

Did you know... by Jvo Siegrist (Sigma-Aldrich Chemie, GmbH, Buchs, Switzerland) – ivo.siegrist@sial.com

... **that spa pools could be dangerous?** The temperature and the circulation of water and air, along with dirt, hair, dead skin cells, etc. from bathers provide optimal growth conditions for *Legionella* bacteria. In June 2004, the BBC reported that an elderly man died after inhaling *Legionella* while shopping in a spa bath showroom.

... **why this novel genus is called *Cronobacter*?** Cronos, was one of the Titans of the Greek mythology who swallowed each of his children as soon as they were born. As *Cronobacter* species are harmful to neonates, the name was found to be adequate.

... ***Salmonella* can cause a chronic infection in some people?** These people are called **carriers** and can be a continued source of food contamination by excreting bacteria even though they are symptom-free.

... **the origin of the word *Vibrio*?** The bacterium was given the Latin name *Vibrio* because it possesses a flagellum and appears to vibrate.

... **that rRNA is decomposed rapidly in dead cells?** Ribosomal RNA disappears in a few hours, unlike DNA, which is quite stable outside of a living cell. This is the reason why PCR can give false positive results.

... **about 99 % of bacteria in nature cannot be cultured in a medium?** They are detected with the **FISH** method (fluorescence in-situ hybridisation) based on general probes labelled with fluorescence marker.

... **what *Campylobacter* means?** *Campylobacter* means "twisted bacteria" because these bacteria are spiral-shaped.

... **the L-form of *Listeria monocytogenes*?** ETH Zurich researchers have discovered a new life form of *L. monocytogenes*. The bacteria are in so-called L-forms and are able to reproduce and proliferate. The cell wall deficient cells are only surrounded by a single membrane, they are spherical and greatly enlarged. These cells cannot be detected with classical plating media.

... **that bacteria accounts for about 7 % of human body weight?** An adult person carries about 2.5-7.5 Kg of living bacteria in the intestinal tract. There are about ten times as many bacterial cells as there are tissue cells in the entire body.

... **that *Pseudomonas aeruginosa* build a protective biofilm?** In a biofilm they avoid attack from the body's immune mechanisms and antibiotics. New studies have showed neutrophil-induced biofilm enhancement due to incorporation of F-actin and DNA polymers into the biofilm, while poly(aspartic acid) and DNase were found to effectively prevent or disrupt biofilm formation. (Source: *Journal of Medical Microbiology*, Q. Parks *et al.*)

... **that *Bacillus cereus* can also be used as a probiotic?** Probiotic products consisting of bacterial spores of *B. cereus* strains are extremely sensitive to simulated gastric conditions and simulated intestinal fluids.

... ***Clostridium perfringens* has one of the highest reproduction rates in the bacteria kingdom?** Under optimal conditions, the cell doubles every 10 minutes!

... ***Streptococcus salivarius* K12 is a very beneficial probiotic?** It has been found that people who possess this bacterium in their natural mouth flora rarely become ill or suffered from other mouth ailments such as bad breath. This organism produces a bacteriocin-like inhibitory substance which helps to control the natural flora.

... **coliforms constitute just a small percentage of natural intestinal flora?** For example, only about 10 % of a calf's intestinal bacteria are coliforms. The number depends on the age and nutrition of the animal. While there are about 200 different species of microorganisms, coliforms are quite characteristic of faecal contamination.

... ***Staphylococcus aureus* is very specific to human blood?** *S. aureus* can hide in human cells in a dormant stage (in which only minimal essential metabolism remains active) for at least two weeks without being detected by the immune system and where it is shielded from antibiotics. In addition, *S. aureus* has a high specificity to human blood, as it shows an enhanced ability to bind hemoglobin derived from humans as compared to other mammals. The destruction of hemoglobin is essential for *S. aureus* to obtain iron for its metabolism.

... ***Aeromonas* is also a health threat to fish?** In aquariums and ponds, *Aeromonas* growth is inhibited by beneficial nitrifying bacteria, with which they compete for the same nutritional source.

... **since 2009, the search term "chromogenic media", has often been searched for on Google?** If you look at the Google statistics, you can find the first peaks in 2007 and 2008 for this topic, and since 2009, it has become a regular search term. Sigma-Aldrich has developed and added new chromogenic media to its microbiology products for 15 years. The range of products has grown to 3 chromogenic broths and 33 chromogenic agars.

... **an oxidase test was first described in 1928?** J. C. Gordon and J. W. McLeod (1928) wrote an article in the *Journal of Pathology and Bacteriology*. "The practical application of the direct oxidase reaction in bacteriology". At that time it showed a red colouration within one minute.

... **coriander helps against MRSA?** Scientists have found that the oil of the herb coriander can inhibit or even kill bacteria such as the resilient MRSA. The extracted oil is able to damage the membrane of bacterial cells.

... **that smokers are easier targets for bacteria?** According to a new study, it was observed that beneficial bacteria are inhibited in the mouths of smokers, resulting in greater susceptibility to other bacteria. (Source: *Science Daily*) Information about the ratio of beneficial flora in the lungs is not yet available, but this study may provide insight into the reason why *Legionella pneumophila* thrives in smokers' lungs.

... **Sigma-Aldrich provides thirty-seven different chromogenic media?** Over the past 15 years, we have continued to develop and add new media to our ever expanding product range designed to meet customer needs.

... ***Staphylococcus aureus* comes from the Greek roots meaning golden (aureus) grapes (staphylé) ball (coccus)?**

... **the combination of garlic and clove is able to kill 99 % of *Escherichia coli* in salami?** (Source: Institute of Food Technologists, 1998)

... **under normal conditions, a yeast cell can live up to two days and produce about 20 offspring?** But in this time it will have more than a 1,020 descendants.

... **using an infant formula with probiotics reduces the risk of diarrhea by nearly half when the baby has been prescribed an antibiotic?**

... **that *Bacillus subtilis* was involved in the testing of the New York subway system's vulnerability to a biological attack?** The organism was released to find out how many people would be killed in the event of a bio-warfare attack. The result? The entire system could be contaminated by the release of bacteria in just one train.

... ***Cronobacter* starts to multiply at low temperatures?** Below 5.5 °C no growth was observed but at temperatures between 5.5 and 8 °C the multiplication begins. Average generation times of *Cronobacter* is about five hours at 10 °C and only 40 minutes at 23 °C.

... **that our intestinal flora started mainly with bifidobacteria?** In adult intestines, only 3-6 % of the fecal flora is composed of bifidobacteria, while in breast-fed infants, bifidobacteria can constitute up to 90 %. With increasing age, the number of bifidobacteria decreases. It was observed that babies and adults with lower numbers of bifidobacteria have a higher risk for diarrhea and allergies.

... **without lactic acid bacteria we would not have any salami?** Samelis *et al.* found a total of 348 lactic acid bacteria from five batches of naturally fermented dry salami. They analyzed flora at various stages of ripening. (Source: *International Journal of Food Microbiology*, 79-96, 1994)

... **where it is most probable to find *Listeria*?** Here are the five most contaminated food types:

1. Canned and raw seafood.
2. Fruit of all kinds.
3. Foods that are refrigerated for long periods of time.
4. Preserved and smoked meats.
5. Root vegetables and soil-grown vegetables.

... **amphibians, such as lizards, frogs and turtles, are potential carriers of *Salmonella*?** There are several cases where a *Salmonella* infection is associated with amphibians kept as pets. It is highly recommended that you wash your hands after touching the animals and that you keep small children away from them.

... **Gram-negative bacteria are generally less sensitive to antibiotics?** The outer membrane of Gram-negative bacteria contributes to this intrinsic resistance by acting as an efficient permeability barrier, because the narrow porin channels limit the penetration of hydrophilic solutes and the low fluidity of the lipopolysaccharide leaflet slows down the inward diffusion of lipophilic solutes. (Source: *Molecular Microbiology*, P. Plésiat *et al.*, 1992)

... **the production of *C. perfringens* toxins starts under certain conditions?** Only one serotype out of five produces toxins, and the toxin production doesn't start until a concentration of 10⁸ vegetative germs per gram of food or beverage is reached.

... ***C. perfringens* is a special anaerobe?** It is a strictly anaerobic bacterium but is able to survive when exposed to oxygen for short periods of time. A complex adaptive response to reactive oxygen species was observed but not completely understood.

... **producing yogurt is very easy?** Just use some pasteurized raw milk and warm it up to 37-43 °C. Then add two tablespoons of fresh yogurt (fresh cultures ferment better) to 1 litre milk, and add some sugar if desired. Incubate 6 to 8 hours until it has the proper consistency. Be aware that, in most cases, fruit and other additives inhibit the fermentation process, so it is recommended that they be added after the incubation. It is important to let the fresh yogurt sit for at least one night in the refrigerator before eating.

... ***S. aureus* builds biofilms to protect itself?** In a biofilm (on any surface), the bacteria organize and build themselves protective substances like polysaccharides to elude attacks by antimicrobial agents such as antibiotics.

... **more than 5 % of false negatives pertain to the most important pathogens?** According to the American Proficiency Institute, a study with the four most common food pathogens – *E. coli* O157:H7, *Salmonella* spp., *L. monocytogenes*, and *Campylobacter* spp. –, showed that the average percentage of false negative results was consistently above 5.0 % for all four pathogens throughout the study period (data collection over 11 years). Mainly, the issues are seen with *Campylobacter* spp.

... **bacteria do not waste time and energy?** Generally, bacteria do not synthesize enzymes unless the substrates are present and they are needed. The regulation of the enzyme production is an interplay of substrates, inducers and inhibitors.

... **supplementation of Bolton broth with triclosan improves detection of *Campylobacter jejuni* and *Campylobacter coli*?** Using this supplemented broth, Korean scientists were able to find a significantly higher number of *C. jejuni* and *C. coli* positive samples than they did using the normally recommended Bolton broth formulation. At the same time, the predominant competing flora was also significantly eliminated. [Source: J-W Chon *et al.*, Supplementation of Bolton broth with triclosan improves detection of *Campylobacter jejuni* and *Campylobacter coli* in chicken carcass rinse, *International Journal of Food Microbiology*, volume 181 (2014)]

... **what "cholera" means?** "Cholera" comes from the Greek word meaning "bile" and is characterized by diarrhea and vomiting with bile expulsion.

... **Sigma-Aldrich counts *Listeria* bacteria and puts them in a disc?** Under the name Vitroids™, Sigma-Aldrich sells Certified Reference Materials, a unique microorganism standard with the lowest standard deviation and highest stability (sigma-aldrich.com/vitroids).

... **to protect food from *Listeria*, special bacteriophages could be taken?** The first products with specific bacteriophages are on the market to control *L. monocytogenes* in food and in food processing.

... ***Klebsiella* spp. increasingly developed an antimicrobial resistance?** *Klebsiella* belong to the family of *Enterobacteriaceae* and are a normal part of the human intestine. They can become highly resistant to antibiotics, and produce an enzyme called carbapenemase, which can destroy the carbapenems. Therefore, this group of antibiotics does not work for treatment.

... **some *E. coli* strains are probiotics?** Strains like *E. coli* Nissle 1917 are known to be beneficial to the human body. They are approved for use in the treatment and prevention of gastrointestinal disorders.

... ***Shigella* is genetically closely related to *E. coli*?** Both genera belong to the tribes of *Escherichieae*, but *E. coli* is biochemically very active while *Shigella* just ferments a few carbohydrates.

... **MRSA can remain in your body for your entire life?** Some people carry MRSA for a few hours or days, while others can carry it unaware for their entire lives since they do not have any symptoms.

... ***Cronobacter* can cause different kinds of infections, and symptoms vary with both the site of the infection and the age of the patient?** In infants, *Cronobacter* usually causes sepsis or severe meningitis, resulting in long-term neurological problems and a high mortality rate. *Cronobacter* can cause wound infections or urinary tract infections in all people. People who are immunodeficient and the elderly may also develop bloodstream infections due to *Cronobacter*. *Cronobacter* has also been isolated from the respiratory secretions of people undergoing mechanical ventilation.

... **some species of cyanobacteria can also be beneficial?** *Arthrospira platensis* and *Arthrospira maxima* were originally classified in the genus *Spirulina*, a classification which for historical reasons is still in use today. The dried powder of these cyanobacteria contains about 51-71 % protein (containing all essential amino acids), a lot of unsaturated fatty acids, diverse vitamins (B1, B2, B3, B6, B9, C, A, E) and also trace metals like calcium, iron, magnesium, manganese, zinc, etc. In addition, their diverse pigments may be beneficial to the human body, by increasing the bioavailability.

... **beverage-spoiling microbes are very thermotolerant?** Compared to pathogens or protozoans, vegetative cells from beverage-spoiling organisms are very heat resistant. Some lactic acid bacteria survive at 55 °C and some alicyclobacilli survive even up to 60 °C and are able to build extremely heat resistant endospores. (Sources: Tribst *et al.*, 2009; Lawlor *et al.*, 2009)

... **the colors of bacteria are also visible in nature?** There are diverse places in nature where you can see unusual colors, and in many cases, microorganisms are responsible for such phenomena. This is especially true in Yellowstone National Park where it is known that different visible colors come from different types of bacteria.

... **quinoa is a complete protein source?** The human body needs 22 different types of amino acids. Thirteen of those can be synthesized within the body (known as non-essential amino acids), but the other 9 essential amino acids must be obtained from food. It's these essential amino acids that define the classification of protein as either a complete or incomplete protein source.

... ***C. jejuni* lacks many of the common metabolic pathways?** Usage of glucose, galactose, or other carbohydrates is not possible. It does, however, make efficient use of citric acid cycle intermediates and various amino acids.

... **humans get used to the bacteria in their water?** In fact, many people become immune to bacteria that are typically present in their own water (National Groundwater Association, Ohio). Guests, infants and people with deficient immune systems may experience some gastrointestinal distress such as diarrhea or gastroenteritis.

... ***in situ* hybridization is seen as one of the most interesting potential methods for detection of coliforms?** The enzymatic method, which has been improved over the past few decades, is still expensive, as is the complicated PCR. In addition, the detection of the lowest cfu and same-day results with a quantitative analysis is not easy. Even though many innovative bacterial detection methods have been developed, few have the potential for becoming a standardized method. (Source: Rompre *et al.*, 2002)

... **in 1918, Nobel Prize winner Richard Zsigmondy developed the first membrane filters for commercial use in the pharma industry?** After the observation that *Pseudomonas diminuta* (now *Brevundimonas diminuta*) could pass the 0.45 µm pore filters, the standard for sterilizing changed to 0.2 µm filters.

... **why the WDCM (World Data Centre for Microorganisms) reference strain catalog was built?** The intention was to enable broader and easier access to the reference strains listed by the ISO TC 34 SC 9 Joint Working Group 5 and by the Working Party on Culture Media of the International Committee on Food Microbiology and Hygiene (ICFMH-WPCM) in their publication *Handbook of Culture Media for Food and Water Microbiology*. It fulfills a need expressed by these bodies for a unique system of identifiers for strains recommended for use in quality assurance.

... **microbiologists are seen as traditionalists?** Since microbiologists continue to work with plates and use methods developed by Robert Koch in the late 1800's, many people view them as traditionalists. They predict that in the future, classical methods will no longer be used. However, microbiologists and bacteria laugh at these experts.

... ***Acinetobacter baumannii* is easily spread in hospitals?** A study found that approximately 40 % of protective gowns and gloves worn by healthcare workers who were exposed to patients with multidrug-resistant *Acinetobacter baumannii* became contaminated during contact. (Source: Morgan *et al.*, 2010)

... **that the viable but nonculturable state was discovered and defined in 1982?** Xu and coworkers introduced the term "viable but nonculturable bacterial cells" to distinguish particular cells that could not form colonies on solid media but retained metabolic activity and the ability to elongate after the administration of nutrients. Since then, many bacterial species have been found to exist in such a state.