

BUGS

CV

We have received an enquiry from the following individual, name of *Lactobacillus acidophilus*. Claims to be a thoroughly good bug, doesn't harm anyone. Lots of relatives too, they call themselves probiotics, friendly bacteria. They say if you drink them (well a few million of them) you will feel the difference in a fortnight. The idea seems to be catching on, the probiotic drink market (*Yakult*,

Actimel, *TESCO Probiotics*, *Flora Pro-Active*) is increasing 50-70% per year and is currently worth £135 million in the UK alone. This applicant has impeccable credentials, has even had the genome sequenced. We have reproduced the CV below and would be pleased to hear from any friends and relatives or anyone who can support or reject these claims.

Name:

Lactobacillus acidophilus NCFM. I have sometimes been called other names like N2, NCK56, NCK45 and RL8K, but I'm really the same bug.

Address:

Intestines of healthy humans. I have been found in pigs and chickens and I'm commercially available as well (Rhodia Inc., Madison, WI). You might find me in cheese, yogurt and other products such as fermented milks, various probiotic yogurts, dried dietary supplements. With my friends and relatives, "the friendly bacteria", we are turning up in all sorts of products that claim to make you feel good.

Date of Birth:

I was first isolated from a human source in the early 1970s and was brought up in the food microbiology laboratories at North Carolina State University, Raleigh, NC by M. Speck and S. Gilliland (see referee 1).

Relatives:

I am closely related to *Lactobacillus acidophilus* ATCC 4356. Our genes are virtually the same so we look and behave the same. You may have heard of some of my *Lactobacillus* cousins: *helveticus*, *salivarius*, *casei*, *plantarum*, *fermentum*, there are lots of us.

Appearance:

I have a very smart appearance, long smooth Gram-positive rods with no slimy coat and no spores to disfigure me. I don't move but I can stick to human intestinal cells, Caco-2 and mucus-secreting HT-29 cells.

Properties:

I can grow at temperatures up to 45°C, and can survive quite well frozen for weeks at -20°C. When I'm dried I don't survive quite so well but I'm happy for months in the fridge as long as I'm in a yogurt. I can protect myself, I make lots of lactic acid (both D and L) and a little bit of hydrogen peroxide. I produce a small protein antibiotic called lactacin B that acts as a natural antibiotic, killing undesirable microorganisms. Some say I can remove cholesterol from growth media.

My genes:

I have just been sequenced (referee 2) so you can look up my entire genome (<http://www.ncbi.nlm.nih.gov/genomes/lproks.cgi>). I have 1.99 million base pairs, 34.7% of which are GC.

Background:

My family are known as the Lactobacillaceae and the *Lactobacillus* genus is the largest of the lactic acid bacteria group, with over 50 species in total, characterised by our metabolic products produced. We are commonly found in the oral, vaginal, and intestinal regions of many animals. We are important as industrial microbes, contributing to the production of many dairy products through the production of lactic acid, which inhibits the growth of other organisms as well as lowering the pH of the food product. I am best known as a normal inhabitant of the intestinal tract of humans. Although my presence in the human small intestine is generally linked with well-being, it is still a matter for debate whether my presence is the cause of feeling good. It is even less clear

whether drinking me and my friends really has a positive influence on human health. Are we supplied in sufficient numbers to survive a trip through the stomach?

Employment:

Lots of studies have been done on the effects of probiotics on health (see referee 3). The list of areas studied includes: hypertension; colo-rectal cancer; immune system stimulation; vaginitis; diarrhoea; antibiotic-associated diarrhoea; Travellers' Diarrhoea; rotavirus infections; small bowel bacterial overgrowth; lactose intolerance; hypocholesterolemia; urinary tract infections in women; miscellaneous cancer; antimutagenicity; and septicemia.

Referees

- 1 Gilliland SE, Speck ML and Morgan CG. Detection of *L. acidophilus* in faeces of humans, pigs and chickens. *Appl. Microbiol.* (1975) **30**:541-545.
- 2 Altermann E, Russell W M, Azcarate-Peril M A, Barrangou R, Buck B L, McAuliffe O, Souther N, Dobson A, Duong T, Callanan M, Lick S, Hamrick A, Cano R, Klaenhammer T R. Complete genome sequence of the probiotic lactic acid bacterium *Lactobacillus acidophilus* NCFM. *Proc Natl Acad Sci U S A.* 2005 **102**(11):3906-12.
- 3 Sanders MA and Klaenhammer T R. The scientific basis of *Lactobacillus acidophilus* NCFM functionality as a probiotic. *J Dairy Sci.* (2001) **84**:319-331.
- 4 where sequenced: http://www.calpoly.edu/~rcano/Lacto_genome.html