Beneficial bacteria in the environment and their uses

In today's world, the environment and its related issues are steadily gaining a lot of importance.

Some bacteria are helpful and are used to obtain balance in the environment. It has been seen that helpful bacteria are useful in dissolving organic sludge from water, breaking down the growth of algae, reducing the various noxious odours such as hydrogen sulfide odours, reducing ammonia levels, promoting faster growth of fish in the water body and also defeating unhealthy bacterial growth in the water body. Bacteria and soil In an environment, all types of life occur in cycles. When a plant or animal dies, it is replaced by another and the cycle continues.

Decomposition occurs when a plant or animal dies. This is the process in which dead organisms are broken down to their basic elements. Streptomycetes are bacteria essential to decomposition found naturally in soil and are responsible for breaking down decaying plant and animal matter. Without this bacteria, dead matter would quickly build up throughout the environment.

The process of the breakdown by streptomycetes releases nutrients into the soil, which allows new life to grow. Bacteria can break down organic compounds at remarkable speed and help us in our waste processing and bioremediation activities. Bacteria are frequently used for cleaning up spills. They are useful in cleaning up toxic waste.

Uses of good bacteria in the human body. Gut Flora. Gut flora consist of microorganisms that live in the digestive tracts of animals and it is the largest reservoir of human flora. It is estimated that these gut flora have around hundred times as many genes in aggregate as there are in human genome. Though people can survive without gut flora, the microorganisms perform a host of useful functions such as fermenting unused energy substrate, training the immune system, preventing growth of harmful and pathogenic bacteria(Guamer F, Malagelada JR, february 2003), regulating the development of the gut, producing vitamins for the host such as biotin and vitamin K and producing hormones to direct the host to store fats. However, in certain conditions, some species are thought to be capable of causing diseases by producing infection or increasing the risk of cancer in the host(Guamer et al 2003).

Over 99% of the bacteria in the gut are anaerobes but in the caecum, aerobic bacteria reach high densities(Guamer). Most of the species of bacteria that exist in the gut which have been identified belong to the genera Bacteriodes, Clostridium, Fusobacterium, Eubacterium, Ruminocococcus, Peptococcus, Peptostreptococcus and Bifidobacterium(Guamer). Other genera such as Escherichia and Lactobacillus are present in lesser amount. Without gut flora, the human body would be unable to utilize some of the undigested carbohydrates it consumes because some types of gut flora have enzymes that human cells lack for breaking down certain polysaccharides(Sears, C. L, October 2005). Rodents raised in a sterile environment and lacking in gut flora need to eat 30% more calories just to remain the same weight as their normal counterpart(Sears, C.

L, October 2005). Carbohydrates that humans cannot digest without bacterial help include certain starches, fibre, oligosaccharides and sugars that the body failed to digest and absorb like lactose in the case of lactose intolerance and sugar alcohols, mucus produced by the gut and proteins. A further result is flatulence, specifically the metabolism of oligosaccharides(notably from beans) by Methanobrevibacter smithii.. Bacteria turn carbohydrates they ferment into short chain fatty acids(SCFA) by a form of fermentation called saccharolytic fermentation.

Products include acetic acid, propionic acid and butyric acid. These materials can be used by host cells, providing a major source of useful energy and nutrients for humans, as well as helping the body to absorb essential dietary minerals such as calcium, magnesium and iron(). Gases and organic acids such as lactic acid are also produced by saccharolytic fermentation. Acetic acid is used by muscle propionic acid helps the liver produce ATP and butyric acid which provides energy to gut cells and may prevent cancer. Evidence also indicates that bacteria enhance the absorption and storage of lipids() and then facilitate the body to absorb neede vitamins like vitamin K. Another less favourable types of fermentation, proteolytic fermentation, breaks down protein like enzymes, dead hosts and bacterial cells, and collagen and elastin found in food and can produce toxins and carcinogens in addition to SCFAs.

Thus, a diet lower in protein reduces exposure to toxins. Beneficial flora increase the gut’s absorption of water, reduce counts of damaging bacteria, increase growth of human gut cells and stimulate growth of indegenous bacteria. Another benefit of SCFAs is that they increase growth of intestinal epithelial cells and control their proliferation and differentiation. They may also cause lymphoid tissue near the gut to grow. Bacterial cells alter intestinal growth by changing the expression of cell surface proteins such as sodium/ glucose transporter. In addition changes they make to cells may prvent injury to the gut mucosa from occuring.

Another important role of helpful gut flora is that they prevent species that would harm the host by colonising the gut, an activity termed as the " barrier effect". Harmful yeasts and bacterial species such as Clostridium difficile(the over growth of which can cause pseudomembranous colitis) are unable to grow excessively due to competition from helpful gut flora species adhering to the mucosal lining of the intestine, thus animals without gut flora are infected very easily. The barrier effect protects humans from both incading species and species normally present in the gut at low numbers, whose growth is usually inhibited by gut flora. Helpful bacteria prevent the growth of pathogenic species by competing for nutrition and attachment sites to the epithelium of the colon. Symbiotic bacteria are more at home in this ecological niche and thus more successful in the competition.

Indegenous gut flora also produce bacteriocins, which are proteinaceous toxins that inhabit growth of similar bacterial strains, substancess that kill harmful microbes and the levels of which can be regulated by enzyme produced by the host(). The process of fermentation, since it produces lactic acid and different fatty acids, also serves to lower the pH in the colon, preventing the proliferation of harmful species. The ph may also enhance the excretion of carcinogens. Gut flora have a continous and dynamic effect on the host's gut and systemic immunity. The bacteria are key in promoting the early development of the gut's mucosal immune system both in terms of its physical components and function, continue to play a rolelater in life in its operation. The bacteria stimulate the lymohoid tissue associated with the gut mucosa to produce antibodies to pathogens.

The immune system recognises and fights harmful bacteria, but leaves the helpful bacteria alone, a tolerance developed in infancy. As soon as an infant is born, bacteria begin colonising its digestive tract. The first bacteria to sttle are able to affect the immune response, making it more favourable to their own survival and less to competing species, thus the first bacteria to colonise the gut are important in determining the person’s lifelong gut flora makeup. However, there is a shift at the time of weaning from predominantly facultative aerobic species, such as Streptococci and Escherichia coli, to mostly obligate anaerobic species. Recent findings have shown that gut bacteria play a role in the expression of toll-like receptors(TLRs) in the intestines, molecules that help repair damage due to injury. Bacteria can influence the phenomenom known as oral tolerance, in which the immune is less sensitive to an antigen once it has been ingested.

This tolerance, mediated in part by the gastrointestinal immune system and in part by the liver, can reduce an overreactive immune response like those found in allergies and auto-immune disease. Some species of gut flora, such as some of those in the Bacteriodes genus, are able to change their surface receptors to mimic those of host cells in order to evade immune response. Bacteria with neutral and harmful effects on host can also use these types of strategies. The host immune system has also adapted to this activity, preventing overgrowth of harmful species.

The resident gut microflora also have some metabolic functions in the body. They possitively control the intestinal epithelial cell differenciation and proliferation through the production of short-chain fatty acids. They also mediate other metabolic effects such as syntheses of vitamins like biotin and folate, as well as absorption of ions including magnesium, calcium and iron. The gut flora also plays a major role in metabolizing dietary carcinogens, the microcomponents and the macrocomponents. The microcomponents are genotoxic, and the major focus is on recent advances in heterocyclic amines (HCAs), which are produced by cooking proteinaceous food, such as meat and fish, which can induce tumors in organs like breast, colon and prostrate.

HCAs are naturally occuring therefore, the complete avoidance of them is impractical, which is why the mmetabolic function of gut flora of such components is of great importance to our body, as this would help in the prevention of such tumors that are difficult to avoid, the macrocomponents consists of the excessive intake of fat and sodium chloride, which can later promote tumors, such as in breasts and colons, from fat and gastric carcinogenesis from sodium chloride. Bacteria are also implicated in preventing allergies. An overreaction of the immune system to non-harmful antigens. Studies on the gut flora of infants and young children have shown that those who have or later develop allergies have different compositions of gut flora from those without allergies, with higher chances of having the harmful species, C.

difficle and S. aureus and lower prevalence of Bacteriodes and Bifidobacteria. One explanation is that since helpful gut flora stimulate the immune system and ‘ train’ it to respond properly to antigens, a lack of these bacteria in early life leads to inadequately trained immune system that overreacts to antigens. On the other hand, the differences in flora could be a result not a cause of allergies. Another indicatorthat bacteria help train the immune system is the epidemiology of Inflammatory bowel disease (IBD), such as Crohn’s disease(CD). Some authors suggest that SCFAs prevent IBD.

In addition, some forms of bacteria can prevent inflammation. The incidence and prevalence of IBD in industrialized countries with high standard of living and low in less economically developed countries, having increased in developed countries having increased the developed countries throughout the twentieth century. The disease is also linked to good hygiene in youth; lack of breastfeeding; and consumption of large amount of sucrose and animal fat. Its incidence is inversely linked with poor sanitation during the first years of life and consumption of fruits, vegetables and unprocessed foods. Also, the use of antibiotics, which kill native gut flora and harmful infections pathogens alike, epsecially during childhood, is associated with inflammatory bowel disease. On the other hand, using probiotics, bacteria consumed as part of the diet that impart health benefits(aside from just nutrition), helps treat IBD.