Science writer Meriel Jones takes a look at some papers in current issues of the Society’s journals which highlight new and exciting developments in microbiological research.

A sticky problem


Mycoplasmas are strange bacteria. They do not have a cell wall. Frequently live as parasites or commensals and glide sedately over surfaces. Typical bacteria propel themselves with flagella, but there is no sign of anything like this in mycoplasmas, neither on the bacteria nor among their genes, and mycoplasmas have long puzzled about the mechanisms.

The authors of this paper have been working on this problem for years. They study Mycoplasma mobile, which can be isolated from fish gills. The cells are flask-shaped and glide around in the direction of the apical end, which is therefore called a ‘head-like’ structure. The authors have identified minute spikes on the head-like structure that stick to glass surfaces and might be involved in motility.

To investigate this, they used antibodies to block the interaction between the spikes and the glass. Their reasoning was as follows. Antibodies are made by the immune system to stain and neutralize pathogenic bacteria. They could find an antibody that stuck to M. mobile, and also stopped the bacterial cells sticking to glass. They could use it to identify exactly what part of the cells adhere to glass.

After testing hundreds of antibodies, they found one, mAB7, with exactly this property. It stuck to the head-like structure only, especially the middle and basal part of it that the researchers dubbed the ‘neck’. Other antibodies also stuck to this neck or other regions on the surface, but the cells could still stick to glass. When the authors discovered that mAB7 interacted with the M. mobile protein Gli349, it fitted with information that mutant cells lacking this protein could not glide. Other antibodies reacted with four proteins on the cell surface from the M. mobile family, proving that they were part of the mycoplasma cell surface. M. mobile has genes for a further 12 closely related Mop proteins.

The authors have put all the information together to give a picture of the M. mobile surface. There are around 450 spikes made of Gli349 clustered on the neck of the cell, while proteins MopSP, MopM and MopP are present on the head. MopP and one further protein, MopK, are found on the body of the cell. The remaining 12 Mop proteins could either be on the surface, but were not detected, or may only be made by the cell in a different environment. Since the cell surface proteins, and adhesion, are essential to the parasitic, life-style of mycoplasmas, this knowledge is important for our understanding of these strange bacteria.

A complementary approach to systematics


An amazing amount of diversity lurks beneath the anonymous pale, slimy cell wall of many bacteria. Species that are more different than a carrot and an elephant can look the same to the human eye. Bacteriologists have put a lot of effort into detecting these differences, and objective ways to assess them. There is a long tradition of using methods that rely on hierarchical clustering to create taxonomies based on both genetic and biochemical characteristics. However, researchers have been aware for over 30 years that the order in which characteristics are grouped together can affect the outcome. Useful relationships may be distorted or missed.

These authors have been trying out alternative, complementary ways to classify bacteria from the Vibrionaceae, some of which are important pathogens of fish. A few years ago they recorded recorded genetic fingerprints from 507 strains, and classified them using a conventional method, Ward’s hierarchical clustering algorithm. Now, they have used a very different method on the same data, and found some interesting, different results.

The method optimizes a given expression in information theory. The authors chose to minimize stochastic complexity (SC), using the BinClass software package, written by Mats Gylenberg and his colleagues. To do this, they had to convert the data into a vectorized data representation. They already knew that the way they carried out the conversion was the final result, but that the sliding-window discretization procedure conserved more of the original information content than other methods, so they used it.

Many of the groupings produced by the two methods were exactly the same, but the SC method also disclosed new clusters that agree with recent information about Vibrio parahaemolyticus. For example, SC brought together strains that had been split into two clusters by the traditional hierarchical method.

Recent information about these strains has shown that they are definitely all the same species. One further SC cluster brought together V. vulnificus and V. harveyi. These species have turned out to be highly related, so it is possible that these four strains of V. harveyi have been misidentified.

The researchers feel that their two analyses of the Vibrio parahaemolyticus genetic fingerprints bring out the value of using two complementary approaches to reveal the most important information about bacterial relationships.

Filtering prions out of blood


The protein PrP that causes the neurodegenerative Creutzfeldt-Jakob disease (CJD) continues to surprise. For unknown reasons, it can change shape and form aggregates within the brain that result in the lethal neurodegenerative disease. Clinicians identify distinct types of disease (MM1 or MM2) depending on the size and location of the aggregates, the effects of proteinase K digestion and the numbers of sugar molecules attached to the protein. This group of researchers has been investigating how one protein can produce so many pathologies.

They focused on the size of the aggregates made by PrP, as this is also important in measures to prevent transmission. The researchers obtained obtaining permission to test brain samples from people who had died from CJD. They filtered extracts from the samples through filters that had pores of around 72 millonths of a millimetre. They already knew that some PrP could pass through these holes and the idea was to use this to check the size of the aggregates, identifying them based on proteinase K digestion patterns. The filters removed particles from patients with MM1 efficiently, while MM1 passed through. As a control, they tested an extract from a person who had died with signs of both pathologies in the brain. Again, most the particles typical of MM2 pathology were caught on the filter, while those characteristic of MM1 passed through.

The results suggest that there is a link between the type of PrP and the efficiency of appearance to filtration. The PrP aggregates in MM1 are generally small, consisting of fewer than 20 protein molecules, while those in MM1 are larger with up to 1,000 molecules. The authors concluded that filtration methods to remove PrPs form, for example, blood donations, should ensure that the smaller type of particles does not pass through.

Antimicrobial resistance in otitis media patients


Otitis media, or an infection of the ear where fluid and mucus are trapped inside the eardrum, is very common in babies and young children. In developed countries, three out of four children have suffered from this painful condition before they are 3 years old. One complication is that fluid can remain within the ear after the infection is over and may affect the child’s hearing. Several types of bacteria and viruses can cause the infection. The bacterial infections can be treated with antibiotics, but the infection sometimes recurs.

Izhak Brook and Alan Gober from the Georgetown University School of Medicine in the USA have been investigating whether the bacteria that cause recurrent infections are more resistant to antibiotics. They analysed nasopharyngeal cultures of 72 children who had appeared at a middle-class suburban clinic, suffering from uncomplicated otitis media between September 1999 and August 2001. Forty children presented with acute otitis media and 32 with recurrent otitis media that had been treated with the antibiotic amoxicillin. The researchers defined a recurrent infection as one that followed a previous ear infection with an infection-free interval of 4–6 weeks. The clinical microbiology showed that pathogenic bacteria such as Streptococcus pneumoniae, Haemophilus influenzae or Moraxella catarrhalis had been identified in swabs taken from almost all of the children. Tests of the resistance of the bacteria to antibiotics indicated that many more of those isolated from the recurrent infections were resistant to a broad range of antimicrobials. The amoxicillin therapy might have selected for these resistant strains.

The researchers suggest that for effective treatment of recurrent ear infections, clinicians need to be aware of the resistance patterns of organisms like S. pneumoniae and H. influenzae within their patient community, as well as any previous treatment the patient has received. In addition, antibiotic sensitivity testing of samples from the patient may be required to prescribe suitable therapy.

### References

- Mycoplasma mobile, 4001–4008.