The Team:
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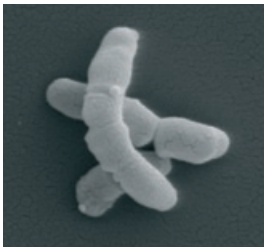
Institute of Microbiology and Biotechnology

Gene Structure-Function Relationship in Anaerobic Bacteria

Our research focuses on obligately anaerobic bacteria. Major projects include: cell differentiation (spore formation) in clostridia; regulation of acetone and butanol formation in *Clostridium acetobutylicum*; metabolic engineering of solvent-producing strains for industrial use (bulk chemicals and biofuel); construction and application of clostridial recombinant endospores for cancer treatment; and identification of acne-causing enzymes in *Propionibacterium acnes* for selective inhibition and hence disease therapy. We have extensive experience in the field of clostridial genetics, which includes developing techniques for transformation, electroporation, conjugation, transposon mutagenesis and mutant selection. Numerous genes have been cloned, sequenced, and analyzed. The genome of *P. acnes* has been sequenced. Metagenome banks are used as a source for novel enzymes (e.g. butanol dehydrogenases), and their analysis and improvement as a source for industrial application.

In the field of molecular medicine, two projects are pursued:
Clostridial endospores germinate only under hypoxic conditions, a situation found only in mammals and in proximity to tumours. Therefore, these survival forms are ideally suited for targeting solid cancer structures. If apathogenic clostridia are provided with genes that encode tumour-attacking proteins, the application of recombinant spores and their selective germination at the tumour allows multiplication and a specific therapy.



Propionibacterium acnes

P. acnes is the major cause of acne vulgaris, a skin disease affecting more than 85 % of all teenagers, of whom 10-30 % require medical treatment. Sequencing the genome of this organism has provided the tools for identifying pathogenic factors and then those agents that specifically inhibit them.

Selected publications:

- *Dürre P (2007) Biobutanol: an attractive biofuel, Biotechnol J 2, 1525-1534.*
- *Dürre P (2007) Clostridia: Encyclopedia of Life Sciences 2007, doi:10, 1002/9780470015902, a0020370.*
- *Theys J, Pennington O, Dubois L, Landuyt W, Anné J, Burke P, Anlezark G, Dürre P, Wouters BG, Minton NP, Lambin P (2006) Repeated systemic treatment cycles of Clostridium-directed enzyme prodrug therapy results in sustained anti-tumour effects in vivo, Br J Cancer 95, 1212-1219.*
- *Dürre P (2005) Handbook on Clostridia, CRC Press-Taylor and Francis Group, Boca Raton, USA.*
- *Brüggemann H, Henne A, Hoster F, Liesegang H, Wiezer A, Strittmatter A, Hujer S, Dürre P, Gottschalk G (2004) The complete genome sequence of Propionibacterium acnes, a commensal of human skin, Science 305, 671-673.*
- *Dürre P, Hollergschwandner C (2004) Initiation of endospore formation in Clostridium acetobutylicum, Anaerobe 10, 69-74.*