	26	27	13	24	20	24	23	137	4	16	11	38	6	34	6	11	29	2	8	24
12	24	-2	6	-3	0	23	5	3	-4	-10	16	0	-2	-8	11	1	24	9	-1	-2	-11
	48	7	21	8	-5	30	16	10	-6	4	16	5	8	2	26	11	30	19	8	1	-9
	72	19	24	14	-6	26	12	12	-9	1	16	0	14	6	34	13	27	23	4	-3	-9
	96	25	27	21	-3	22	11	11	-11	2	21	-4	16	9	35	17	21	21	1	-5	-9
13	4	-3	-1	8	-3	-1	8	-3	-14	-11	2	18	2	-7	2	2	3	7	3	25	11
	24	3	46	16	-7	9	17	-1	-18	10	17	27	6	5	-6	2	10	6	0	30	11
	48	4	58	18	-20	10	22	-3	-20	12	17	20	8	3	-4	1	13	17	4	36	21
	72	10	69	19	-21	12	16	-3	-21	14	24	26	11	6	-3	4	16	19	7	48	23
	96	13	76	19	-15	21	21	2	-19	20	32	32	15	10	-1	12	19	26	9	68	26
14	24	-9	-3	-9	-8	4	0	4	-1	-9	4	3	3	-9	-8	-12	16	5	-2	6	4
	48	-14	-7	-13	-17	-4	-5	-3	-11	-13	-5	-8	-5	-15	-13	-17	16	-4	-13	-5	-13
	72	-7	6	-4	-11	3	2	7	-10	-10	5	-4	5	-4	-7	-13	20	10	-6	3	-9
	96	-8	2	-9	-15	-3	-7	-2	-23	-20	-1	-14	-5	-10	-15	-17	7	5	-9	-7	-23
18	24	-6	8	4	5	19	22	-2	-2	3	13	32	30	-5	5	-5	21	34	10	9	17
	48	-3	12	5	5	20	25	0	0	6	13	36	39	0	9	-5	26	48	14	10	19
	72	-3	16	7	6	20	27	0	0	10	14	41	46	1	12	-1	34	59	16	13	20
	96	-5	16	6	6	21	28	0	-1	3	12	38	45	0	10	-5	30	61	16	10	18
19	4	-11	-15	-19	-32	-14	-12	-2	-23	-27	1	25	-3	-15	-1	-11	-18	-13	-10	-2	-23
	24	-15	-15	-21	-37	-16	-13	-5	-22	-23	-2	17	-4	-14	0	-15	-13	-13	-11	-6	-13
	48	-14	-5	-19	-37	-16	-13	-6	-18	-20	0	17	-1	-7	6	-14	-7	-9	-9	-6	-13
	96	-7	0	-4	-19	-15	-10	-5	-17	-15	0	25	0	0	10	-5	0	-2	-2	0	-5
24	24	-9	5	-2	-2	5	-5	-5	1	-6	20	6	6	-9	5	-4	11	1	-1	1	1
	48	-11	4	-2	-5	0	-5	-2	6	-3	2	2	2	-9	11	-3	6	2	-5	-3	2
	72	-8	4	1	-7	-2	-5	1	4	-4	0	2	4	-4	16	-4	7	2	-7	-2	2

Strain	Time	G5 (L-phenylalanine)	G6 (L-proline)	G7 (L-pyroglutamic acid)	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D,L-carnitine)	G12 (g-amino butyric acid)	H1 (uroconic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D,L-a-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
	96	-7	5	0	-9	-1	-5	1	0	-7	1	4	4	-3	17	-5	7	-1	-6	4	0
26	4	14	11	1	-5	39	-12	-7	1	1	3	-3	6	-4	5	-7	5	-7	-8	-8	-5
	24	52	59	21	20	85	-7	1	17	7	11	7	14	11	15	5	35	3	1	0	8
	48	36	90	24	16	75	-3	5	18	5	15	10	13	13	14	6	31	0	3	4	6
	72	32	98	23	15	81	2	8	35	11	20	9	15	10	16	3	27	3	3	5	5
	96	31	124	24	18	83	2	10	67	11	21	9	20	9	19	2	28	6	5	7	4
32	4	-5	-2	3	2	9	3	-5	0	1	13	2	8	-4	20	8	15	13	-2	-1	4
	24	-31	-24	-6	-17	-8	-16	-30	-7	-6	-11	-22	-20	-31	22	-6	-16	6	-25	-27	-5
	48	-44	-31	-14	-26	-14	-20	-38	-10	-12	-15	-29	-22	-41	23	-14	-17	2	-34	-31	-10
	72	-36	-27	-5	-17	-1	-11	-31	1	-13	-12	-28	-12	-38	41	-9	-6	15	-30	-20	-10
	96	-14	-23	-8	-6	17	-5	-20	-6	-10	-5	-20	-1	-31	46	-13	-3	21	-17	-9	-1
36	24	-20	19	-13	-36	56	8	-25	-27	-18	1	7	-7	-19	-15	-27	-15	-14	2	-16	-2
	48	-20	56	-13	-39	84	35	-27	-24	-16	5	12	-7	-20	-15	-27	-16	-14	5	-16	-4
	72	-17	78	-13	-38	92	45	-24	-25	-8	7	19	-7	-18	-15	-25	-12	-11	9	-14	-4
	96	-15	104	-12	-37	101	58	-22	-24	0	11	24	-7	-17	-13	-24	-9	-8	12	-12	-4
38	24	-5	-11	-16	-8	-1	-9	-25	-10	-9	-6	-11	-12	-7	-10	-14	-9	-7	-12	-10	-7
	48	-1	-9	-13	-3	4	-7	-21	-4	-1	2	-8	-10	-1	0	-9	15	1	-9	-4	-7
	72	5	-13	-13	-5	-2	-13	-24	-9	-9	0	-9	-14	-4	-3	-13	7	-3	-14	-11	-16
	96	5	-13	-15	-8	-1	-15	-27	-13	-11	2	-6	-17	-8	1	-16	-2	-6	-15	-15	-24
39	24	15	107	27	24	102	8	2	30	11	17	17	29	-4	38	3	32	2	6	-3	11
	48	24	158	46	22	126	22	11	48	19	26	22	38	6	51	14	58	9	13	12	22
	72	11	142	26	24	125	26	2	43	21	23	19	45	0	55	6	29	8	6	0	22
	96	1	140	-1	26	126	37	-20	42	23	21	-6	51	-11	66	1	0	7	-6	-30	22
42	24	-14	-3	-18	-14	3	-21	-21	5	-10	-5	-21	-11	-17	-2	-11	-13	28	-16	13	7
	48	-26	-16	-31	-33	-13	-39	-38	1	-32	-31	-39	-25	-36	-13	-30	-28	52	-35	17	-13
	72	-20	-5	-21	-29	0	-32	-36	36	-33	-31	-38	-18	-34	-10	-29	-28	89	-34	46	-12
	96	-15	7	-13	-27	6	-34	-34	56	-33	-27	-36	-13	-33	-3	-28	-27	160	-33	68	-11
	120	-11	22	3	-21	19	-31	-30	82	-31	-24	-34	-9	-32	4	-25	-23	211	-31	92	-6
43	24	4	1	-1	31	19	7	1	-1	-7	284	105	47	-8	13	-9	4	-10	4	10	31
	48	-1	2	-1	23	21	10	5	0	-5	307	111	44	-4	22	-5	10	-5	7	11	25
	72	-2	2	-2	25	20	3	5	2	-4	426	87	37	-2	31	-2	14	4	5	11	23
	96	5	6	-4	35	16	-1	4	2	-3	446	78	52	5	42	3	19	19	11	13	24
46	4	-22	-2	-11	-25	-3	-17	-5	-25	-23	6	9	3	-20	2	-8	-3	1	-1	1	-3
	24	-35	6	-3	-49	11	-36	6	-45	-46	28	21	2	-22	-4	-6	5	4	6	15	9
	48	-42	3	-15	-54	-1	-43	1	-51	-49	23	8	5	-31	-7	-8	0	6	3	17	6
	72	-42	1	-20	-55	-14	-44	1	-52	-51	17	9	4	-33	-6	-8	1	10	1	22	5
	96	-40	3	-16	-54	-8	-44	1	-53	-51	20	11	5	-34	-5	-8	2	14	1	30	1
55	24	-9	1	-10	-8	-4	-4	-4	6	8	8	-61	-11	8	19	-8	49	19	-4	0	7
	48	-21	5	-11	-14	-4	-6	-2	-4	1	4	-62	-15	2	28	-10	25	23	-3	-8	7
	72	-23	9	-11	-13	1	-4	-3	-5	3	6	-61	-12	4	38	-7	17	33	1	4	13
	96	-25	6	-14	-12	-1	-3	-6	-8	-3	5	-58	-8	-1	42	-9	12	38	2	6	8
57	24	-5	14	-4	-33	7	-2	-4	-2	1	8	6	11	-5	9	-6	-34	5	1	-7	-1
	72	0	13	-2	-29	0	-4	-4	9	10	13	5	26	-3	30	3	-4	19	3	1	3

Strain	Time	G5 (L-phenylalanine)	G6 (L-proline)	G7 (L-pyroglutamic acid)	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D L-carnitine)	G12 (g-amino butyric acid)	H1 (urocanic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D,L-a-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
	96	11	28	15	-21	13	10	15	26	23	29	20	44	13	54	19	-9	42	18	20	19
58	24	30	19	1	-2	108	28	1	3	5	401	54	68	8	37	6	-6	60	10	4	18
	48	24	56	-2	-1	175	42	7	4	21	617	99	73	15	35	9	13	211	62	10	10
	72	32	89	1	2	189	69	8	2	18	655	156	69	14	40	8	18	325	50	6	6
	96	39	121	1	4	204	91	9	-1	15	662	190	65	13	44	7	21	407	44	0	0
	120	44	150	3	9	251	135	7	-1	15	686	272	67	11	48	9	24	529	44	-1	0
59	24	-8	6	4	-9	8	-1	-9	3	0	1	-1	-2	0	16	9	29	-2	-7	-7	-6
	48	-8	-11	-14	-24	-10	-16	-9	-2	-6	-8	-18	-7	-11	24	-2	6	-4	-16	-12	-6
	72	-3	-13	-11	-14	-12	-14	-4	6	4	-4	-12	5	-5	42	2	18	16	-10	-11	0
	96	0	-10	-10	-8	-11	-15	-6	10	5	0	-10	10	0	55	4	25	25	-10	-11	0
63	24	-27	18	0	-40	24	-40	-11	-27	-34	-10	13	-4	-17	-7	-8	-2	-8	-12	5	3
	48	-27	29	2	-41	29	-43	-8	-30	-30	-10	15	-2	-16	-5	-7	2	-6	-11	6	4
	96	-24	51	10	-39	37	-43	-1	-29	-23	-6	22	5	-9	4	-1	14	1	-4	13	10
64	24	-12	4	-15	-29	29	4	-13	-35	5	-11	-7	-16	-34	-3	-21	-2	-112	-12	-13	-40
	48	-9	8	-14	-26	38	10	-9	-34	9	-7	-1	-14	-33	-3	-20	-3	-9	-8	-8	-41
	72	3	22	-8	-18	56	24	3	-25	22	4	12	-2	-23	9	-11	8	3	3	3	-33
	96	0	27	-13	-20	55	24	-4	-28	26	0	9	-11	-31	7	-19	1	-8	-4	-4	-37
66	24	12	2	-6	-6	7	4	0	-11	-14	6	20	-2	-13	-3	-10	-9	-11	-7	0	-2
	48	13	3	-1	-14	8	1	2	-15	-11	7	22	1	-19	-4	-9	-3	-8	-6	2	-3
	96	8	3	6	-22	8	-3	7	-20	-5	15	32	6	-24	-5	-9	5	-5	0	8	-4
67	4	-4	4	-2	1	9	-11	0	-2	-4	-2	3	-2	-5	0	4	8	9	-13	5	6
	24	-6	8	3	-6	9	-7	6	3	8	7	3	2	-4	9	9	13	19	-11	2	10
	48	-10	-1	-4	-14	2	-14	-4	-4	4	-2	-10	3	-15	9	7	4	18	-20	-11	-3
	72	-5	-3	-3	-8	-5	-12	1	-3	6	3	-5	13	-12	18	12	11	25	-16	-12	-6
	96	1	3	7	-1	7	-7	8	0	5	10	3	22	-7	28	16	22	33	-13	-10	-7
70	24	-6	7	5	9	26	2	-10	6	1	9	10	2	1	25	7	22	11	7	-6	7
	48	-3	21	23	18	44	9	6	18	6	21	29	24	13	56	16	49	38	17	9	28
	72	1	11	13	6	35	-12	-6	14	9	14	19	16	1	47	6	35	32	3	-4	8
	96	11	16	18	19	43	-4	-2	21	9	19	22	25	7	54	7	36	45	2	-1	9
72	24	-5	12	-4	-4	2	-7	-8	-2	-11	21	16	15	-9	-3	-6	6	28	-2	-4	-3
	48	-6	29	1	-16	8	-5	-5	-1	-6	39	26	8	-2	5	-5	5	27	7	-3	-4
	72	-9	37	2	-15	7	-8	-5	-2	11	47	26	6	9	13	-1	7	36	12	1	2
	96	8	35	8	-11	9	-6	2	-1	14	49	24	10	16	23	2	14	36	10	2	-5
74	24	-2	0	-13	-25	-3	-5	-15	-19	-13	2	-12	-10	-19	2	-17	-14	-5	-10	-15	-12
	48	-3	0	-16	-28	-6	5	-19	-17	-12	5	-11	-9	-19	4	-17	-12	-5	-10	-15	-11
	72	1	3	-14	-26	-3	8	-17	-15	-11	8	-7	-5	-17	8	-16	-9	-1	-7	-14	-12
	96	5	5	-15	-29	-3	11	-19	-15	-11	11	-8	-6	-18	11	-18	-9	2	-6	-15	-12
76	4	44	116	24	0	159	7	-7	6	3	8	-1	-5	-4	8	-5	14	-3	0	-9	2
	24	44	116	24	0	159	7	-7	6	3	8	-1	-5	-4	8	-5	15	-3	0	-9	2
	48	41	199	148	4	234	32	6	11	21	17	9	-1	4	9	-3	24	-1	3	5	-2
	96	31	234	226	-2	255	78	10	-16	33	9	2	-5	-8	5	-14	12	0	-14	3	-8
	120	15	201	208	-13	226	67	-7	-27	28	-1	-17	-13	-21	3	-19	-8	-3	-19	-17	-15
	4	38	-12	-7	-3	48	-6	-11	5	-15	-9	-2	-1	-5	-7	-4	5	-8	-11	-8	-2

Strain	Time	G5 (L-phenylalanine)	G6 (L-proline)	G7 (L-pyroglutamic acid)	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D,L-carnitine)	G12 (g-amino butyric acid)	H1 (uricanic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D,L-a-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
78	24	46	-6	11	2	110	31	-18	61	-22	-6	-5	3	1	12	31	-4	-12	-16	-14	13
	48	43	-4	18	2	123	43	-13	53	-18	-9	-11	-4	7	12	23	9	-19	-15	-3	15
	72	37	-21	1	29	123	61	-7	55	-2	-7	2	5	5	23	-4	-5	6	-12	-1	9
	96	58	-17	10	42	147	74	13	71	8	8	9	13	38	33	14	0	14	-1	8	8
81	24	-1	-12	4	-19	18	-1	-2	-3	3	5	3	1	-21	-7	-15	-3	-19	-4	5	5
	48	-2	-5	6	-15	24	3	2	-2	1	4	4	-1	-19	-5	-16	-1	-12	-3	6	2
	96	11	5	19	-6	38	13	17	14	9	17	4	11	-8	2	-5	7	2	5	20	8
86	4	11	25	-1	-1	-3	0	1	-7	-10	-7	9	10	-10	4	3	4	2	-5	6	-4
	24	-8	74	-3	-19	-7	-3	-2	-4	-14	-3	6	-12	-13	0	2	-8	-8	-10	0	-5
	48	-1	99	5	-18	-5	0	5	-5	-12	0	3	-7	-7	7	4	-4	0	-8	5	-2
	72	1	101	12	-11	-1	5	12	-3	-10	2	6	-8	-4	16	9	-2	11	1	10	-3
	96	18	135	32	1	16	21	30	0	-9	15	13	-1	9	28	16	9	25	14	18	-1
88	4	-4	-6	-1	3	12	-1	-2	6	-5	-1	15	7	-12	5	-2	9	10	7	0	7
	24	-3	1	1	8	42	9	1	7	-1	312	86	179	-5	15	-7	17	15	13	6	19
	48	-11	-7	-10	-7	26	1	-9	-3	-7	287	70	148	-11	5	-14	5	1	-8	-9	1
	72	-1	-9	-6	4	30	-2	6	6	3	241	53	131	1	17	-12	9	14	-4	-2	3
	96	12	-10	-5	8	37	2	11	8	7	268	50	134	10	28	-11	9	21	0	2	15
89	24	-16	3	-3	-31	-22	-36	-7	-21	-23	-7	-7	-15	-11	8	-9	-1	-4	-28	3	11
	48	-15	29	4	-33	-23	-35	-2	-24	-24	-7	-5	-14	-7	10	-10	1	0	-31	8	10
	96	-9	34	8	-33	-25	-42	3	-22	-23	-1	0	-14	-7	19	-10	7	10	-20	19	17
	120	0	36	9	-27	-25	-37	11	-21	-23	1	2	-9	1	29	-6	12	19	-10	21	21
92	4	-8	-8	-11	-25	-12	-7	-19	-14	-22	-8	-2	-13	-26	-8	-13	-16	-16	-14	-15	-16
	24	-11	-8	-14	-25	-16	-10	-20	-17	-18	-13	-4	-9	-24	-4	-16	-15	-14	-14	-13	-11
	48	-13	-8	-16	-26	-16	-10	-22	-16	-20	-17	-6	-9	-26	-1	-18	-14	-14	-16	-18	-19
	72	-8	-5	-16	-23	-14	-8	-19	-16	-19	-15	-4	-4	-25	3	-17	-11	-11	-15	-17	-20
	96	-4	-6	-15	-23	-15	-9	-18	-15	-19	-6	-5	-3	-25	5	-16	-10	-10	-14	-17	-20
94	24	-17	-7	0	-15	7	8	4	-8	-32	3	27	0	-24	-8	-18	-4	-13	13	17	18
	48	-24	-7	1	-26	7	5	4	-12	-35	-3	26	-13	-32	-11	-24	-11	-19	9	14	12
	72	-22	0	10	-25	15	8	11	-10	-34	-1	31	-13	-29	-8	-19	-9	-15	15	18	19
	96	-19	5	10	-23	18	9	11	-10	-34	0	34	-12	-28	-6	-8	-9	-11	14	21	15
96	24	1	-8	-12	-5	-23	-6	-17	-6	-5	6	0	1	-8	6	-13	36	8	-18	-14	10
	48	0	-9	-11	-4	-31	-7	-17	-7	-6	5	-1	-3	-6	14	-18	37	15	-29	-12	12
	72	4	-6	-7	5	-25	-5	-12	-1	-6	6	1	1	1	26	-13	39	28	-33	-10	15
	96	5	-22	-7	9	-23	-5	-13	-1	-7	2	2	2	5	33	-12	38	36	-32	-10	15
97	4	8	4	1	1	6	4	-3	-1	-3	4	4	6	-9	7	0	4	11	0	-5	-1
	24	4	16	5	-8	0	2	-4	-2	-4	0	2	9	-14	-3	-2	0	14	-6	-12	-5
	48	0	27	16	-6	1	8	7	8	3	12	10	16	-4	10	9	15	41	5	-2	12
	72	5	22	13	1	7	14	7	5	7	11	15	12	-5	10	-1	6	38	0	-7	2
	96	22	40	37	14	23	28	28	19	15	29	33	37	10	35	23	29	72	23	13	12
99	24	-7	7	8	-8	7	3	-2	-4	13	16	8	12	-5	27	-2	-7	73	-5	-8	1
	48	-6	13	11	-7	7	4	2	-1	18	19	9	26	-4	36	-1	-5	92	-5	-4	-1
	72	-2	-1	7	-4	8	4	-2	3	29	21	16	37	-5	48	-2	4	120	-2	-4	-2
	96	15	27	37	18	35	28	24	23	58	56	42	70	20	80	18	34	210	18	18	15

Strain	Time	G5 (L-phenylalanine)	G6 (L-proline)	G7 (L-pyroglutamic acid)	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D,L-carnitine)	G12 (g-amino butyric acid)	H1 (urocanic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D,L-a-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
100	24	-5	-10	-14	-12	-6	-7	-7	-9	-12	4	-4	-4	-12	-6	-3	-7	-5	-19	-8	-8
	48	5	-5	-7	-1	10	10	-1	-1	-1	17	3	15	-1	14	3	5	6	-8	-1	11
	72	3	-4	-7	-3	6	4	-3	0	-1	11	-3	19	0	12	4	7	8	-9	-3	3
	96	7	-2	-4	2	8	5	-1	3	0	14	-1	28	4	19	7	12	12	-5	-2	4
101	4	-1	0	4	7	2	2	-4	-2	-4	34	12	21	-58	3	0	11	2	-1	1	3
	24	-7	110	12	12	9	77	3	7	5	260	142	108	-64	15	11	12	20	13	79	113
	48	-16	160	20	21	12	123	1	9	9	415	123	136	-64	31	13	17	37	13	230	359
	72	-20	178	11	10	17	161	-1	-6	8	476	157	194	-64	17	1	5	44	15	320	372
	96	-22	190	-7	-2	91	239	-2	-3	1	426	156	247	-68	3	-12	-13	122	9	289	321
103	24	7	49	-1	28	603	140	-3	5	9	288	261	117	-13	29	8	5	14	10	-4	5
	48	5	98	11	26	891	229	3	-3	40	445	340	118	3	36	8	26	16	5	-5	-5
	96	17	173	18	34	971	342	-11	-2	85	487	309	110	-8	47	4	14	25	-1	-7	-8
	120	31	144	-5	42	980	282	-4	-2	90	325	314	127	-2	61	8	14	41	6	-5	-1
105	24	9	72	-1	-19	70	61	-2	2	17	9	33	1	-5	4	0	1	-11	-2	22	24
	48	11	125	9	-22	113	91	4	-2	29	8	36	-6	-8	-3	-5	2	-13	-2	38	38
	72	11	160	12	-24	140	103	6	-4	35	11	36	-3	-5	-2	-3	3	-11	-2	52	40
	96	12	172	15	-25	157	108	7	-4	44	15	46	-1	-2	-1	-2	6	-9	2	55	42
	120	25	186	12	-13	168	109	11	4	36	15	38	9	-1	13	0	2	1	-1	57	49
106	24	-9	45	-3	-9	0	-7	-7	10	0	34	54	60	-13	17	-7	-5	76	-6	-6	3
	48	-8	48	1	-8	-1	-8	-11	-14	10	30	48	69	-9	20	-7	4	95	-10	-15	-18
	96	19	61	16	5	7	10	9	-1	27	39	73	99	10	42	-1	22	137	-1	-3	-7
	120	20	40	-2	1	-4	-2	-2	-4	14	32	57	108	12	52	-1	22	150	-2	-6	-9
108	24	22	14	20	21	20	-3	10	1	-8	1	3	11	18	5	-12	19	49	6	3	4
	48	18	24	44	20	19	-4	6	0	-11	-1	0	9	13	5	-15	19	61	5	0	1
	72	27	42	87	31	27	6	18	10	0	8	10	22	24	17	-5	33	94	18	12	13
	96	24	34	89	25	18	2	11	0	-9	0	1	15	12	11	-13	23	95	11	1	-1
109	24	-4	2	-8	-6	-10	0	-6	-4	-1	-9	165	97	-14	19	2	13	-4	-7	5	0
	48	-2	17	1	0	-4	13	8	5	10	-7	177	95	-11	36	9	4	3	-1	5	12
	72	-2	16	1	-1	10	11	3	-1	3	-2	187	96	-12	27	2	4	-3	1	3	3
	96	8	21	1	5	125	19	11	2	4	12	191	102	-14	30	2	11	2	5	6	4
113	24	6	5	-5	-2	-2	-5	-5	-1	-1	8	9	14	-2	4	-3	6	33	-6	-1	10
	72	12	10	1	-1	4	-1	1	5	1	22	14	24	2	13	-2	11	62	-3	5	12
	96	18	13	4	3	10	2	5	9	2	29	16	30	4	18	1	14	65	0	8	15
116	4	-5	2	0	-3	6	-8	-3	5	-6	-3	-4	-4	-6	13	-2	4	22	-6	1	7
	24	-5	-1	4	-12	0	-10	-4	5	-13	-5	-5	-8	-12	12	-2	-1	7	-13	-8	-2
	48	-4	8	18	-21	-4	-17	8	5	-12	1	2	-4	-13	18	-3	5	19	-13	-8	3
	72	-6	-9	-5	-13	2	-18	3	5	0	1	-2	5	-17	29	-4	-4	28	-12	-3	9
	96	10	4	17	-2	9	-9	22	13	16	18	17	16	-9	41	1	8	50	3	13	15
121	24	-5	11	0	16	11	-1	-2	1	-2	13	6	11	-6	6	0	-2	7	0	-16	7
	48	-10	-4	-12	15	-12	-17	-10	-4	-1	3	-15	21	-15	14	-6	3	20	-17	-29	5
	72	5	-3	-10	35	-7	-14	-2	7	14	10	-9	45	-3	37	9	25	49	-4	-18	18
	96	16	8	10	-1	-2	-1	10	17	15	20	-3	24	10	37	5	23	28	7	12	3
	120	16	-24	-27	-7	-17	-28	-18	-12	-1	-1	-24	16	-9	25	-9	6	24	-12	-9	-5

Strain	Time	G5 (L-phenylalanine)	G6 (L-proline)	G7 (L-pyroglutamic acid)	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D L-carnitine)	G12 (g-amino butyric acid)	H1 (urocanic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D L-a-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
125	24	-16	-7	-7	-17	-7	-12	-13	-10	-13	0	-4	-4	-8	-5	-13	-12	-13	-13	-12	-10
	48	-15	-12	-3	-11	-3	-12	-12	-10	-16	2	-1	0	-3	-2	-13	-8	-10	-11	-12	-15
	96	-4	10	12	4	13	2	-1	-4	-13	25	14	23	14	26	-3	12	10	2	6	-8
137	24	-24	2	-4	-3	3	-6	-6	-4	-5	-1	12	3	2	13	23	10	10	4	-3	-4
	48	-13	11	8	9	10	-1	8	6	13	12	25	20	22	32	45	30	32	11	10	13
	72	-3	9	11	13	3	-5	12	3	9	15	22	27	28	36	42	32	41	-1	12	5
	96	-7	1	1	13	-6	-10	6	8	1	8	14	29	18	31	32	23	42	-6	5	-2
138	24	10	13	5	-9	10	12	3	-9	-13	-5	34	18	-20	9	7	19	7	5	9	24
	48	4	11	6	-13	12	4	1	-15	-10	-6	35	19	-25	6	6	18	6	6	12	27
	72	5	11	12	-14	15	3	5	-15	-7	0	45	26	-24	9	10	24	14	11	22	36
	96	-3	1	7	-18	8	-4	1	-24	-16	-3	46	21	-32	4	6	17	10	9	24	30
140	24	8	5	-8	-14	14	26	-8	-7	-12	0	9	-5	-10	-7	-7	-6	-11	-9	6	8
	48	7	10	-4	-18	20	27	-6	-9	-16	-1	8	-7	-8	-8	-9	-6	-9	-13	8	3
	96	10	25	6	-13	36	40	1	-1	-13	5	16	-4	-1	-3	-6	4	5	-5	23	4
143	24	-15	10	-4	-7	74	23	-11	3	-16	63	123	63	-18	-12	-2	-10	6	-9	5	14
	72	-13	22	6	-13	506	49	-2	2	-13	70	111	41	-19	1	-1	-9	7	-4	13	15
	96	-8	25	7	-11	523	61	-2	4	-11	81	117	47	-19	5	1	-8	9	0	18	20
155	24	-12	4	4	-15	4	6	4	3	9	4	0	5	4	6	3	18	1	7	5	-1
	48	-1	17	20	-12	16	18	18	3	16	13	4	24	17	23	7	20	18	18	15	1
	72	6	28	30	-6	21	24	32	11	31	17	17	42	30	36	17	35	35	28	30	7
	96	17	28	36	6	25	24	37	8	14	18	17	45	27	35	23	33	45	14	29	15
158	24	-8	7	-2	3	3	-2	-1	-1	-10	7	4	6	-11	7	-4	10	14	-2	-3	2
	48	4	21	10	5	10	7	10	2	-5	13	9	7	-3	16	-2	12	17	2	-1	6
	72	16	32	20	5	16	13	18	13	5	25	18	20	10	33	9	30	27	19	14	16
	96	23	45	34	16	25	24	30	16	14	39	28	36	20	51	14	25	43	27	19	21
162	24	0	36	8	0	30	34	3	0	32	14	25	-6	-3	4	9	11	10	6	38	19
	48	-2	64	11	-6	37	45	7	-11	43	8	22	-5	-7	2	3	9	7	1	40	15
	72	3	89	13	1	43	54	15	-14	56	7	23	1	-6	6	3	12	12	3	47	17
	96	9	92	12	4	43	44	15	-19	57	2	22	2	-6	6	-1	11	14	0	51	15
200	24	-1	-2	-6	-6	3	12	-3	3	-1	-3	-5	-2	-9	16	-5	37	7	2	-2	9
	48	2	6	4	-6	9	10	2	8	4	9	-2	7	-7	33	0	39	14	2	-2	8
	72	15	15	15	6	18	21	12	17	15	28	13	27	11	60	14	52	32	13	8	20
	96	13	7	8	-1	9	13	3	6	1	34	3	20	-2	54	3	32	17	3	-4	3
201	24	-42	-8	-4	-51	51	9	-5	-49	-10	-9	5	-22	-33	11	2	4	12	1	-7	1
	48	-25	66	13	-23	148	54	9	-21	31	17	36	-15	-13	30	17	9	49	18	14	4
	96	-13	237	16	10	348	116	20	-17	52	42	33	2	3	44	21	23	72	22	24	4
202	24	-15	175	-6	-3	439	292	-8	-7	10	580	410	322	-7	-3	-11	-24	292	133	504	538
	48	-19	296	-10	-11	672	477	-10	-19	7	600	472	306	-15	-6	-18	-42	461	277	645	559
	96	-2	722	-1	6	999	860	-13	-13	29	841	988	462	2	8	-16	-33	881	404	725	657
204	24	3	276	3	5	303	189	-3	4	5	383	36	5	13	5	12	12	14	17	3	23
	48	0	477	-2	11	549	413	0	4	4	587	41	5	15	12	14	12	19	43	2	11
	72	12	725	0	24	780	750	6	9	15	562	59	19	21	23	19	15	55	72	8	13
	96	25	961	4	38	935	941	14	11	22	551	88	32	26	32	23	17	80	99	13	14

Strain	Time	G5 (L-phenylalanine)	G6 (L-proline)	G7 (L-pyroglutamic acid)	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D L-carnitine)	G12 (g-amino butyric acid)	H1 (urocanic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D L-a-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
205	24	-7	-7	-4	-9	-1	-6	-6	-3	-3	-3	-8	-10	-7	1	-7	-4	-13	-6	-7	0
	48	2	-1	9	1	-1	10	7	11	16	7	3	13	11	24	8	4	10	1	9	20
	96	9	6	9	14	8	25	15	0	17	10	7	21	7	32	2	8	19	-3	3	1
207	24	-19	-33	-27	-33	-14	-9	-19	-10	-21	-2	-18	-19	-25	-19	-20	-5	-1	-21	70	3
	48	-18	-29	-24	-29	-13	-8	-16	-11	-16	7	23	-11	-20	-14	-16	-5	-4	-17	75	6
	72	-15	-27	-22	-26	-12	-6	-14	-9	-14	12	28	-7	-16	-10	-14	-3	8	-15	79	8
	96	-14	-27	-21	-26	-11	-6	-12	-9	-13	15	31	-5	-15	-8	-11	-2	9	-14	78	7
209	24	-13	136	1	9	370	290	-1	-6	15	664	332	304	-10	12	-3	-3	255	132	8	15
	48	-12	277	7	10	631	428	-2	-10	19	712	399	240	-7	27	7	-2	506	251	9	24
	72	-6	413	9	15	912	645	0	-4	29	802	624	357	2	42	6	5	635	302	17	33
	96	4	561	13	26	999	891	4	3	40	875	990	483	8	55	5	12	776	357	25	49
210	24	37	73	14	3	138	-9	5	65	-3	4	-2	-2	0	23	-5	29	-10	6	-5	3
	48	31	147	21	-2	103	-8	10	124	1	-2	-12	-11	-3	72	-3	10	-7	16	-7	12
	72	24	205	15	-3	91	-9	9	250	3	0	-4	0	3	85	0	14	11	11	-6	8
	96	10	215	12	-5	80	-10	9	372	4	0	-2	8	8	93	0	17	20	8	-2	4
211	24	-7	46	14	3	298	67	-15	0	-11	62	119	151	-10	16	-11	-10	-2	-4	-13	-9
	48	-3	60	22	2	970	124	-7	8	12	70	132	153	-1	33	-2	-1	14	3	-4	2
	72	-4	63	21	0	985	169	-8	8	26	225	140	160	3	38	-4	-2	17	1	-6	-2
	96	-4	68	20	-2	999	213	-9	8	40	379	147	167	6	42	-5	-3	20	-1	-7	-6
212	24	-9	172	1	6	371	242	-13	-7	20	610	327	314	-14	2	-3	-4	244	17	454	462
	48	5	369	11	-1	562	472	-15	-10	20	728	517	316	-12	10	-6	1	452	18	548	505
	72	13	588	16	1	671	636	-9	-12	29	849	743	439	-9	12	-7	5	726	101	603	545
	96	20	806	20	3	779	800	-2	-13	38	970	969	562	-6	13	-8	8	999	184	658	585
216	24	-15	35	-2	-7	5	-12	-15	-2	-5	-3	30	4	-15	47	-13	-1	102	-11	-12	-13
	48	-15	52	4	-13	8	-2	-10	0	-3	8	114	12	-14	74	-11	2	238	-13	-12	-14
	72	-12	68	6	-18	13	1	-6	5	3	21	164	19	-10	119	-15	4	366	-10	-9	-15
	96	-14	82	4	-12	9	0	-7	4	6	36	193	32	-11	163	-13	1	517	-9	-9	-12
218	24	0	0	-8	-15	-12	-2	-3	-10	-12	20	0	-3	2	-2	-7	8	9	6	27	7
	48	-4	-3	-9	-18	-12	-3	-9	-10	-12	21	2	-2	1	0	-4	0	11	5	27	5
	72	-3	-2	-8	-17	-11	-2	-7	-9	-12	23	3	-2	1	1	-3	2	13	7	28	6
	96	-2	-2	-7	-17	-10	0	-6	-8	-13	25	4	-1	1	4	-3	1	14	8	28	6
219	24	3	23	10	9	104	4	1	6	-3	10	7	17	-7	15	1	4	6	7	1	0
	48	3	24	17	6	122	5	1	4	-8	7	6	21	-10	19	-5	2	8	4	0	0
	96	-1	37	29	16	144	12	8	8	-11	15	12	32	-6	26	1	11	19	8	8	0
220	24	-12	-14	-3	-20	-15	-15	-22	-9	-36	7	10	-3	-19	-8	-11	0	-23	-20	-12	6
	48	-14	-15	-6	-20	-16	-15	-22	-6	-34	9	15	-1	-17	-8	-16	-8	-21	-18	-10	8
	72	-12	-11	-3	-17	-12	-9	-16	-2	-33	10	20	1	-15	-5	-15	-8	-17	-15	-7	8
	96	-9	-9	0	-15	-9	-6	-13	-1	-32	12	25	4	-14	-4	-14	-11	-15	-14	-5	9
221	24	-23	-5	-17	-25	-8	-9	-9	5	-12	-6	-10	-17	-25	-10	-11	-15	10	-2	5	33
	48	-28	-19	-21	-28	-11	-10	-11	2	-14	-10	-11	-16	-27	-11	-14	-15	6	-3	4	23
	96	-26	-15	-17	-26	-8	-7	-9	3	-13	-8	-8	-14	-26	-3	-14	-11	2	-1	5	24
223	24	25	13	16	10	16	10	13	7	-5	22	10	15	15	14	14	19	28	12	20	15
	48	25	14	18	9	15	13	18	10	-3	24	11	19	16	18	13	19	30	15	21	20

Strain	Time	G5 (L-phenylalanine)	G6 (L-proline)	G7 (L-pyroglutamic acid)	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D L-carnitine)	G12 (g-amino butyric acid)	H1 (urocanic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D,L-a-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
	72	24	13	17	8	14	12	18	10	-2	24	11	19	16	19	12	19	30	15	20	21
	96	21	11	14	5	11	11	16	10	-4	20	9	16	13	16	13	18	26	13	16	18
224	24	-21	-5	-20	-16	-15	-18	-8	-16	-19	-9	-16	-20	-20	-23	-17	-19	-11	-19	-12	-13
	48	-15	1	-17	-17	-12	-22	-3	-17	-14	-8	-19	-19	-22	-18	-17	-3	-7	-22	-12	-16
	72	-18	-3	-25	-23	-15	-26	0	-27	-15	-6	-25	-23	-26	-19	-27	-14	-8	-29	-16	-23
	96	-18	-7	-30	-24	-17	-29	-2	-29	-13	-8	-27	-24	-28	-20	-28	-15	-7	-30	-18	-24
226	24	-1	4	-2	-10	2	2	-2	-3	-13	-5	-1	3	-10	22	2	5	7	-5	-4	2
	48	0	7	2	-7	6	7	3	3	-8	-2	6	11	-6	31	7	9	17	-1	2	8
	96	7	11	7	-2	11	11	6	4	-6	3	12	20	1	43	10	12	21	3	3	7
227	24	3	-3	-3	-1	702	35	-1	-5	-2	536	280	173	-7	13	-5	-6	-1	3	6	-4
	48	9	12	-3	-9	974	55	3	0	9	959	390	184	-18	18	-5	-1	0	2	7	-4
	96	18	61	7	-8	999	122	11	4	86	999	724	274	-13	42	-4	7	10	18	25	2
228	24	0	0	-6	-6	-7	-16	-8	1	-11	-17	-9	3	-13	0	-11	-7	0	-7	-7	-5
	48	18	15	12	8	14	0	9	30	-1	-3	5	18	1	20	4	9	25	8	11	13
	72	13	9	4	0	7	-5	1	22	-11	-12	-4	9	-9	11	-7	2	16	-1	0	-1
	96	15	10	6	1	8	-5	2	24	-12	-12	-3	10	-10	13	-7	5	19	-1	0	-2
230	24	-33	-23	-32	-27	-27	-10	-32	-14	-32	-32	-32	-31	-30	-20	-27	-6	-29	-31	-24	-17
	48	-28	-17	-28	-19	-23	-7	-27	-12	-25	-29	-26	-27	-25	-12	-17	-8	-21	-26	-21	-17
	72	-27	-15	-25	-16	-21	-7	-24	-13	-22	-21	-21	-21	-22	-12	-14	-7	-15	-22	-18	-19
	96	-23	-9	-19	-12	-15	-1	-17	-9	-21	-14	-16	-14	-18	-7	-8	-4	-7	-16	-14	-18
231	24	-30	14	3	-43	-2	-9	-4	-19	-6	2	2	-10	-6	-6	3	2	17	4	33	14
	48	-34	38	6	-49	12	-4	-1	-23	-7	-1	-9	-13	-4	1	-6	-3	34	1	33	16
	96	-30	50	7	-49	11	-2	-3	-34	6	-1	3	-2	-2	10	3	15	60	5	56	36
232	24	0	173	2	14	278	174	-4	-2	5	272	18	21	-14	1	-4	7	14	19	-5	14
	48	-7	332	-1	16	428	290	-6	-3	5	417	18	-3	-13	1	-9	0	22	30	-13	12
	96	8	832	17	25	693	758	16	12	50	525	63	32	20	40	1	35	276	99	19	38
234	24	-10	27	14	-29	26	12	0	-13	-9	12	8	4	-14	-15	-1	10	0	1	25	14
	48	-1	71	26	-30	39	17	1	-11	-2	14	8	-5	-5	-3	5	15	22	0	26	19
	72	-1	110	26	-33	35	15	-3	-19	2	5	8	-2	-6	-2	4	16	19	-1	26	24
	96	0	148	25	-35	30	12	-7	-26	6	-4	8	1	-7	-1	3	17	16	-2	26	28
236	24	8	22	10	11	26	19	5	12	11	6	11	8	4	22	7	21	21	16	1	5
	48	2	27	9	7	23	14	11	16	15	5	8	5	1	20	9	21	28	14	3	6
	96	5	31	23	11	18	13	15	7	19	19	10	10	3	31	5	17	37	20	3	5
237	24	-9	95	-12	-5	189	93	-15	-15	-13	215	-6	-12	-19	-5	-17	-7	-47	-2	-16	-9
	48	-14	230	-10	-13	352	256	-12	-11	-7	463	-12	-17	-17	3	-15	-3	-40	11	-15	7
	96	-10	476	-11	-7	478	543	-13	-9	-1	620	-2	-5	-11	21	-8	3	-26	43	-6	-5
238	24	-5	183	-6	0	440	297	-4	-3	20	679	339	277	-12	10	-7	10	308	197	417	522
	48	0	377	0	-15	798	551	-5	-8	33	816	490	313	-18	17	-4	7	573	345	614	595
	96	22	858	4	-4	999	995	-5	-15	55	999	999	455	-21	27	-13	10	999	444	657	686
239	24	27	169	-4	9	231	182	-9	7	-4	374	48	12	0	-2	-2	-3	1	2	-2	4
	48	36	325	-13	15	423	375	-7	9	8	667	53	9	4	11	-1	1	9	5	0	8
	96	78	628	-9	2	641	754	-10	-6	15	657	43	15	11	16	-10	4	42	3	-3	-8
	24	-15	-15	-11	-15	-5	-18	-14	-10	-9	-11	-14	-13	-11	3	-12	-12	-1	-10	-11	-4

Strain	Time	G5 (L-phenylalanine)	G6 (L-proline)	G7 (L-pyroglutamic acid)	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D L-carnitine)	G12 (g-amino butyric acid)	H1 (uracanic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D L-a-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
241	48	-18	-18	-8	-19	-12	-17	-10	-3	-7	-9	-18	-16	-4	13	-10	-20	-6	-6	-9	-5
	96	-10	2	11	3	-1	-7	12	8	11	7	-5	3	7	41	-4	-1	27	11	9	1
242	24	-10	147	9	5	228	149	-1	-11	-9	204	18	-1	-8	-6	9	11	21	21	19	17
	48	-14	206	13	-16	324	236	3	-17	-12	368	-2	-6	-16	-9	8	13	30	24	11	15
	96	-23	295	10	-24	348	326	0	-24	-14	419	4	-5	-14	-6	7	14	25	29	19	18
243	24	7	37	11	-16	41	19	-5	41	-1	43	16	30	-9	-9	7	0	29	-4	-3	-4
	48	34	57	31	-18	60	39	3	51	15	58	32	40	-5	-4	22	0	63	-3	-2	-3
	72	47	70	45	-20	78	53	5	62	26	77	45	47	-5	-2	36	0	115	-3	-1	-2
	96	60	88	67	-20	93	72	7	76	41	105	65	57	-5	0	55	-2	143	-3	-2	-3
244	24	-11	28	8	-9	342	52	-12	18	-6	6	201	65	-28	1	2	-5	7	7	42	15
	48	-4	42	22	1	470	112	1	27	18	14	245	81	-22	15	10	3	22	14	59	28
	96	3	53	21	-2	476	266	8	21	24	425	264	84	-27	20	5	2	24	13	65	23
245	24	0	-6	-1	-6	26	-11	-4	12	-7	-2	5	5	-6	21	7	-5	0	-6	2	15
	48	-9	-12	-5	-13	-3	-5	-4	8	-2	-1	-4	11	1	30	9	-14	1	-2	1	-1
	96	-5	-3	0	-7	0	-9	10	3	5	13	4	33	19	55	4	-9	23	-2	4	-4
246	24	-15	-3	-9	-9	-1	-11	-18	-4	-12	5	-10	-10	-11	-11	-15	-5	-10	-6	-21	3
	48	-12	1	-5	-12	1	-12	-8	-4	-9	-7	-5	-14	-12	-7	-12	-2	-15	-12	-17	13
	72	-16	-8	-16	-17	-14	-15	-12	-12	-7	-8	-10	-16	-16	-9	-21	-9	-16	12	-18	2
	96	-18	-10	-19	-20	-21	-16	-11	-16	-5	-5	-16	-20	-21	-10	-22	-8	-18	-16	-20	2
250	24	-11	28	-1	1	130	31	-10	-3	-16	48	125	115	-23	-5	-15	-28	-21	-17	-12	-6
	48	2	44	4	11	553	81	-5	4	13	78	169	136	-9	8	-9	-20	-15	-15	-10	-3
	72	6	49	7	15	811	142	-1	7	25	300	203	155	-5	15	-7	-15	-9	-13	-7	2
	96	11	59	11	17	993	213	1	8	30	838	226	171	-4	21	-8	-13	-6	-14	-7	3
251	24	-11	24	-13	-34	69	15	-23	-13	12	175	21	103	-22	-25	-23	-17	11	-15	-22	-10
	48	-22	11	-24	-46	81	21	-37	-27	5	137	12	93	-41	-22	-32	-29	2	-20	-30	-20
	96	1	105	12	-36	282	121	-24	-13	42	444	79	257	-27	-23	-22	-15	45	3	-18	-29
254	24	-26	-7	-26	-14	-9	-25	-23	-27	-18	-20	-20	-20	-16	-9	-15	-18	-22	-23	-24	-27
	48	-29	-14	-30	-20	-14	-31	-23	-24	-11	-25	-22	-23	-16	-6	-20	-16	-21	-23	-23	-25
	96	-24	-5	-23	-11	-4	-25	-13	-19	-8	-15	-12	-13	-5	5	-19	-6	-8	-18	-18	-27
256	24	-10	-21	-17	-23	-11	-23	-23	-24	-27	-22	-14	-19	-15	-17	-30	-13	-31	-25	-20	-14
	48	-30	-28	-24	-33	-26	-33	-28	-26	-22	-24	-21	-19	-13	-12	-31	-22	-31	-24	-22	-19
	96	-29	-30	-14	-27	-26	-30	-27	-23	-20	-22	-22	-18	-6	-8	-33	-17	-24	-28	-26	-24
257	24	-3	34	-2	-29	22	18	-7	-13	13	1	20	4	-21	-16	-10	-2	-9	-5	1	3
	48	2	51	2	-36	39	37	3	-11	27	18	25	10	-27	-15	-9	3	0	-5	1	11
	72	8	59	7	-38	62	50	9	-6	37	25	35	17	-23	-12	-5	11	8	2	7	15
	96	15	74	13	-32	72	58	12	-6	32	32	37	19	-20	-5	-4	12	13	5	10	16
258	24	-23	-10	-6	-22	-2	-12	-25	-18	-22	419	206	203	-20	-14	-28	-25	1	45	-6	5
	48	-22	-4	-5	-21	5	-2	-24	-16	-22	429	224	207	-21	-16	-32	-18	54	78	-5	2
	72	-19	1	-2	-19	9	7	-21	-15	-22	432	254	216	-23	-15	-32	-16	154	81	-4	4
	96	-22	5	-3	-22	8	19	-23	-17	-24	430	318	220	-25	-15	-33	-19	240	82	-5	3
259	24	-55	61	52	20	37	32	23	17	-51	85	99	115	-43	16	-49	17	57	28	63	65
	72	-53	107	62	27	59	37	29	17	-45	109	108	120	-47	26	-46	20	112	32	65	59
	96	-57	130	66	26	52	38	29	13	-45	161	112	117	-49	26	-49	19	206	30	64	59

Strain	Time	G5 (L-phenylalanine)	G6 (L-proline)	G7 (L-pyroglutamic acid)	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D,L-carnitine)	G12 (g-amino butyric acid)	H1 (urocanic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D,L-a-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
261	24	-3	14	2	8	623	19	-3	11	-8	747	303	178	-9	8	-8	-10	-18	-12	-7	-6
	48	3	15	2	7	932	33	0	15	14	999	379	202	-9	15	-6	-10	-10	-15	-6	-12
	72	9	18	8	12	999	62	2	14	54	999	466	246	-11	26	-4	-3	-9	-13	0	-12
	96	17	57	16	15	999	107	4	34	107	999	693	291	-8	42	-12	2	-6	-11	-1	-14
262	24	31	78	5	-12	168	-14	-19	-9	3	-9	-5	-4	-10	-35	-11	-5	1	-28	-29	-24
	48	7	93	69	-14	181	-21	-22	-10	7	-9	-15	-5	7	-38	-3	-14	-1	-33	-32	-27
	96	53	155	142	1	321	-8	1	9	42	-8	-16	-8	3	-52	-2	2	11	-26	-35	-26
263	24	1	1	-9	-6	225	38	-10	-6	-18	31	218	181	-8	-8	-3	-8	-7	-10	-7	0
	48	1	2	-13	-18	727	80	-11	-9	2	16	169	163	-6	-9	-6	-12	-9	-13	-7	-1
	96	13	17	1	-10	999	254	3	-1	30	19	271	209	21	-4	-3	1	5	-5	-1	3
265	24	-33	14	-10	-14	19	33	-17	-15	-1	362	163	280	-18	-22	-33	-18	115	-14	289	290
	48	-26	45	13	-6	16	73	-9	-8	12	413	204	313	-12	-20	-38	-13	316	-22	337	303
	72	-27	54	17	-11	26	95	-13	-17	9	405	246	317	-16	-24	-41	-14	487	-15	343	292
	96	-24	74	28	-11	33	142	-12	-18	11	422	349	324	-16	-20	-42	-23	619	-17	329	306
271	24	-12	29	10	-31	96	4	-16	1	45	207	83	110	-15	-17	-20	-10	24	-17	-10	-6
	48	-10	48	38	-31	154	27	-14	5	46	323	94	120	-18	-14	-20	-5	115	-7	-12	-15
	72	1	73	72	-25	228	64	-2	17	68	470	126	156	-5	-8	-13	-6	254	13	-1	-6
	96	2	110	127	-25	296	116	-3	19	67	676	147	188	-7	-14	-15	-5	357	28	-2	-5
278	24	5	6	-7	2	7	15	-3	-2	-11	3	3	7	-5	-8	-10	-27	-1	-5	4	17
	48	0	1	-7	0	6	14	-4	0	-8	5	1	4	6	-7	-11	-15	0	-8	4	18
	72	9	3	2	5	13	17	8	7	3	13	7	17	21	0	-4	-2	15	0	11	23
	96	15	0	6	5	18	22	13	5	4	15	2	12	27	2	-8	-2	17	-2	5	20
283	24	-19	-14	-16	-23	-10	-21	-14	-10	-14	-4	-9	-12	-13	-12	-13	-25	-3	-17	-14	-8
	48	-13	-9	-9	-19	38	-15	-5	-4	-5	0	10	-4	0	-6	-7	-18	5	-12	-9	-12
	96	4	-3	6	-14	229	3	11	1	4	-4	23	5	8	4	2	-7	23	3	-1	-14
289	24	-9	-3	-5	-18	-5	-7	-23	-5	-8	9	-1	4	-9	22	-11	-11	46	-12	-39	-10
	48	-7	-4	-5	-17	-9	-9	-23	-6	-6	10	-2	5	-11	24	-11	-10	48	-14	-39	-12
	72	-4	-5	-4	-16	-12	-10	-22	-6	-3	11	-2	6	-13	26	-10	-9	50	-16	-39	-13
	96	-7	-7	-8	-19	-17	-17	-26	-13	2	10	-3	6	-15	26	-11	-11	56	-17	-38	-19
7708	24	8	51	19	21	8	10	34	18	-18	90	94	51	-4	16	8	14	16	17	25	41
	48	29	75	39	49	26	29	67	21	5	117	104	74	12	35	19	46	50	37	43	71
	72	8	42	25	31	0	-4	19	7	-10	106	77	48	-3	10	5	36	34	14	19	52
	96	11	46	32	32	7	4	26	10	-10	126	83	39	-4	9	8	42	40	14	19	60
8071	24	38	49	44	44	817	181	-1	11	-13	582	280	175	-5	-1	-12	10	-6	-1	-1	1
	48	56	32	50	46	847	374	0	9	-16	835	253	167	-9	-2	-16	8	-4	-2	-1	-3
	72	57	34	48	35	844	541	-2	0	-21	878	248	147	-13	-5	-23	8	-5	-6	-5	-9
	96	58	35	46	23	841	707	-4	-9	-25	920	242	126	-17	-7	-29	7	-6	-9	-9	-15
10144	24	-12	-3	-9	-7	-4	-8	-9	-8	-19	3	-3	-11	-15	-7	-2	0	-6	-8	-12	-6
	48	-9	-2	-3	1	-1	-9	2	-3	-11	18	9	-2	-8	1	5	20	8	1	-5	0
	96	-8	-7	2	4	-2	-8	1	-11	-15	28	7	-4	-14	-8	-2	21	-4	-7	-9	15
11040	24	-3	56	-15	49	45	-4	-13	7	9	84	30	60	-4	-5	-13	-12	97	23	132	182
	48	1	129	-15	103	88	-8	-16	17	18	182	42	121	-13	19	-20	-10	224	24	202	207
	72	6	234	-24	218	134	-11	-24	49	74	267	50	143	-21	85	-26	-17	270	24	181	182

Strain	Time	G5 (L-phenylalanine)	G6 (L-proline)	G7 (L-pyroglutamic acid)	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D,L-carnitine)	G12 (g-amino butyric acid)	H1 (urocanic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D,L-a-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
	96	10	339	-32	332	180	-13	-32	81	129	351	58	164	-28	151	-31	-24	316	24	160	156
14393	24	100	130	91	71	112	38	5	10	110	141	26	82	69	77	71	52	93	11	22	11
	48	190	291	135	89	135	52	9	12	144	290	46	122	120	174	128	58	176	16	31	9
	72	370	597	269	96	238	52	10	32	362	295	121	269	223	252	245	56	358	85	46	13
	96	549	902	403	102	341	52	10	51	579	299	195	416	325	329	362	54	539	153	61	16
17749	24	27	152	83	31	152	23	6	77	80	28	7	-16	7	16	13	17	-6	1	5	3
	48	79	288	108	55	227	43	36	201	213	54	-2	-6	24	80	34	51	12	27	33	27
	72	91	486	140	81	236	48	32	343	442	88	12	-12	46	165	46	83	52	37	40	38
	96	81	538	147	55	184	28	-2	393	575	59	-10	-16	10	201	19	47	26	16	19	18
19260	24	1	27	19	10	24	15	-1	5	4	30	17	34	-2	59	10	7	106	-1	0	8
	48	5	29	18	20	25	25	4	2	15	67	27	58	0	70	6	17	225	1	4	11
	72	2	25	17	7	9	14	1	10	16	91	18	63	-15	62	-7	6	304	-16	-13	-10
	96	6	26	19	12	15	15	3	5	15	122	26	58	-13	66	-9	5	350	-14	-10	-10
19323	24	55	165	3	151	149	31	-4	148	140	57	44	62	2	4	-4	8	158	245	157	114
	48	110	281	0	300	222	26	-9	331	401	120	72	101	-2	19	-11	12	296	215	302	306
	72	191	560	1	421	424	29	-18	693	766	257	112	132	-7	203	-15	16	330	190	283	308
	96	22	815	4	415	604	38	-17	687	762	269	131	143	-9	378	-15	16	339	186	275	299
19326	24	4	222	-3	6	185	44	-2	-4	-6	8	0	-11	-4	0	-3	3	231	2	11	4
	48	2	300	0	4	245	29	-5	-13	-12	16	-1	-12	-9	-4	-12	10	407	-1	12	-3
	72	-10	388	-5	-3	290	30	-10	-20	-19	15	0	-17	-20	-10	-20	8	637	-3	11	-10
	96	-17	437	-5	-4	294	32	-17	-23	-26	13	0	-21	-27	-14	-24	4	730	-9	6	-15
23597	24	12	148	148	34	197	123	0	22	-4	13	17	28	8	-2	13	27	108	15	11	6
	48	6	134	177	40	201	141	-7	38	-8	3	12	22	6	-15	15	24	120	8	4	-4
	72	9	146	198	44	220	164	9	52	-7	8	9	26	4	-15	30	25	141	7	3	-7
	96	12	157	218	47	238	187	24	66	-5	12	6	30	1	-14	45	25	161	6	1	-10
25374	24	41	199	129	52	177	99	79	158	-8	139	128	22	-17	3	16	12	166	97	12	13
	48	88	549	289	66	392	109	157	428	-5	284	223	28	-22	7	18	28	388	110	8	9
	72	76	848	440	73	565	114	205	492	-5	364	329	28	-25	7	19	32	407	114	7	7
	96	95	880	492	83	546	127	218	494	-8	401	414	36	-28	8	19	35	417	121	5	5
25521	24	-7	51	-16	43	230	95	-20	-21	-15	362	272	271	-4	-17	-17	-6	336	47	324	296
	48	3	74	-9	48	375	141	-13	-15	-13	422	330	315	3	-12	-10	3	500	106	297	267
	72	19	96	-2	68	592	246	-2	-2	-7	523	454	180	19	6	0	17	609	163	409	419
	96	34	117	5	87	808	351	10	11	0	624	578	45	34	23	10	31	718	220	520	571
25915	24	4	117	-3	57	346	364	2	2	-5	184	233	426	-1	-11	-12	-13	290	19	241	214
	48	-11	101	-21	36	369	473	-10	-17	-21	176	227	420	-19	-20	-23	-20	507	-2	293	270
	72	-9	122	-21	34	492	721	-9	-22	-20	301	401	386	-20	-20	-26	-21	753	-5	312	308
	96	-6	143	-21	31	614	968	-7	-26	-18	425	574	352	-20	-19	-29	-22	999	-8	330	346
27118	24	70	241	38	37	91	-6	106	210	33	143	35	19	253	266	40	20	91	7	14	9
	48	116	509	115	36	185	9	264	516	40	284	42	16	498	391	42	14	233	9	13	6
	72	182	754	307	59	499	34	313	740	46	350	96	17	738	472	110	20	501	21	28	20
	96	247	999	499	81	813	59	361	963	52	415	150	17	978	552	177	25	769	33	42	33
27119	24	-15	150	79	-31	90	35	14	59	42	61	74	3	-25	-3	-8	-4	101	2	9	2
	48	-17	229	128	-33	106	46	15	86	87	73	74	1	-28	-2	-11	-5	153	-6	-2	1

Strain	Time	G5 (L-phenylalanine)	G6 (L-proline)	G7 (L-pyroglutamic acid)	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D,L-carnitine)	G12 (g-amino butyric acid)	H1 (urocanic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D,L-a-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
	96	0	527	282	-25	207	126	35	203	237	96	141	-4	-27	5	-4	2	373	5	18	4
27122	24	110	117	66	5	112	35	6	20	69	227	47	16	66	66	1	17	86	47	6	2
	48	204	331	71	19	233	90	-3	16	288	531	215	6	198	153	-6	26	282	259	3	-12
	72	315	590	90	14	444	115	0	29	755	583	244	15	363	200	3	41	461	300	16	1
	96	577	999	151	25	763	160	27	188	916	694	296	16	743	245	13	54	568	360	28	18
27123	24	9	201	1	168	564	41	1	6	88	18	5	4	-2	262	0	-9	5	2	-1	4
	48	13	404	-5	560	911	135	35	112	482	195	-6	-6	14	429	-8	-13	-1	-7	-8	-13
	72	25	573	-2	646	99	101	126	284	596	247	-3	-3	-8	526	-7	-7	-1	-10	-7	-12
	96	43	950	49	719	999	175	199	525	621	302	17	12	-1	654	5	-3	18	21	-6	22
27124	24	28	389	27	33	409	27	-1	18	12	222	16	44	-26	222	-5	17	290	10	29	2
	48	35	999	30	52	999	88	29	241	150	406	30	55	-14	649	8	37	567	3	93	19
	72	29	999	22	31	999	59	20	445	273	348	20	43	-28	553	-3	17	526	19	79	4
	96	25	999	26	32	999	63	60	599	301	420	25	51	-30	554	-3	14	530	27	92	7
27125	24	102	121	26	-3	158	-2	-7	8	50	152	10	6	21	81	-6	-3	54	23	-2	3
	48	319	366	26	-9	473	56	-4	11	247	337	159	-5	156	178	-23	-14	316	185	-18	-13
	72	512	764	42	-5	861	91	10	16	722	354	167	-1	310	223	-20	-11	461	255	-1	2
	96	751	999	57	8	963	139	9	152	784	375	175	5	734	242	-21	-11	588	290	3	-2
27126	24	11	10	0	-4	23	5	-8	-5	-11	6	-3	-1	-1	8	-15	9	12	-9	-5	-11
	48	14	19	3	1	29	11	-6	2	-11	1	1	6	-1	17	-11	18	10	-2	-2	-4
	72	17	16	5	2	35	13	-5	5	-14	11	4	11	3	23	-8	26	15	0	0	-8
	96	27	27	16	10	47	22	4	11	-10	20	12	21	8	35	-2	36	25	6	5	-2
27128	24	-10	16	9	0	38	8	-2	0	-29	4	3	4	-15	-5	-1	12	4	-4	-6	-3
	48	-8	10	5	0	37	11	-4	-6	-33	3	1	1	-20	-8	-9	12	-3	-6	-10	-9
	96	4	19	16	15	50	26	6	1	-31	11	8	9	-15	0	-5	26	5	1	-3	-3
27130	24	59	106	2	-17	-17	-7	-9	2	-3	-4	-12	-6	82	17	-8	-18	-2	-2	-8	1
	48	96	153	3	-27	-27	-14	-9	14	-12	-4	-20	-9	127	53	-13	-26	10	-15	-23	-9
	96	155	488	11	-1	-2	11	24	157	-15	12	-10	-10	270	143	-8	-5	59	12	2	-6
27132	24	51	136	113	91	146	88	83	116	-3	141	143	39	-31	-7	-13	29	141	81	2	3
	48	45	310	231	90	293	92	110	314	-2	195	180	39	-32	3	-17	29	380	85	-2	0
	96	81	763	494	95	527	106	218	374	0	412	294	46	116	234	-18	34	408	90	-1	-2
27562	24	-7	122	72	-10	163	-13	48	166	139	130	37	-5	-3	0	49	-11	132	-5	-9	0
	48	19	448	401	14	578	20	255	622	568	501	317	9	19	172	380	23	551	34	12	17
	72	-1	885	602	13	784	27	278	706	561	479	398	-13	-4	444	484	10	685	38	-10	-3
	96	1	999	569	7	666	44	245	631	476	436	373	-17	-11	481	453	3	693	24	-19	-16
27593	24	72	138	38	10	153	22	1	130	106	90	74	176	9	11	4	3	286	207	149	176
	48	133	279	124	-9	220	7	-18	279	346	238	140	311	-12	69	-22	-10	320	144	188	255
	72	248	582	450	-21	355	3	-33	557	584	287	311	238	-32	219	-40	-16	331	106	134	185
	96	343	733	639	-19	483	13	-37	614	594	290	289	216	-35	369	-42	-17	336	91	113	167
27950	24	154	111	-6	-15	68	129	0	-5	0	26	24	15	5	-9	-7	-9	-14	-4	20	17
	48	215	196	3	-21	107	181	5	-20	0	38	31	17	-1	-15	-16	-3	2	-6	42	31
	72	293	255	16	-18	135	245	13	-21	12	56	45	21	9	-15	-21	8	19	-6	58	43
	96	352	290	30	-14	168	292	26	-13	16	73	62	36	15	-14	-22	19	24	0	59	60
	24	-26	-4	-11	-20	15	11	-13	-10	7	15	4	6	4	4	10	8	-2	-8	-5	0

Strain	Time	G5 (L-phenylalanine)	G6 (L-proline)	G7 (L-pyroglutamic acid)	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D,L-carnitine)	G12 (g-amino butyric acid)	H1 (urocanic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D,L-a-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
29570	48	-34	-27	-25	-17	23	9	-20	-28	-7	14	-4	-1	-7	-12	0	14	-9	-18	-18	-18
	72	-37	-22	-15	-2	52	8	-17	-21	-3	27	1	11	-5	-10	-6	42	8	-15	-15	-19
	96	-41	-22	-14	-1	63	-4	-26	-23	-11	26	-6	10	-18	-17	-14	42	-1	-24	-22	-26
33127	24	-11	16	52	-15	188	18	-10	-7	-12	6	2	7	-10	-15	33	-2	40	-6	-14	-18
	48	4	105	144	-2	342	53	10	5	3	11	6	24	0	11	52	17	112	11	-6	-12
	72	11	172	159	8	421	73	22	-4	-4	24	11	23	-10	2	89	27	163	11	-10	-11
	96	11	197	170	18	442	83	30	-7	-5	43	20	26	-8	1	114	30	216	18	-8	-8
33539	24	2	83	-1	18	227	92	-5	-5	-5	387	292	196	-8	-5	-5	-4	266	32	596	545
	48	7	105	0	14	365	105	3	1	-3	648	477	299	-7	-2	-1	-4	347	57	740	632
	72	23	143	4	11	620	143	21	-2	-5	712	823	383	-3	4	5	12	437	100	908	734
	96	3	185	1	16	790	216	7	-4	-13	745	988	412	-12	-10	-4	19	497	132	915	795
33653	24	10	14	12	171	192	20	2	2	-18	284	212	98	-2	-12	-2	1	202	5	-7	5
	48	10	110	14	304	241	17	5	4	-18	359	210	102	-3	-12	-4	8	239	8	-11	4
	72	12	189	16	333	292	24	13	14	-22	401	240	112	-3	-8	0	6	253	15	-10	1
	96	7	263	7	310	424	19	4	30	-21	412	245	107	-10	-15	-9	11	310	9	-11	-1
35016	24	30	111	10	-8	79	23	16	14	-13	363	26	81	12	7	5	7	74	159	272	280
	48	12	136	-20	-23	47	4	0	-3	-13	456	12	57	-8	-20	-23	0	232	199	453	400
	72	10	188	-16	-17	143	-14	-19	37	-6	492	78	57	-18	-22	-22	4	326	162	422	377
	96	13	223	-19	-19	197	-16	-23	52	-2	471	210	49	-20	-20	-25	0	309	147	372	342
35084	24	-5	155	14	38	213	148	18	15	29	317	178	192	-12	10	17	8	192	234	269	251
	48	-22	272	-7	12	316	245	12	11	49	491	245	210	-16	-11	-7	5	326	261	363	392
	72	-24	336	3	18	383	327	12	31	51	439	407	235	-17	-16	-16	11	392	276	368	392
	96	-20	407	4	21	456	416	19	59	56	471	606	255	-15	-15	-16	15	421	288	370	401
35912	24	26	96	17	180	184	40	10	6	-16	343	214	119	2	-5	0	6	217	12	24	4
	48	23	96	2	152	213	41	7	0	-19	419	226	116	-4	-19	-11	6	354	7	19	2
	72	21	131	2	196	251	45	5	0	-23	489	256	111	-4	-21	-15	11	377	7	19	-3
	96	17	168	11	244	305	52	6	4	-20	518	289	110	-3	-19	-8	23	414	14	21	6
51192	24	65	61	10	16	554	152	-5	13	-23	536	432	312	-21	21	-6	5	-23	-3	-5	6
	48	85	49	14	26	583	157	-4	-4	-20	592	453	303	-20	82	-6	21	-18	-5	-9	-4
	72	72	50	13	22	584	194	-16	-6	-23	649	467	297	-25	171	-8	26	-17	-11	-11	-7
	96	81	67	27	31	633	249	-7	2	-12	713	533	328	-20	233	3	38	-6	-3	-2	12
51288	24	6	91	24	10	273	180	-7	1	-2	460	108	76	0	1	-5	0	247	-4	-4	10
	48	17	238	47	25	650	433	8	-1	25	721	135	113	17	9	2	33	499	23	11	19
	72	4	405	38	21	960	710	-11	-15	29	763	615	102	3	-6	-14	28	634	5	-11	-12
	96	2	530	46	29	999	888	-14	-17	36	831	865	134	4	-6	-16	31	763	4	-11	-15

APPENDIX D

Data matrix of 23 regional strains and 2 reference strains producing a positive reaction in the A1 control well of the Biolog-GN microplate as recorded after 96 hours of incubation at 20°C. The presence or absence of a positive response to each of the 95 substrates was recorded as 1 and 0 respectively.

BIOLOG Identification (96 Hour Incubation)	Strain	A2 (α -cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 ((D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)
	17	0	1	1	1	0	0	1	0	0	0	0	0	1	0	1
	30	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	33	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
CDC Group DF-3	104	0	1	1	1	0	0	1	0	1	0	1	0	1	0	1
Kingella kingae	115	0	1	1	1	0	0	0	0	1	0	0	0	1	1	0
	119	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
	136	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
	206	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
Enterobacter agglomerans biogroup 2B	208	0	1	1	1	0	1	1	0	1	0	1	0	1	1	1
	213	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	214	0	1	1	1	0	1	1	0	0	1	1	0	1	1	1
Sphingobacterium thalpophilum	215	0	1	1	0	0	0	1	0	1	0	1	0	1	0	1
Sphingobacterium mizutaii	225	0	1	1	1	0	1	1	0	1	0	1	0	1	1	1
Acinetobacter radioresistens/genospcs 12	229	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
	233	0	1	0	1	0	0	1	0	1	0	1	0	1	0	1
Acidovorax	240	0	0	0	1	1	0	1	0	0	1	0	0	1	0	0
	260	0	1	1	0	0	0	1	0	0	0	1	0	1	0	1
Vibrio	269	0	1	1	1	1	0	1	0	0	0	0	0	1	0	0
Vibrio anguillarum	270	0	1	1	1	1	0	1	0	0	0	1	0	1	0	1
Acidovorax	273	0	0	0	1	1	0	1	0	0	1	0	0	1	0	0
	274	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
	285	0	0	0	1	1	0	1	0	0	1	0	0	1	0	0
	288	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0
	29659	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
	33414	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1

Strain	B5 (gentiobiose)	B6 (α -D-glucose)	B7 (m-inositol)	B8 (α-D-lactose)	B9 (lactulose)	B10 (maltose)	B11(D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (β-methyl D-glucoside)	C3 (D-psicose)	C4 (D-raffinose)	C5 (L-rhamnose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	D1 (acetic acid)
17	1	1	0	1	1	1	1	1	1	1	1	1	0	0	1	1	1	0	0	0	1
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
104	1	1	0	1	1	1	1	1	1	1	0	1	0	0	1	1	1	0	0	0	0
115	0	1	1	0	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
119	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
206	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
208	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
213	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
214	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
215	1	1	0	1	1	1	0	1	1	1	0	1	1	0	1	1	1	0	0	0	1
225	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
229	1	1	0	0	0	0	1	0	1	1	0	0	1	1	0	1	0	0	1	1	1
233	1	1	0	1	1	1	0	1	1	1	0	1	0	0	1	1	1	0	0	0	0
240	0	1	1	0	0	0	1	0	0	1	0	0	0	1	1	1	0	0	1	1	1
260	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0
269	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	1	1	1
270	1	1	0	1	0	1	1	1	0	0	1	0	0	1	1	1	0	0	1	0	0
273	1	1	1	0	0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1
274	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
285	1	1	1	0	0	1	1	0	1	1	1	0	0	1	1	1	0	1	1	1	1
288	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
29659	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
33414	0	1	0	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1

Strain	D2 (cis-aconitic acid)	D3 (citric acid)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (α-hydroxybutyric acid)	D11 (β-hydroxybutyric acid)	D12 (γ-hydroxybutyric acid)	E1 (p-hydroxy phenylacetic acid)	E2 (itaconic acid)	E3 (α-keto butyric acid)	E4 (α-keto gluctaric acid)	E5 (α-keto valeric acid)	E6 (D,L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 (quinic acid)	E10 (D-saccharic acid)
17	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	1	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
33	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0	0
104	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
115	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
206	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
208	1	1	1	1	1	1	1	1	0	0	0	0	0	0	1	0	1	0	1	1	1
213	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
214	1	1	0	1	1	1	1	1	0	0	0	0	0	0	1	0	1	1	1	1	1
215	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0
225	1	1	1	0	1	1	1	1	0	0	0	0	1	0	0	0	1	0	1	1	1
229	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
233	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0
240	1	0	0	0	0	1	0	0	1	1	0	0	1	1	0	1	1	0	1	1	0
260	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
269	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0
270	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
273	1	1	1	0	0	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1	0
274	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
285	1	0	1	0	0	1	0	0	1	1	0	0	1	1	0	1	1	0	1	1	0
288	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
29659	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	1	0	0	1	0	0
33414	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1

Strain	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alaninamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-aspartic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)	G5 (L-phenylalanine)	G6 (L-proline)	G7 (L-pyroglutamic acid)
17	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	1	0	1	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	1	0	1	1	0	0	0	1	1	0	1	0	1	0	1	0
104	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
115	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
206	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
208	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1	1
213	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
214	0	1	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1
215	0	0	0	0	1	0	0	0	1	0	1	1	1	1	1	0	0	1	0	1	0
225	0	0	0	1	1	1	0	1	1	1	1	1	1	1	0	0	0	1	0	1	1
229	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
233	0	0	0	0	0	1	0	1	1	0	0	1	0	1	1	0	0	1	0	1	1
240	1	1	1	1	0	1	1	1	1	1	0	1	0	0	0	0	1	0	1	1	1
260	0	1	0	0	0	0	1	1	1	1	0	1	1	1	0	0	0	0	0	1	0
269	0	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0	1	1	0	1	0
270	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	0
273	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	0	1	1	1
274	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
285	1	1	1	0	0	1	1	1	1	1	1	1	0	1	0	0	1	0	1	0	0
288	0	1	1	0	0	1	1	1	1	1	1	1	1	1	0	0	1	0	0	1	0
29659	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33414	0	0	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1

Strain	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D,L-carnitine)	G12 (γ-amino butyric acid)	H1 (urocanic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D,L-α-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
17	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
104	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
115	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
206	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
208	1	1	1	0	0	0	0	0	0	1	0	0	1	1	0	1	1
213	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
214	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	1
215	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
225	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	1
229	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
233	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
240	1	1	1	0	1	1	0	0	0	0	1	1	1	1	0	0	0
260	0	1	1	0	0	0	1	1	1	0	0	0	0	1	1	1	1
269	0	1	1	0	0	0	1	1	0	0	0	0	0	1	1	0	0
270	0	1	1	0	0	0	1	1	1	0	0	0	0	1	1	1	1
273	1	1	1	0	1	1	0	0	1	1	1	1	1	1	0	0	0
274	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
285	1	1	1	0	1	1	0	0	0	0	1	1	0	1	0	0	0
288	1	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0
29659	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1
33414	1	1	1	0	0	1	1	0	1	0	0	0	1	1	0	0	0

APPENDIX E

Data matrix of the average percent change in optical density values of the Biolog-GN tests results as recorded over a range of incubation times for 23 regional strains and 2 reference strains which produced a positive response in the A1 control well.

Strain	Time (Hours)	A2 (α -cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 (D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)	B5 (gentiobiose)	B6 (α -D-glucose)	B7 (m-inositol)	B8 (α-D-lactose)
17	24	26	22	19	2	-46	14	17	-3	4	-5	33	0	35	-9	27	50	35	13	72
	48	25	34	32	24	-49	14	28	-3	1	-2	24	5	54	-3	37	55	37	11	79
	96	31	45	50	44	-51	16	46	4	6	-2	32	8	72	6	55	64	47	16	93
30	24	5	97	49	153	85	17	25	10	23	26	2	13	14	24	28	18	70	16	26
	48	7	127	66	195	114	16	24	10	22	38	3	16	23	24	40	21	98	19	31
	96	8	174	102	304	268	21	31	17	25	54	-2	22	32	24	60	21	137	18	35
33	4	0	9	11	1	-28	2	16	6	13	0	10	-1	8	9	8	9	5	4	8
	24	-3	8	15	6	-41	0	5	1	11	-4	7	2	18	11	2	10	1	4	12
	48	1	10	21	12	-45	-1	8	1	12	-5	5	2	14	8	2	5	1	-2	5
	72	4	17	27	18	-48	4	12	8	17	-1	5	3	22	13	5	7	2	-1	2
	96	4	21	37	26	-52	8	15	14	21	0	6	5	28	19	10	12	7	2	7
104	4	21	38	34	17	-41	-5	11	3	46	-6	69	-25	29	6	41	64	57	-14	47
	24	21	82	41	35	-48	5	22	5	63	-1	132	-17	53	21	50	133	131	-3	122
	48	22	113	50	42	-48	3	24	1	121	-2	156	-20	67	16	61	167	174	-4	157
	72	23	131	61	48	-47	8	27	1	202	4	161	-20	74	11	74	171	183	-11	163
	96	33	147	77	55	-47	15	28	4	275	2	184	-20	92	17	100	190	203	-5	181
115	24	-7	13	18	71	7	11	4	18	44	17	11	5	14	25	12	13	19	16	7
	48	-7	19	25	89	1	6	2	13	38	19	8	7	18	28	8	16	28	20	5
	72	-1	27	33	95	7	10	8	17	48	21	7	11	25	34	13	22	35	23	12
	96	3	32	43	110	15	14	14	20	54	23	7	13	33	42	18	29	39	30	18
119	24	13	57	26	-9	-26	0	-16	-26	-9	-23	38	-10	-10	3	46	36	123	-11	-9
	48	5	54	23	-10	-35	-5	-20	-24	-11	-18	30	-7	-6	-4	41	34	118	-14	-3
	96	5	57	26	-7	-44	-5	-21	-22	-13	-17	28	-5	-1	-6	43	36	122	-14	3
136	4	16	8	11	45	2	3	3	3	4	0	3	7	4	9	6	7	11	6	4
	24	5	6	5	44	96	-7	-5	-3	1	-4	0	3	-6	1	-1	-1	6	-3	-3
	48	2	7	4	44	145	-9	-6	-4	-1	-5	-1	3	-6	0	0	-2	6	-4	-4
	72	2	5	5	44	183	-7	-4	-3	0	-5	-1	3	-6	1	1	-1	5	-3	-3
	96	-1	3	4	43	185	-9	-5	-4	0	-5	-1	2	-7	0	-1	-3	4	-4	-4
206	24	17	34	19	4	-65	11	42	13	24	10	31	5	50	39	45	63	67	8	62
	72	28	164	78	57	-71	34	122	21	31	26	37	10	87	65	82	76	105	20	76
	96	30	226	111	138	-72	42	188	26	35	32	34	14	114	72	102	78	113	22	79

Strain	Time (Hours)	A2 (α -cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 (D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)	B5 (gentiobiose)	B6 (α -D-glucose)	B7 (m-inositol)	B8 (α-D-lactose)
208	24	8	74	51	29	-47	-3	59	4	15	-6	64	0	72	28	45	84	73	0	84
	72	18	188	137	119	-54	29	180	10	32	11	228	9	144	69	119	174	159	9	186
	96	20	267	181	167	-55	45	281	16	40	17	322	12	165	80	159	236	224	13	245
213	24	-2	2	1	-55	-74	-7	-6	0	2	-5	1	0	6	0	-2	3	3	-1	0
	48	-2	7	7	-54	-78	-5	-6	2	11	1	4	6	8	6	4	4	8	5	2
	72	-3	11	12	-49	-79	-3	-5	5	19	5	6	8	10	10	9	6	11	9	5
	96	1	12	20	-39	-80	0	-4	7	34	10	10	12	16	15	12	9	15	14	6
214	24	10	37	17	22	-66	6	32	10	21	7	35	4	42	24	26	48	2	10	49
	72	20	130	68	85	-72	27	91	16	28	23	46	11	84	54	64	62	83	19	63
	96	22	172	93	128	-71	36	142	16	28	26	48	10	105	58	80	63	87	20	63
215	24	4	30	24	-13	-50	-3	16	1	27	-10	35	2	38	9	31	57	53	-4	51
	48	4	78	33	-10	-52	6	38	5	63	-3	69	2	70	18	65	10	92	-3	82
	72	4	90	50	-5	-53	4	47	4	94	-4	93	7	101	13	74	106	98	-9	95
	96	5	130	66	3	-43	14	95	4	139	3	143	6	151	19	118	150	135	-2	107
225	24	5	78	54	59	-32	6	66	6	21	-3	69	3	81	22	36	90	74	1	91
	72	15	198	140	148	-25	30	177	8	33	18	254	9	147	60	109	178	162	5	181
	96	18	259	185	198	-16	49	294	18	36	22	356	14	158	75	143	230	222	9	238
229	24	0	4	2	136	109	-3	3	2	0	-1	2	31	20	31	5	9	13	-4	4
	72	-11	15	5	154	135	2	7	8	-1	7	4	21	12	17	14	26	22	5	14
	96	-14	20	7	162	146	3	9	10	-1	9	5	20	9	14	19	35	29	7	18
233	24	-2	23	19	20	-29	-9	20	2	22	-13	22	1	27	14	27	37	46	-1	36
	48	12	84	11	12	-48	11	35	3	46	-10	55	1	45	16	52	89	79	-8	87
	96	12	63	32	95	62	-1	62	-3	120	-8	51	3	69	7	88	46	71	-16	51
240	24	2	-6	13	113	119	11	127	16	6	88	7	-8	162	12	-19	-2	49	20	3
	48	12	4	27	168	164	13	152	19	9	120	3	-3	165	4	-20	3	59	32	8
	96	9	-11	25	231	239	-14	269	-1	-26	188	-27	-10	251	-2	-12	-23	66	113	-4
260	24	-2	188	209	47	30	-5	197	2	14	-24	199	-28	191	10	154	48	159	-21	-12
	48	-3	238	291	91	94	-7	271	-1	4	-30	265	-26	262	14	222	56	186	-18	-3
	96	0	380	431	179	313	-2	394	5	-1	-26	394	-22	320	12	455	49	209	-19	347
269	24	-4	128	124	24	-15	-30	119	-15	-19	-34	10	-21	-1	-25	-19	11	105	-33	-23
	48	4	218	155	64	2	-27	213	-9	-8	-25	6	-7	17	-22	-14	10	216	-28	-11

Strain	Time (Hours)	A2 (α -cyclodextrin)	A3 (dextrin)	A4 (glycogen)	A5 (tween 40)	A6 (tween 80)	A7 (N-acetyl-D-galactosamine)	A8 (N-acetyl-D-glucosamine)	A9 (adonitol)	A10 (L-arabinose)	A11 (D-arabitol)	A12 (cellobiose)	B1 (i-erythritol)	B2 (D-fructose)	B3 (L-fucose)	B4 (D-galactose)	B5 (gentiobiose)	B6 (α -D-glucose)	B7 (m-inositol)	B8 (α-D-lactose)
	96	14	294	215	106	44	-5	248	-2	9	-18	13	4	28	-21	-12	5	238	-23	1
270	24	2	196	139	13	-12	-23	153	-2	5	-15	151	-20	147	-2	115	50	192	-32	-24
	48	2	307	235	61	48	-25	286	-1	-4	-18	296	-19	204	-4	206	55	259	-16	-2
	72	5	362	300	103	102	-20	347	10	11	-11	372	-20	208	1	340	71	282	-8	10
	96	-2	366	299	153	148	-22	359	0	-11	-22	352	-26	183	-15	377	45	262	-18	41
273	24	25	3	-4	106	101	-10	88	-7	3	63	-4	6	130	6	-6	39	42	61	-22
	96	30	23	7	212	213	-14	181	14	18	147	-5	14	234	20	9	59	97	117	-11
274	24	-3	7	1	59	-44	-11	-20	-17	-9	-18	-7	0	54	-9	-9	-17	-3	-13	-18
	96	-6	19	7	165	-36	-21	-11	-16	-11	-13	-10	10	77	-12	-13	-5	-3	-9	-19
285	24	-21	11	-8	93	97	-32	92	-9	-4	73	2	-20	46	13	-1	20	26	59	2
	48	-25	30	-2	150	149	-34	142	-1	-11	105	-3	5	94	18	4	33	68	94	6
	72	-14	43	8	201	193	-23	245	-1	-14	151	2	17	130	20	9	35	91	124	16
	96	-19	27	9	214	219	-16	329	-3	-12	270	4	11	225	14	7	35	93	265	12
288	24	4	13	5	-27	-36	-4	40	1	-5	-11	3	-4	6	0	3	8	33	-4	2
	48	5	28	21	-11	-29	-19	95	13	2	-5	-1	1	19	6	10	14	66	0	9
	72	1	55	30	6	-23	-20	113	14	-6	-10	-10	-7	27	10	17	13	83	3	14
	96	-5	76	72	27	2	-24	136	12	-10	-13	-15	-10	19	9	18	4	86	3	14
29659	24	-16	-7	-3	46	-23	-16	-2	-10	-4	-13	-9	4	-10	-4	-12	1	-8	-2	-1
	48	-2	0	2	73	-20	1	4	-4	-1	-13	-23	-7	-21	-12	-18	2	-11	17	4
	72	-5	-13	-3	51	-29	-15	3	-9	-17	-21	-30	-14	-13	-15	-7	-8	-14	-14	-23
	96	-11	-12	7	59	-27	-16	8	-12	-18	-24	-48	-6	-8	-12	-9	10	-20	-28	-31
33414	24	6	12	20	-4	-34	3	6	9	12	1	-2	29	30	18	12	9	13	0	0
	48	27	39	47	19	-25	20	30	12	33	14	1	28	25	18	29	10	22	-1	3
	72	63	70	91	50	-14	41	64	22	62	44	3	32	42	33	52	12	45	4	20
	96	88	71	117	76	-8	37	87	29	73	55	5	33	62	48	90	22	59	10	40

Strain	Time (Hours)	B9 (lactulose)	B10 (maltose)	B11 (D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (β-methyl D-glucoside)	C3 (D-psicose)	C4 (D-raffinose)	C5 (L-rhamnose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	D1 (acetic acid)	D2 (cis-aconitic acid)	D3 (citric acid)
17	24	48	44	13	27	55	50	9	27	8	-4	42	41	24	-6	-27	-12	36	7	9
	48	61	46	20	44	69	63	26	51	9	-2	46	51	36	-8	-23	17	26	6	10
	96	72	44	36	66	80	70	39	70	14	9	54	62	39	1	-22	36	36	8	18
30	24	17	86	14	2	34	31	24	11	36	17	78	76	58	19	115	55	56	27	25
	48	22	119	19	7	37	38	29	7	41	26	102	110	76	27	186	56	56	34	30
	96	22	162	24	9	39	40	27	15	41	28	136	157	88	37	258	58	68	37	30
33	4	17	2	0	11	2	3	7	7	0	5	7	7	6	0	-15	-10	1	0	5
	24	7	4	-2	3	4	13	11	4	2	1	7	7	4	0	-6	-2	10	15	8
	48	5	0	-5	2	6	9	8	3	-2	-2	5	1	8	-5	6	3	19	21	10
	72	14	2	-2	5	11	8	12	6	-5	1	-1	0	3	-6	15	6	3	24	16
	96	18	3	2	10	16	14	19	12	-2	7	6	7	10	-2	26	11	40	31	24
104	4	40	50	26	37	15	42	7	26	-12	-2	47	43	37	8	-14	-15	-16	-27	-26
	24	84	125	36	56	52	70	11	34	7	10	100	75	90	14	-13	1	-11	-10	-16
	48	119	158	65	90	84	84	14	35	7	2	117	118	118	12	-7	16	-4	-5	-15
	72	143	165	79	139	97	85	12	45	4	4	116	183	131	9	-8	23	-1	-8	-19
	96	189	189	102	179	119	112	14	65	5	8	144	203	171	21	1	28	4	-6	-15
115	24	22	15	18	17	5	-1	23	13	11	11	12	12	17	8	-14	-8	6	5	0
	48	22	22	24	19	3	-5	20	8	11	2	12	12	9	8	-15	-15	2	4	-3
	72	22	28	29	21	7	0	23	11	17	8	17	18	13	15	-9	-12	7	11	4
	96	31	34	36	23	9	5	30	16	23	12	22	25	19	21	-4	-10	9	17	11
119	24	-21	66	-24	33	-26	-23	-13	-18	-9	-17	-13	-13	-29	-31	-14	-3	2	-37	-29
	48	-21	63	-24	37	-23	-19	-14	-16	-4	-17	-13	-12	-35	-31	-20	-6	2	-35	-28
	96	-17	66	-22	33	-22	-18	-10	-11	2	-15	-10	-9	-37	-30	-20	-8	5	-34	-27
136	4	5	8	-2	2	10	9	15	10	9	4	14	11	9	-1	5	5	23	10	5
	24	-6	6	-6	-2	6	0	5	1	1	-3	5	2	2	-10	18	4	20	-6	-7
	48	-7	7	-6	-2	8	1	5	2	1	-2	24	2	1	-10	18	5	26	-6	-6
	72	-6	6	-5	-2	7	1	4	2	1	-2	9	2	1	-11	14	3	23	-5	-6
	96	-7	5	-6	-3	6	0	4	1	0	-3	12	0	0	-12	12	1	25	-7	-8
206	24	59	65	17	43	57	62	33	59	39	24	58	58	54	5	-5	17	59	32	27
	72	79	78	44	74	80	94	65	102	71	43	71	90	76	22	12	47	64	50	43
	96	86	80	51	93	98	107	76	122	79	51	74	95	77	26	15	70	68	56	50

Strain	Time (Hours)	B9 (lactulose)	B10 (maltose)	B11(D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (β-methyl D-glucoside)	C3 (D-psicose)	C4 (D-raffinose)	C5 (L-rhamnose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	D1 (acetic acid)	D2 (cis-aconitic acid)	D3 (citric acid)
208	24	80	79	17	54	74	74	18	77	30	13	78	79	80	5	-8	10	16	13	11
	72	174	178	62	173	162	168	52	180	142	33	183	178	174	25	33	43	53	39	26
	96	233	248	94	302	261	229	64	246	208	40	255	238	233	34	51	68	67	49	36
213	24	3	0	-5	-4	1	-4	9	3	-2	-3	0	-1	1	1	-21	-7	33	-9	-7
	48	5	4	3	-2	4	-5	15	5	6	-2	2	0	4	6	-25	4	36	-9	-6
	72	26	7	7	1	8	-5	19	7	9	-1	33	3	9	9	-26	10	39	-8	-6
	96	7	12	13	6	32	-2	27	10	15	2	4	6	12	13	-26	28	51	-3	-2
214	24	49	51	8	42	43	47	29	54	31	16	43	50	47	8	-13	18	36	19	17
	72	73	65	38	91	68	91	61	98	69	40	62	86	64	30	10	44	43	45	35
	96	78	66	46	132	74	106	67	112	79	42	62	91	65	32	15	59	41	47	37
215	24	25	63	-10	25	47	39	8	39	5	8	59	26	23	-14	-12	8	48	8	5
	48	62	105	-4	29	95	68	16	87	15	16	107	75	69	-6	-3	25	46	8	6
	72	88	134	-8	37	118	82	20	105	11	9	109	94	102	-7	-4	12	50	2	2
	96	125	158	-3	91	182	130	20	138	23	18	138	143	154	-2	5	17	65	10	11
225	24	88	93	11	67	85	81	25	85	26	13	82	75	88	5	-14	18	18	15	11
	72	171	182	52	185	179	180	64	175	135	26	188	175	178	21	15	55	50	41	24
	96	226	238	73	299	299	209	75	239	206	31	247	245	234	28	30	81	64	51	33
229	24	5	4	37	1	43	28	5	0	28	24	4	9	-3	-10	9	64	73	32	15
	72	23	15	32	-2	45	27	-2	8	33	29	12	29	5	-11	92	67	73	35	1
	96	30	20	30	-2	48	28	-2	11	44	38	16	38	6	-14	122	73	74	38	1
233	24	26	30	-13	32	46	27	8	22	7	11	16	2	3	5	-15	16	35	5	0
	48	75	87	-3	9	82	57	29	45	20	15	115	82	88	13	-10	18	16	3	8
	96	77	59	-13	75	110	62	4	81	-6	1	52	69	70	-2	-20	42	51	1	-3
240	24	9	-1	72	42	30	38	65	-14	30	111	58	60	41	14	19	151	126	19	-5
	48	18	2	109	42	27	30	48	-18	42	127	71	88	40	25	50	166	138	15	-5
	96	-6	6	187	22	17	30	22	-10	21	169	53	81	29	14	79	288	188	30	6
260	24	11	213	186	194	22	-24	63	5	-13	17	-8	184	-11	-9	107	-16	-15	30	12
	48	20	235	243	250	28	-21	75	0	-8	33	-2	253	-5	-4	136	3	25	58	36
	96	28	287	286	347	32	-24	69	-10	-11	41	4	361	-8	-10	153	3	88	120	178
269	24	-28	83	-20	8	0	24	-37	-13	-36	-20	-50	104	-20	-29	-19	25	21	-2	-11
	48	-16	169	-12	-8	2	115	-24	3	-30	-16	-41	223	-5	-20	6	44	35	13	-2

Strain	Time (Hours)	B9 (lactulose)	B10 (maltose)	B11(D-mannitol)	B12 (D-mannose)	C1 (D-melibiose)	C2 (β-methyl D-glucoside)	C3 (D-psicose)	C4 (D-raffinose)	C5 (L-rhamnose)	C6 (D-sorbitol)	C7 (sucrose)	C8 (D-trehalose)	C9 (turanose)	C10 (xylitol)	C11 (methyl pyruvate)	C12 (mono-methyl-succinate)	D1 (acetic acid)	D2 (cis-aconitic acid)	D3 (citric acid)
	96	4	304	4	11	3	233	-12	24	-26	-7	-25	243	18	1	39	69	57	3	-5
270	24	-1	164	176	170	15	-31	37	-9	0	65	192	178	-9	-12	103	-41	-22	20	3
	48	-2	238	276	246	13	-28	38	-7	-1	52	278	246	-7	-11	135	-19	-6	58	34
	72	6	280	306	290	18	-29	45	-2	6	61	338	313	1	-3	156	-13	16	85	67
	96	-16	250	282	283	17	-39	31	-11	-15	27	318	299	-10	-17	136	-19	23	87	186
273	24	-11	3	81	50	6	45	35	8	33	110	36	32	32	47	36	133	136	32	16
	96	14	21	153	59	39	57	51	24	51	214	62	72	61	74	80	146	188	52	29
274	24	-13	1	8	-2	9	-10	21	7	-16	1	10	-15	1	-18	11	-18	-12	-20	-18
	96	-8	6	8	1	19	0	17	15	-2	15	11	-11	-1	-6	24	-9	-21	-18	-15
285	24	10	2	68	28	40	-7	29	-20	-25	97	25	48	-21	31	51	69	90	1	-8
	48	14	19	113	32	52	25	38	-9	-5	153	120	115	-6	41	99	84	104	27	6
	72	20	33	153	35	53	41	47	-3	1	194	189	141	16	54	120	170	119	34	13
	96	17	39	246	24	50	41	47	-6	-5	258	250	152	25	52	121	246	131	39	11
288	24	-1	18	-7	2	-6	-1	-5	-2	-1	-4	-28	33	-2	-7	-24	-17	-12	9	-2
	48	8	56	-1	10	0	4	-2	6	8	5	-23	73	7	1	-16	3	-7	23	4
	72	15	87	3	-2	9	5	1	12	15	10	-22	91	13	7	-7	9	-4	31	9
	96	14	136	3	-8	12	0	1	12	14	10	-25	126	13	6	-3	5	3	51	8
29659	24	0	-9	-6	-14	1	-8	-10	-13	3	-8	2	0	0	-3	4	29	0	-16	-2
	48	16	-1	-10	-12	6	0	-8	-9	17	-27	6	4	12	8	6	46	6	-22	3
	72	-7	-7	-2	-24	3	0	0	4	7	-24	-2	-9	3	-1	5	37	10	-11	-16
	96	-19	-13	-2	-27	-6	-7	2	10	8	-14	-9	-30	-10	-2	-5	31	10	-10	-17
33414	24	5	4	1	9	10	26	26	7	8	12	9	12	9	-6	37	17	36	30	25
	48	11	15	8	12	10	46	17	28	20	1	18	25	17	2	73	20	37	55	54
	72	35	23	13	15	19	69	26	42	53	10	21	48	41	21	122	27	48	82	87
	96	48	43	29	15	26	83	43	56	74	24	29	68	53	45	141	32	56	100	123

Strain	Time (Hours)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (α-hydroxybutyric acid)	D11 (β-hydroxybutyric acid)	D12 (γ-hydroxybutyric acid)	E1 (p-hydroxy phenylacetic acid)	E2 (itaconic acid)	E3 (α-keto butyric acid)	E4 (α-keto gluctaric acid)	E5 (α-keto valeric acid)	E6 (D,L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 (quinic acid)	E10 (D-saccharic acid)
17	24	-34	-7	3	8	19	2	-14	-19	-20	-46	-5	-14	20	-30	10	0	63	-6	-4
	48	-28	-9	0	4	16	2	-5	-15	-14	-42	-1	-4	19	-23	11	-3	72	-1	-7
	96	-24	-5	7	16	33	9	3	-6	-7	-37	8	10	36	-16	32	7	100	13	1
30	24	127	3	18	29	19	12	20	3	34	20	67	23	38	5	25	29	56	17	18
	48	153	10	25	37	23	10	25	16	29	21	71	33	47	4	30	34	55	15	18
	96	176	10	23	52	21	18	27	26	24	24	76	39	43	10	39	38	85	25	23
33	4	-16	-1	6	5	6	10	-5	-9	-4	-23	48	-4	4	6	2	2	-2	8	1
	24	4	-12	0	2	5	5	-3	-8	-8	-18	60	12	3	10	12	5	8	10	-4
	48	8	-17	3	3	1	4	-2	-7	-8	-12	66	11	5	10	23	10	15	6	-5
	72	14	-14	9	8	-2	8	1	-6	-7	-11	75	7	15	16	34	16	17	6	-6
	96	23	-9	16	14	3	13	7	-2	-3	-7	89	13	28	25	47	26	25	12	-1
104	4	-33	-18	-12	-12	14	16	-11	-23	-22	-46	-22	-1	-5	-21	-2	-24	-4	-8	-1
	24	-26	-11	7	1	21	39	2	-16	-12	-30	-16	14	6	-16	15	-10	7	7	7
	48	-28	-10	25	4	18	48	12	-15	-11	-32	-18	10	7	-20	19	-5	12	5	9
	72	-26	-14	40	1	15	50	10	-19	-8	-31	-21	5	10	-17	18	-6	21	10	6
	96	-23	-5	66	11	23	54	7	-7	-9	-33	-15	3	10	-14	28	-3	36	14	6
115	24	-23	1	16	8	9	17	-1	16	-11	-15	16	-12	13	-11	-15	7	3	9	6
	48	-25	0	19	6	3	8	-2	13	-18	-19	13	-17	13	-19	-17	8	-5	2	6
	72	-22	4	27	8	3	13	3	19	-16	-15	20	-11	21	-14	-12	18	4	9	5
	96	-17	11	32	13	11	19	7	22	-13	-11	26	-5	29	-8	-7	27	13	15	14
119	24	-38	-34	-19	-18	-12	-21	-34	-18	-25	-47	-39	-32	-17	-28	-3	-25	29	-38	-25
	48	-41	-33	-24	-18	-13	-25	-34	-17	-24	-47	-42	-36	-15	-32	10	-23	40	-36	-23
	96	-41	-30	-24	-18	-11	-27	-31	-15	-26	-49	-42	-38	-13	-33	28	-21	53	-33	-21
136	4	8	2	11	8	7	7	2	12	-3	-8	24	17	4	14	0	1	19	8	2
	24	7	-6	-10	0	-6	-5	-2	10	0	-1	13	17	0	5	-1	-9	8	-1	-11
	48	8	-5	-10	1	-6	-6	-2	11	1	1	14	19	2	6	0	-8	11	-1	-10
	72	8	-5	-11	1	-6	-7	-2	10	0	-2	12	18	0	5	-1	-10	12	-2	-11
	96	7	-7	-11	-1	-7	-8	-3	8	-1	-4	12	17	-2	4	-3	-11	13	-3	-12
206	24	5	17	40	34	32	41	13	2	8	-8	5	5	35	12	36	20	44	28	15
	72	18	36	68	63	49	76	26	18	14	3	16	18	52	24	62	31	63	45	34
	96	19	42	84	72	59	91	29	20	20	7	20	20	54	30	76	35	56	51	38

Strain	Time (Hours)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (α-hydroxybutyric acid)	D11 (β-hydroxybutyric acid)	D12 (γ-hydroxybutyric acid)	E1 (p-hydroxy phenylacetic acid)	E2 (itaconic acid)	E3 (α-keto butyric acid)	E4 (α-keto gluctaric acid)	E5 (α-keto valeric acid)	E6 (D,L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 (quinic acid)	E10 (D-saccharic acid)
208	24	-3	4	35	12	9	34	1	-3	-6	-17	-3	-6	10	-24	21	1	25	7	4
	72	24	23	72	44	32	69	21	11	1	-3	13	19	28	-8	73	16	63	27	18
	96	33	29	85	57	41	86	28	15	5	2	21	28	37	-3	101	24	76	36	27
213	24	-17	-4	7	-4	-9	1	-3	-2	0	2	21	-16	-5	14	2	-3	13	-1	-2
	48	-15	-1	9	-4	-9	3	2	5	6	10	26	-11	-1	23	8	-3	9	2	1
	72	-13	0	12	-3	-7	6	5	9	10	15	28	-9	1	27	11	-1	18	4	3
	96	-10	5	14	0	5	9	7	13	16	26	35	-10	5	30	13	3	26	7	7
214	24	-3	10	30	24	16	29	7	3	3	-13	-5	3	20	0	26	13	23	14	14
	72	9	29	62	52	37	64	23	18	7	5	6	23	41	16	57	27	39	31	29
	96	11	32	74	59	42	79	25	20	7	6	7	24	43	21	67	29	36	33	31
215	24	-4	-7	6	0	1	0	-3	-8	-7	-27	15	-3	0	-4	6	0	22	-11	2
	48	-2	-2	7	4	1	10	2	-4	-1	-22	24	6	11	3	12	2	31	2	12
	72	-7	-9	-2	2	-3	12	5	-3	-8	-22	26	4	14	-3	7	-2	37	-2	7
	96	0	2	9	8	3	28	4	0	-4	-13	30	13	19	6	18	5	50	14	13
225	24	-3	5	22	14	13	30	4	-3	-5	-16	4	-12	9	-21	22	4	24	6	7
	72	20	17	54	42	33	65	18	9	1	-7	17	8	25	-9	68	17	55	23	20
	96	28	25	64	53	42	79	24	12	8	1	25	15	33	-4	98	25	67	31	27
229	24	-5	-6	7	6	6	3	18	29	-5	-25	24	21	17	23	17	9	36	7	-3
	72	0	3	17	11	4	1	17	34	-10	-21	32	0	3	21	20	5	31	3	-3
	96	0	4	22	14	3	1	15	41	-13	-19	38	-8	-5	19	21	3	25	-2	-4
233	24	-6	-3	6	4	-3	7	2	-2	1	-9	5	20	20	9	8	1	46	2	-11
	48	-1	-3	20	5	1	13	3	-6	-4	-18	5	13	23	5	12	6	88	7	7
	96	-1	-5	1	-2	-3	32	-5	-8	0	-2	5	8	23	6	3	-1	81	5	-2
240	24	-10	-11	-3	99	6	-9	82	154	22	18	54	95	14	116	24	5	167	70	-13
	48	-14	-18	4	136	4	-4	90	151	18	12	53	92	7	111	18	6	157	46	-13
	96	-12	-11	-14	241	4	-7	153	228	7	8	58	117	20	195	43	10	229	298	-7
260	24	24	-7	-15	178	-23	125	-8	-53	-22	-56	-19	-49	63	-49	130	-24	-5	-10	-18
	48	41	-3	-18	284	-21	261	-7	-47	-26	-56	-18	-48	109	-47	206	-20	20	-6	-12
	96	46	-6	-21	430	-16	360	-16	-45	-34	-51	-19	-42	262	-45	250	-12	96	-4	-13
269	24	-56	-22	-30	-20	-27	-27	31	13	7	-58	-13	-15	-13	-21	122	-21	-12	-29	-26
	48	-49	-16	-19	-10	-16	-20	40	15	4	-49	-1	-2	3	-5	224	-20	-6	-26	-18

Strain	Time (Hours)	D4 (formic acid)	D5 (D-galactonic acid lactone)	D6 (D-galacturonic acid)	D7 (D-gluconic acid)	D8 (D-glucosaminic acid)	D9 (D-glucuronic acid)	D10 (α-hydroxybutyric acid)	D11 (β-hydroxybutyric acid)	D12 (γ-hydroxybutyric acid)	E1 (p-hydroxy phenylacetic acid)	E2 (itaconic acid)	E3 (α-keto butyric acid)	E4 (α-keto gluctaric acid)	E5 (α-keto valeric acid)	E6 (D,L-lactic acid)	E7 (malonic acid)	E8 (propionic acid)	E9 ,quinic acid)	E10 (D-saccharic acid)
	96	-37	-15	-8	3	-3	-8	73	35	16	-39	10	-13	20	1	303	-10	5	1	4
270	24	-4	-4	-2	171	-9	-7	-21	-48	-26	-61	-22	-45	73	-32	140	-12	-49	-8	-16
	48	-20	3	-4	323	-4	1	-22	-43	-36	-58	-16	-40	197	-29	251	1	-43	-3	-9
	72	-21	10	2	392	2	8	-18	-39	-25	-57	-13	-38	255	-27	279	6	-29	3	-6
	96	-21	-5	-13	372	-10	-3	-28	-48	-32	-62	-22	-43	263	-37	258	0	-19	-8	-15
273	24	22	-23	8	85	14	8	87	86	-9	36	49	99	36	112	71	11	126	65	3
	96	38	-25	15	191	19	13	170	132	10	52	81	158	43	176	138	27	190	129	16
274	24	-20	-17	-16	-15	-14	1	-15	-17	-19	-25	-17	-22	-10	-25	-10	-28	-13	-17	-20
	96	-17	-11	-17	-14	-15	1	-21	-9	-11	-18	-12	-16	-11	-20	-12	-31	-4	-8	-18
285	24	8	-20	-21	85	-17	-16	75	75	0	-4	31	49	-30	94	50	-10	11	70	-14
	48	20	-9	-7	159	-9	-5	108	128	4	5	41	144	-13	142	113	1	38	119	-2
	72	33	-4	-4	208	-1	-1	131	159	4	5	47	170	2	168	137	5	49	313	2
	96	30	-8	-5	295	-7	-4	177	243	-2	8	47	174	1	155	141	0	52	341	-1
288	24	-48	-3	-4	-13	1	-3	-4	-25	-13	-34	-13	-10	8	-27	4	-3	-13	-5	-19
	48	-46	2	1	-2	5	2	9	-14	1	-32	-5	-2	25	-24	24	6	0	1	-5
	72	-44	6	6	3	8	4	13	-8	1	-26	0	3	45	-21	40	9	1	2	0
	96	-45	5	5	3	6	4	7	-10	-4	-28	0	-4	65	-22	56	9	5	1	-1
29659	24	-4	-17	-12	-12	-7	-13	-10	9	8	13	12	-25	-3	6	-15	-11	19	-3	-9
	48	-11	-26	-24	-19	-16	-19	-1	27	11	25	14	-19	-9	7	-17	-18	41	7	-5
	72	-9	-19	-31	-15	-21	-15	-13	12	-10	13	9	-9	-9	-4	-15	-23	33	-6	-9
	96	-9	-16	-32	-14	-23	-15	-13	11	-38	16	12	-10	-17	-8	-14	-20	33	-9	-9
33414	24	18	7	12	20	15	7	5	40	-2	0	48	33	27	44	18	10	13	16	8
	48	32	28	36	39	29	17	16	36	6	10	80	72	56	79	41	30	24	29	16
	72	50	26	64	76	56	38	40	50	10	28	125	103	79	109	68	54	57	58	24
	96	67	28	94	90	77	61	75	67	11	39	152	142	75	95	88	62	82	83	38

Strain	Time (Hours)	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alaninamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-aspartic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)	G5 (L-phenylalanine)
17	24	-64	3	-11	6	13	5	-11	1	44	22	22	50	28	22	13	-5	4	25	-9
	48	-66	4	-5	15	14	4	-12	0	42	36	37	65	39	39	35	7	2	37	-6
	96	-64	27	13	29	18	13	-7	7	55	84	58	89	65	82	82	35	11	64	6
30	24	-26	4	7	35	34	30	21	13	14	20	22	36	9	9	-1	17	25	15	9
	48	-17	7	11	43	33	37	18	13	14	26	23	40	13	11	-4	15	33	20	3
	96	-6	11	16	46	28	48	29	15	14	35	21	60	15	12	-2	23	35	17	6
33	4	-40	14	1	7	8	29	16	35	29	17	12	18	13	24	-13	11	5	13	8
	24	-44	10	-2	21	14	36	3	43	24	3	6	10	14	22	-35	8	2	11	-4
	48	-45	12	-2	23	7	36	4	37	28	5	8	7	20	27	-42	19	0	13	-5
	72	-46	12	3	21	9	38	10	40	35	7	6	9	23	33	-45	26	6	19	1
	96	-45	18	8	23	15	48	18	45	44	11	11	14	31	35	-43	34	11	31	9
104	4	-53	-1	-25	-23	-19	-14	-21	-9	-13	-36	-7	33	1	24	-16	-35	-26	9	-21
	24	-53	7	-21	-8	-9	-6	-22	1	-5	-37	-3	50	11	31	-11	-34	-21	21	-21
	48	-53	5	-23	-14	-21	-9	-23	-4	-10	-41	-5	43	15	28	-10	-36	-23	26	-22
	72	-53	4	-16	-12	-14	-10	-20	-5	-10	-39	-13	40	18	33	-9	-34	-27	23	-18
	96	-50	2	-11	-9	-10	-8	-17	-10	-9	-40	-7	45	19	32	-12	-34	-30	25	-17
115	24	-33	0	-9	-1	10	6	2	15	11	2	5	16	-8	6	-3	-3	0	6	1
	48	-35	-8	-13	-4	8	5	-3	15	-2	-1	3	6	-10	-4	0	-10	-4	6	-5
	72	-31	-6	-14	3	12	14	5	24	5	-3	11	11	-6	-2	2	-6	-3	12	0
	96	-27	-3	-13	8	19	20	14	29	13	3	17	16	-3	2	5	0	2	19	5
119	24	-48	5	-21	-27	-18	-2	-33	4	-3	11	9	21	6	28	-24	-35	8	14	-3
	48	-49	6	-23	-27	-17	-5	-36	2	-5	5	12	18	12	19	-27	-38	0	21	-9
	96	-48	5	-24	-23	-14	-7	-38	0	-7	5	11	19	13	22	-28	-38	-2	22	-10
136	4	-26	4	4	2	1	4	10	4	9	8	8	5	3	6	3	1	-3	0	-5
	24	-15	-5	-1	-4	-4	-1	0	-1	-2	-5	-5	-1	-3	-4	-4	-8	-5	-6	-15
	48	-16	-5	1	-2	-1	2	1	1	0	-4	-4	0	-3	-2	0	-6	-2	-3	-12
	72	-16	-5	-1	-3	-2	0	-2	-1	-1	-5	-6	-1	-4	-5	-2	-9	-4	-5	-13
	96	-18	-7	-3	-4	-3	-1	-3	-2	-3	-7	-7	-2	-5	-6	-2	-10	-5	-6	-12
206	24	-21	21	5	31	42	35	18	27	35	31	31	38	29	19	5	35	21	39	19
	72	-16	41	21	58	62	58	37	48	58	58	63	61	58	16	-3	42	40	72	35
	96	-15	49	29	68	71	69	42	56	70	72	78	75	69	17	-2	49	49	91	38

Strain	Time (Hours)	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alaninamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-aspartic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)	G5 (L-phenylalanine)
208	24	-35	10	0	16	31	10	1	9	12	6	32	59	17	37	-17	15	-9	24	-1
	72	-25	24	13	36	64	46	22	40	57	39	98	152	48	91	-26	25	10	69	15
	96	-21	31	20	48	78	65	30	59	80	58	126	208	59	126	-22	34	21	104	25
213	24	-47	3	1	-5	-2	10	-2	14	20	-2	12	6	8	19	-43	-1	-11	7	-15
	48	-46	5	2	-5	7	12	-1	15	29	2	14	9	11	19	-46	-1	-7	15	-9
	72	-45	6	4	-5	9	12	0	18	36	5	16	11	14	21	-48	-1	-4	18	-9
	96	-45	7	8	-3	12	17	7	25	44	10	18	15	18	27	-48	2	2	20	-7
214	24	-26	16	0	19	28	19	9	19	25	20	26	31	18	20	3	19	12	26	15
	72	-22	31	12	42	47	40	28	39	47	47	51	50	47	14	-8	27	31	54	28
	96	-22	34	16	47	49	47	31	44	53	54	66	59	56	8	-13	27	34	65	29
215	24	-35	0	0	8	7	20	-8	14	26	-15	3	56	14	29	8	-14	5	36	-8
	48	-29	0	-3	9	17	18	-5	13	33	-12	16	80	27	40	12	-11	10	58	-2
	72	-28	8	-2	3	15	17	-11	8	31	-11	18	84	30	42	27	-11	7	73	-1
	96	-29	4	5	12	23	25	-3	11	41	-7	37	102	37	59	92	-6	14	103	-3
225	24	-37	10	-1	14	27	17	4	8	16	7	33	63	15	38	-13	16	-8	25	3
	72	-28	26	9	33	55	42	16	39	53	38	93	160	42	92	-23	20	8	69	14
	96	-25	33	17	45	70	50	22	58	75	55	113	218	52	130	-21	24	16	106	23
229	24	-26	-1	3	24	8	8	-2	2	11	12	2	4	-3	3	4	-1	11	-5	-20
	72	-19	-8	-1	22	-4	-3	-10	-3	5	-5	-6	7	4	5	8	-2	1	-13	-17
	96	-14	-10	-1	17	-14	-8	-13	-5	2	-11	-8	9	5	6	10	-3	1	-17	-22
233	24	-32	7	4	3	15	19	-12	16	19	-17	8	34	6	38	0	-9	12	30	-14
	48	-25	1	-9	6	9	40	-19	17	39	-18	-4	32	13	40	5	-21	10	48	-12
	96	-25	17	5	-3	14	10	-1	9	29	-7	18	50	15	85	60	-3	3	83	1
240	24	30	57	106	28	19	58	68	83	56	96	25	38	-7	22	-16	-8	101	2	84
	48	36	70	112	10	-9	52	62	69	24	93	20	32	-8	27	5	-20	78	-6	58
	96	266	129	146	47	18	73	110	166	97	248	18	48	6	2	11	-4	166	-4	116
260	24	-64	92	43	17	23	25	69	147	143	135	57	109	121	121	5	3	-4	10	-2
	48	-60	130	55	22	30	38	113	225	241	212	127	177	194	183	22	9	1	14	3
	96	-51	173	70	34	39	44	282	448	437	503	389	385	315	347	129	14	-4	11	-3
269	24	-59	36	16	19	-34	22	13	72	83	89	43	107	38	107	2	-9	27	55	-29
	48	-53	53	18	37	-29	26	55	169	144	176	111	195	96	183	5	4	33	81	-21

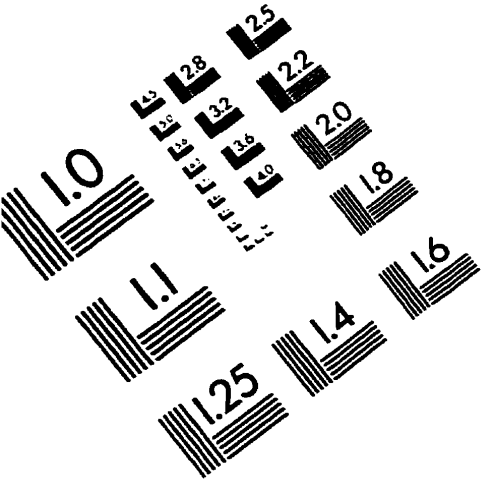
Strain	Time (Hours)	E11 (sebacic acid)	E12 (succinic acid)	F1 (bromo succinic acid)	F2 (succinamic acid)	F3 (glucuronamide)	F4 (alaninamide)	F5 (D-alanine)	F6 (L-alanine)	F7 (L-alanyl-glycine)	F8 (L-asparagine)	F9 (L-aspartic acid)	F10 (L-glutamic acid)	F11 (glycyl-L-aspartic acid)	F12 (glycyl-L-glutamic acid)	G1 (L-histidine)	G2 (hydroxy L-proline)	G3 (L-leucine)	G4 (L-ornithine)	G5 (L-phenylalanine)
	96	-31	165	45	35	-26	10	155	347	277	350	305	373	222	389	30	12	41	121	-13
270	24	-66	78	30	8	3	19	39	125	152	155	43	121	125	117	-5	-10	9	3	-21
	48	-62	145	48	25	13	46	90	220	269	260	107	222	196	246	22	8	30	17	10
	72	-59	162	53	29	15	50	183	340	297	383	159	300	308	316	52	13	28	17	11
	96	-63	132	36	23	6	45	256	338	351	410	346	339	282	311	90	6	28	14	12
273	24	43	66	104	28	32	47	45	91	95	110	33	52	11	42	26	9	93	14	86
	96	119	134	196	42	53	121	111	171	186	180	62	110	23	82	38	10	153	24	132
274	24	-51	-15	-3	-9	-12	-8	-10	-18	-47	-33	-10	-6	-13	-5	-4	-12	-10	-21	-24
	96	-51	-22	8	-6	-4	5	-8	-18	-48	-36	-10	-4	-4	4	-13	-7	-9	-18	-16
285	24	41	80	93	9	-20	33	58	36	70	102	25	46	-4	20	12	-17	76	-26	87
	48	77	144	140	18	4	103	111	56	118	153	49	93	13	42	20	-5	119	-6	128
	72	155	197	146	29	15	131	136	74	142	262	51	124	19	47	10	4	152	3	155
	96	266	179	146	31	9	145	143	76	132	269	45	154	8	47	8	4	296	-3	280
288	24	-63	22	9	7	-2	15	3	15	9	25	23	3	35	48	5	-2	9	4	-7
	48	-55	52	23	18	7	29	34	53	56	75	74	49	75	116	10	8	38	14	1
	72	-56	87	34	25	13	38	62	84	100	106	103	82	113	179	9	13	55	19	4
	96	-57	142	42	26	13	42	92	112	132	147	142	144	204	278	12	8	66	18	3
29659	24	-14	0	-3	-8	1	-2	-22	-15	-7	-2	-6	-11	-14	3	-5	-8	-6	-13	-13
	48	-1	2	-3	2	-10	6	-15	-26	-14	1	-12	-12	-12	15	-28	-10	-8	-18	-12
	72	-28	-27	-1	-1	-14	-4	-18	-28	-24	-9	-24	-12	-20	-19	-35	-20	-7	-18	-16
	96	-41	-43	4	-4	-19	-14	-14	-31	-23	-9	-26	-13	-35	-35	-34	-25	-13	-20	-28
33414	24	-34	5	1	35	4	35	34	31	25	-11	15	25	7	15	4	8	31	12	7
	48	-31	5	10	72	5	73	65	43	35	-15	32	37	24	23	14	17	39	35	22
	72	-15	14	14	115	19	120	66	48	39	-3	53	34	26	34	28	13	55	54	37
	96	-5	18	15	124	35	137	91	71	48	10	70	41	29	41	34	21	67	57	47

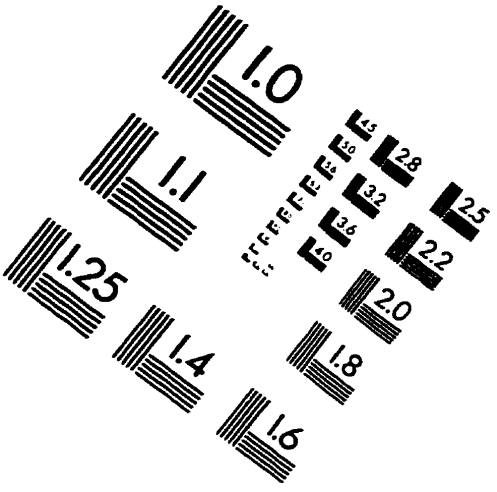
Strain	Time (Hours)	G6 (L-proline)	G7 (L-pyroglutamic acid)	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D,L-carnitine)	G12 (γ-amino butyric acid)	H1 (urocanic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D,L-α-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
17	24	-1	9	-5	-6	5	-7	-30	-19	-4	3	-2	-13	-10	3	5	-11	-3	11	-2
	48	11	9	-7	-1	11	-6	-33	-13	-6	-1	-1	-6	-7	4	10	-6	-4	16	-8
	96	45	21	1	7	27	3	-32	-4	6	2	4	5	5	10	23	13	7	42	11
30	24	59	37	20	43	8	12	19	15	16	25	34	-1	3	21	33	77	25	15	12
	48	80	39	18	47	13	15	22	22	18	20	38	-6	4	19	36	102	26	14	12
	96	121	36	21	50	18	16	33	35	34	27	52	-5	12	17	34	162	32	19	10
33	4	10	7	-9	26	9	0	7	-25	8	12	3	-6	13	1	1	7	3	6	12
	24	18	9	-36	25	-1	1	6	-17	12	131	-3	-8	9	-2	2	-7	-1	1	9
	48	23	7	-44	18	2	-2	8	-11	7	18	-2	-9	13	-1	10	2	-2	3	10
	72	29	7	-50	21	7	0	10	-5	8	25	0	-8	17	-2	12	3	1	5	8
	96	39	14	-51	26	14	0	12	3	11	35	4	-3	23	1	18	9	4	7	11
104	4	-24	-18	-30	2	13	-9	18	-31	-8	11	-13	-17	0	-20	-3	3	-5	34	14
	24	-2	-4	-35	4	16	-2	11	-19	0	13	-11	-8	2	-14	14	9	-1	46	21
	48	3	-5	-39	-2	13	-3	8	-11	-2	9	-10	-7	6	-13	15	13	-3	56	27
	72	1	-5	-36	-9	6	-4	12	-7	-2	12	-6	-1	9	-12	19	26	-3	74	29
	96	-1	-3	-34	-9	11	-1	16	-6	-3	9	-5	-4	8	-13	15	31	-4	86	26
115	24	15	2	-1	4	14	4	-2	-14	8	2	0	-20	-3	-14	-1	-1	5	0	12
	48	16	-4	-5	3	18	5	-6	-10	7	2	7	-24	3	-16	3	-4	7	1	10
	72	24	0	-5	8	18	8	-5	-6	10	7	11	-21	8	-14	7	0	11	4	12
	96	31	7	1	12	27	14	-2	-4	13	11	18	-17	14	-10	12	7	14	7	15
119	24	-11	-13	-24	-23	-32	-12	-17	-39	-3	-10	-17	-36	-12	-12	-40	-16	-14	1	-9
	48	-11	-12	-25	-26	-34	-10	-20	-45	-6	-8	-16	-36	-10	-15	-38	-11	-13	3	-9
	96	-13	-9	-26	-29	-35	-9	-22	-47	-6	-6	-15	-36	-10	-15	-34	-10	-13	5	-10
136	4	1	5	3	12	9	-1	3	-6	2	-2	10	-9	-1	-4	3	6	-1	-1	0
	24	2	-3	-7	6	-1	-6	-5	5	-6	-3	2	-10	-2	-6	1	7	-5	-5	-4
	48	3	-1	-4	6	1	-4	-3	10	-3	1	9	-6	4	-4	5	10	-2	-3	-2
	72	2	-3	-7	5	-1	-5	-5	5	-6	-1	6	-9	0	-7	0	5	-5	-5	-5
	96	1	-4	-8	3	-2	-7	-7	3	-7	-2	6	-10	-1	-8	-1	3	-6	-7	-6
206	24	33	23	20	32	23	10	12	-22	4	24	15	15	6	11	21	18	14	31	11
	72	53	37	26	48	43	21	23	-13	6	31	22	26	6	17	31	51	28	60	30
	96	63	42	29	54	61	24	28	-8	12	38	26	32	9	23	36	69	38	83	40

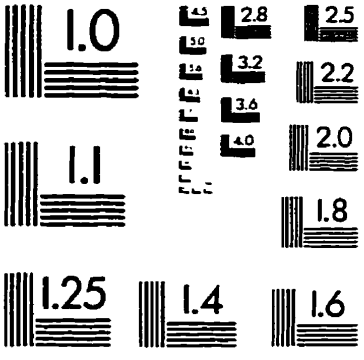
Strain	Time (Hours)	G6 (L-proline)	G7 (L-pyroglutamic acid)	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D,L-carnitine)	G12 (γ-amino butyric acid)	H1 (urocanic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D,L-α-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
208	24	19	10	3	2	10	2	7	-18	4	8	0	5	-3	-3	7	7	1	48	9
	72	54	25	17	24	40	12	16	-9	1	18	10	21	3	4	19	35	13	88	41
	96	84	38	28	35	58	22	25	-1	18	28	18	30	13	15	31	59	26	118	66
213	24	-2	0	-23	18	6	-2	-5	-9	-4	4	3	-17	-2	-11	0	4	-5	0	-1
	48	0	2	-25	24	11	0	-2	-2	5	5	9	-20	4	-9	-2	9	-1	2	0
	72	-1	3	-24	29	14	2	2	2	9	5	9	-21	7	-7	-1	12	-1	2	-1
	96	2	3	-23	33	21	5	10	7	13	4	5	-20	12	-7	-3	16	13	2	-1
214	24	20	17	11	22	11	4	7	-25	-5	9	5	1	-3	3	11	9	7	18	6
	72	39	32	15	41	20	9	18	-15	-3	12	10	6	-5	0	18	27	16	42	27
	96	33	34	14	43	33	4	17	-13	-4	9	4	1	-7	-3	12	39	19	52	35
215	24	4	4	-13	22	13	8	-12	-7	-1	1	2	-10	-6	-8	-5	12	3	10	15
	48	18	14	-15	24	12	15	-15	-5	-3	-8	-3	-7	-2	-6	-9	25	2	18	16
	72	26	9	-16	29	16	12	-14	-5	-5	-11	-8	-8	-5	-13	-7	37	7	21	22
	96	50	17	-13	29	19	22	-11	11	5	-4	-3	-5	5	2	-11	85	12	32	31
225	24	14	10	3	-3	8	2	0	-20	-1	2	-2	7	7	7	6	4	6	36	6
	72	51	24	12	15	34	7	6	-15	1	2	2	12	16	7	17	26	11	70	34
	96	60	32	16	27	47	10	13	-12	4	5	2	14	20	11	17	45	20	92	52
229	24	21	22	-6	-8	-4	-2	-2	4	16	8	33	-16	-9	-14	5	-1	-3	-6	-6
	72	17	10	-20	-4	-6	-1	-6	14	18	6	19	-18	-7	-17	-5	-1	-9	-8	-10
	96	16	2	-26	-5	-8	-1	-8	19	20	5	15	-20	-6	-23	-7	-1	-12	-10	-13
233	24	16	11	-16	21	0	-16	-7	-3	4	7	4	-14	-14	-6	2	3	10	12	6
	48	14	22	-22	13	-8	3	-15	-9	-10	-4	-7	-11	-15	-7	3	6	1	6	5
	96	51	5	-17	37	8	-3	4	2	3	1	-6	-6	-5	-6	7	62	22	30	16
240	24	105	51	32	61	69	-3	98	107	0	-2	-4	-4	25	62	132	116	18	-3	3
	48	64	20	14	41	62	-5	111	140	2	-9	-16	-23	34	56	65	154	12	-2	-6
	96	132	46	39	81	130	11	361	265	9	-8	1	-2	112	126	124	272	21	6	-2
260	24	68	1	2	126	113	-4	7	-2	262	156	147	-6	-20	0	21	154	93	175	193
	48	114	7	10	231	190	0	-1	4	338	222	174	-9	-21	-3	3	218	115	202	215
	96	291	14	18	403	359	-4	3	9	428	361	209	2	-3	-3	15	278	131	238	230
269	24	75	-8	10	89	61	-23	4	-21	138	52	23	-20	-28	-28	-60	-12	-4	-17	-3
	48	139	-17	11	191	166	-25	-4	-13	263	56	11	-22	-31	-22	-61	-1	1	-20	-5

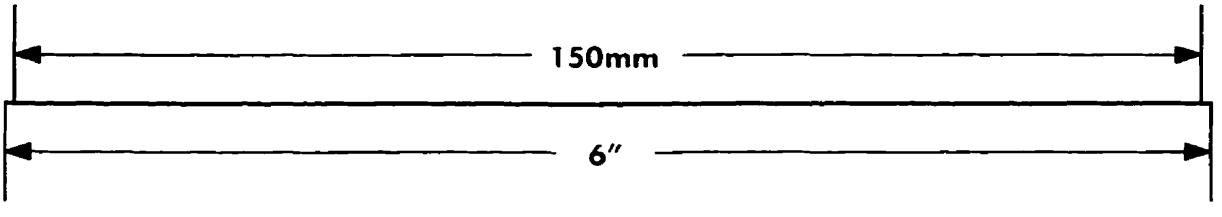
Strain	Time (Hours)	G6 (L-proline)	G7 (L-pyroglutamic acid)	G8 (L-serine)	G9 (L-threonine)	G10 (L-threonine)	G11 (D,L-carnitine)	G12 (γ-amino butyric acid)	H1 (urocanic acid)	H2 (inosine)	H3 (uridine)	H4 (thymidine)	H5 (phenyl ethylamine)	H6 (putrescine)	H7 (2-amino ethanol)	H8 (2,3-butanediol)	H9 (glycerol)	H10 (D,L-α-glycerol phosphate)	H11 (glucose-1-phosphate)	H12 (glucose-6-phosphate)
	96	255	-9	21	321	362	-14	20	16	257	75	10	-5	-1	-9	-41	52	40	-1	11
	24	51	-5	22	170	110	-17	6	-15	238	108	113	-20	-39	-4	-24	105	57	168	175
270	48	126	14	34	339	230	7	-20	-7	357	256	193	0	-30	12	10	298	170	247	241
	72	179	9	33	378	290	6	8	4	392	323	203	-2	-24	1	4	406	195	269	254
	96	271	6	22	346	344	-1	-19	-1	400	361	231	-1	-21	6	0	409	179	253	241
273	24	86	83	35	53	75	-18	24	90	-9	7	26	21	31	79	138	94	13	9	9
	96	119	100	55	101	132	15	40	216	0	-5	37	36	81	136	153	230	18	15	0
274	24	-17	-79	-22	5	-12	-15	-1	-4	-9	-7	-15	-19	-12	-21	-13	8	-17	-21	-14
	96	-13	-87	-20	7	-9	-7	7	1	-7	-6	-12	-10	-2	-19	-13	24	-12	-15	-20
	24	16	17	13	34	59	-9	6	86	-43	-8	-1	-12	24	14	-59	-2	-8	-9	-26
285	48	29	27	27	68	100	4	14	171	-7	-16	0	-4	50	42	-62	19	5	5	-21
	72	29	33	34	82	125	8	19	247	-10	-7	10	6	74	62	-63	32	5	2	-20
	96	13	17	31	89	135	-2	35	286	-14	-20	-11	-5	106	95	-65	39	-7	-7	-8
	24	15	-11	8	19	7	-6	1	1	24	11	8	-15	-13	-5	-11	-14	-8	0	-18
288	48	59	0	25	55	34	9	10	14	61	25	23	-10	-16	2	3	2	-1	10	-14
	72	99	5	28	95	43	10	7	9	101	31	24	-5	-22	0	3	4	-2	9	-15
	96	137	12	42	154	73	14	4	16	184	37	22	-5	-24	-1	3	6	-2	10	-17
	24	-6	-8	-7	-12	-12	-3	0	-4	-9	-3	2	-6	-21	-3	24	6	1	-7	6
29659	48	-21	6	-10	-4	-6	-1	7	-24	-8	-18	4	-8	-16	-7	12	2	-3	-10	-12
	72	-32	-13	-37	-7	-5	-18	-26	-24	-24	-32	-21	-34	-31	-24	-31	-17	-33	-26	-38
	96	-31	-21	-41	-20	-4	-13	-32	-18	-23	-34	-27	-39	-29	-18	-36	-11	-12	-15	-30
	24	28	2	30	35	30	3	4	8	11	12	13	-6	-1	-1	6	-23	-2	1	0
33414	48	23	3	43	44	46	21	0	22	39	14	27	-1	8	-1	27	1	5	8	1
	72	42	16	64	50	50	11	4	30	68	18	40	-1	15	3	55	18	9	8	-1
	96	64	31	82	58	56	18	6	38	93	21	48	0	20	5	68	35	14	8	0

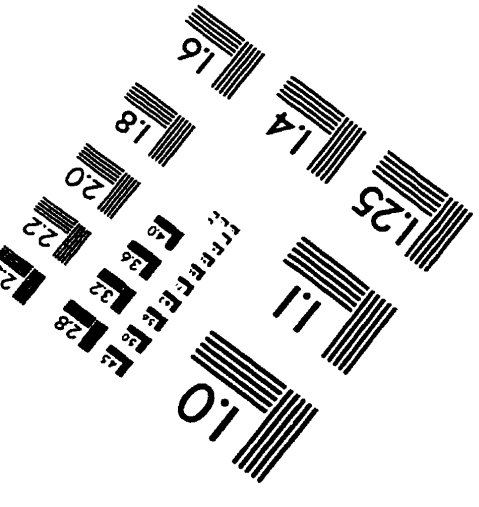
IMAGE EVALUATION
TEST TARGET (QA-3)

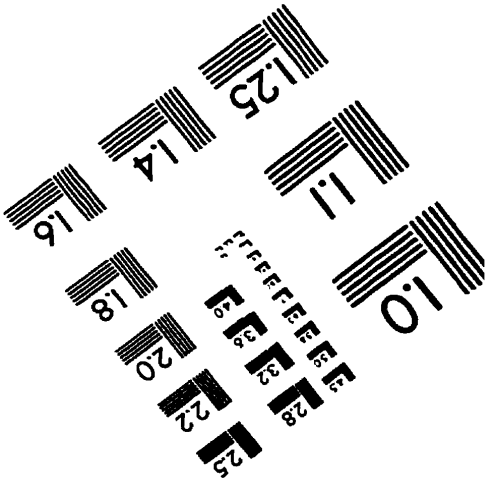












APPLIED IMAGE, Inc
1653 East Main Street
Rochester, NY 14609 USA
Phone: 716/482-0300
Fax: 716/288-5989