



# Probiotic News

**The following article is written by Dr Andrew Barnes**

**For seven years, a researcher into new vaccine development and the immunology of *Bacillus subtilis* spores (at Guy's Hospital, King's College London). Currently a freelance scientific consultant.**

## **Bacillus subtilis: From probiotic to modern medicine**

I first came across *Bacillus subtilis* when I was invited over to Vietnam, to give a series of lectures on the treatment and spread of HIV/AIDS, at the main hospital in Ho Chi Minh City. The Vietnamese took the approach that when a person became ill, they simply took one of every known antibiotic available (all of which were available from corner shops) and one would hopefully affect a cure. That way, there was no need to spend time and money on seeking professional medical help when suffering from illness. As a consequence, people regularly killed off their entire gut flora and so took *B. subtilis* to help repopulate themselves. This summarises in a nutshell, the dilemma that faced the scientific community back then, with regard to *B. subtilis*. It was taken to help repopulate the gut, yet *B. subtilis* is a soil organism that cannot colonize the gastro-intestinal (GI) tract.

*B. subtilis* needs to breathe air that contains oxygen (an obligate aerobe). *B. subtilis* is of course very small, so does not require lungs, but it requires oxygen just as much, and for much the same reasons, as humans do. The gut, however, contains very little oxygen, testified to by the methane generated in the hind gut (flatulence). The low oxygen levels make the gut a very bad environment for *B. subtilis* to grow. If the environment is not good for growth, *B. subtilis* 'sporulates' (changes into its 'spore' form, which is dormant and very hardy). Spores can remain dormant for many years and then germinate when the conditions are favourable. Because of the low oxygen (anaerobic) environment of the bowel, the majority of spores do not germinate and pass straight out again - at about the same rate as small polystyrene balls, if eaten, might be expected to do. It is therefore not at all obvious why someone who has killed the bacteria in their gut through the misuse of antibiotics would benefit from eating *B. subtilis*

Despite this, spores are taken throughout the world, (from south-east Asia to Mediterranean Europe) to achieve that very purpose. Can a million people all be wrong? (they were about the world being flat but not about aspirin in willow bark). Alternatively, if people by their millions are taking *B. subtilis*, should not the effects of their doing so, be scientifically established? Since spores do not stay in the gut long, they are far more straightforward to study than many other probiotic bacteria that do colonise the gut (such as *Lactobacillus* & *Bifidobacter* strains). Furthermore, if spores help to repopulate the gut, they achieve it without interfering with the levels of gut bacteria directly.

The only obvious mechanism by which they might achieve this is through the immune system. You might expect a non-pathogenic bacterium, such as *B. subtilis*, to be treated like food and get completely ignored by the immune system. This, as it turns out, is precisely what does 'not' happen. Recent scientific research has clearly established that spores are extremely good at stimulating the immune system, especially the innate immune system.

The innate immune system forms the oldest part of the general immune system. The cells within it are found in all animals that have a backbone (vertebrates) and the receptors they employ go all the way back to fruit flies.

However, far from being antiquated and useless, the innate cells are critical for telling the immune system how to respond in any given circumstance. Innate cells have been combating infections since before mankind and have become extremely effective at recognising the tell-tale structures found on pathogens. Because these structures are fundamental to how bacteria are made, all bacteria contain them, not just the pathogens. Furthermore, the body needs the stimulation provided by these structures to develop, coordinate and maintain a healthy immune system.

Stimulation provided by recognised bacterial structures, tells the body which parts are potentially exposed to attack and require special immunological protection. The gut lining acts as a barrier to bacterial invasion. However, this barrier would soon be breached, if it weren't for antibodies made by the immune system. Antibodies bind to bacteria and viruses to prevent them from being able to infect cells. Pathogens can provide the stimulation to make antibodies, along with the other aspects of host immunity, but will do so too late to prevent the infection from occurring. However, if 'friendly' bacteria, such as *B. subtilis* provide the stimulation, the same benefits are achieved, but without disease. Once stimulated, the immune system prevents bacteria and viruses from crossing the gut lining and regulates bacterial levels within the gut. The immune system achieves this to a large extent by making antibodies that selectively bind and inhibit pathogenic bacteria, but not the 'friendly' ones. Science has therefore explained why regularly eating *B. subtilis* helps regulate the repopulation of the gut with bacteria, despite the fact that the spores may neither persist or even germinate.

Innate stimulation such as the type provided by *B. subtilis* has been proven to be critical for the development and maintenance of gut immunity and through it a healthy balance of gut flora. Gut bacteria stimulate gut immunity, which in turn regulates the bacteria present. However, if this balance becomes skewed, due to e.g. a bad diet, excessive alcohol intake, stress etc., the consequences can result in many conditions including constipation, flatulence, indigestion, susceptibility to infection, etc. By supplementing a diet with bacteria, such as *B. subtilis*, many of these problems can be potentially reduced or circumvented entirely due to the gut being better able to regulate itself.

However, the science goes much further than this, and suggests spores could be used in a much broader context. Disease caused by *Clostridium difficile* has become a bigger problem than the infamous MRSA in hospitals today. *C. difficile* disease is caused by the use of broad spectrum antibiotics, killing the gut flora and suppressing gut immunity. Probiotics have been shown to be effective at treating the disease after antibiotics have been lowered or stopped. However, because spores are resistant to antibiotics and have no requirement for germination, *B. subtilis* could potentially be used during treatment and without taking the patient off the antibiotics.

Likewise, *B. subtilis* could also potentially be used to prevent illness due to external changes in bacteria. When travelling abroad, diarrhoea is commonly caused by drinking normal tap water (Delhi belly). This is because bacteria abroad, exhibit regional differences from those a person is used to. Natural antibodies differ from those made in response to an infection or a vaccine. They are preprogrammed into your genes because they bind to a wide range of pathogens that have been experienced in our ancestral past. Since *B. subtilis* spores stimulate the production of natural antibodies, they could prove highly effective at minimizing the impact of being populated by foreign strains of bacteria, either due to travel abroad or due to sudden outbreak.

**Footnote:**

*B. subtilis* has recently been evaluated and listed by the European Food Safety Authority as QPS (Qualified Presumption of Safety). In addition *B. subtilis* is rated as GRAS (Generally Regarded as Safe) by the Food and Drug Association (FDA) of the United States.

Bio-Kult is the leading practitioner probiotic in the UK for Intervention, with over six years clinical use.

It contains 8 strains of *Lactobacillus*, 4 strains of *Bifidobacter*, 1 *Streptococcus* and more importantly it's highest strength component is *B. subtilis*.



**Cambridge Bioceuticals Ltd**

38, Paddock Street, Soham, Cambridgeshire, CB7 5JB  
e-mail: [probio@bio-kult.com](mailto:probio@bio-kult.com), [www.cambridgebioceuticals.com](http://www.cambridgebioceuticals.com)

Issue 3