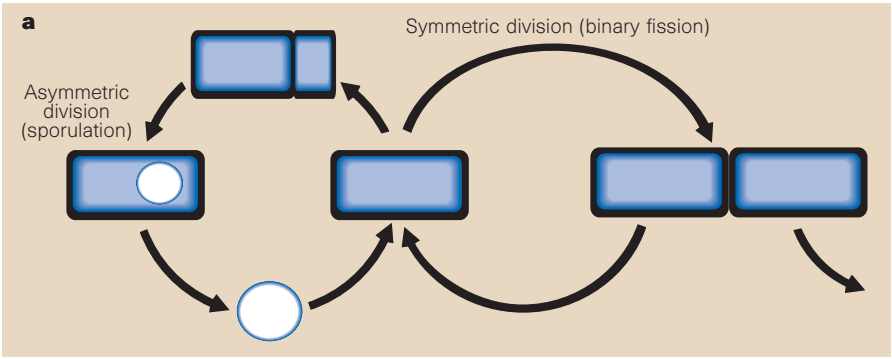

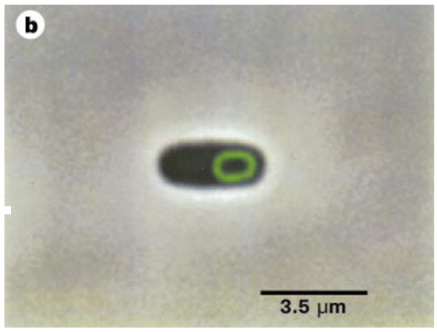

Figure 1a, **Asymmetric division (sporulation) and symmetric division (binary fission) in *B. subtilis*.** b, **During sporulation the nascent *B. subtilis* spore is pinched off within the mother cell to create a cell-within-a-cell. In the photomicrograph, the outer membrane surrounding the spore fluoresces green because of the presence of green fluorescent protein fused to a sporulation protein that localizes around the developing spore. (Courtesy of K. Price, Harvard University.)**

provides a solid basis for understanding the genes and genomes of other Gram-positive microorganisms.

Understanding the functions of newly identified genes through their close similarity (homology) to genes of known function is the basis of bioinformatics; the success of this is entirely dependent on how accurately the known genes have been characterized. With the completion of the *E. coli* genome sequence earlier this year[2], we now have the pre-eminent organisms of both Gram-positive and Gram-negative groups as reference standards for gene identification. Forty years of intensive studies into the genetics, biochemistry and physiology of *B. subtilis* provides a high degree of confidence in such comparisons, especially for Gram-positive microorganisms where *E. coli* information may be of only limited usefulness. Because of the large differences in the cell walls, cell membranes and surface structures of Gram-positive and Gram-negative bacteria, there will be discrete groups of genes unique to each (orthologues) that are likely to hold a rich repository of new targets for antibacterial agents. If the lesson from the *B. subtilis* genome sequence of multiple transport systems is a general phenomenon, then efforts to develop new classes of antibiotics against Gram-positive pathogens should be directed towards the discovery of agents that prevent these bacteria from exporting antibacterial compounds.

A driving force behind genetic, biochemical and cytological studies in *B. subtilis* has been interest in the mechanisms regulating sporulation[3,4], a developmental process where a cell undergoes metamorphosis into a dormant spore form that can resist extremes of environment (including, perhaps, those of interstellar travel). Because of this, we know more about gene expression during the post-exponential phase of growth in *B. subtilis* than in any other bacteria. Yet we are only now beginning to understand how sporulation is linked to DNA replication and the cell cycle. A fundamental question in bacteria, which lack a spindle apparatus, is how they segregate newly duplicated chromosomes. Recent advances in visualizing chromosome movement in *B. subtilis* and other bacteria has prompted a search for the chromosome segregation machinery[5–8].

The septation process during cell division also remains a mystery in all bacteria, but particularly in *B. subtilis*, which undergoes symmetric division (binary fission) during growth and asymmetric division during sporulation (Fig. 1a). A hallmark of sporulation is the process of engulfment (phagocytosis) in which the nascent spore is wholly pinched off within the nurturing mother cell to create a cell-within-a-cell (Fig. 1b). Yet little is understood about how the bacterial membranes mediate this remarkable example of prokaryotic phagocytosis. These and other fundamental problems pose challenges in research, the solutions to which will be greatly accelerated by the availability of the entire sequence of the *B. subtilis* genome. □

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Daedalus

Congealed fat

Our body fat melts at about 17 °C, so that the body can store it in liquid form. Cold-blooded creatures such as fish, and cold parts of warmer animals (such as the feet of cows), contain even lower-melting fats, so as not to risk their freezing in storage. People in cold climates slowly manage to shift the composition of their fat towards lower-melting mixtures, for the same reason. The process is slow, because fat tends to be stored direct from the diet, with whatever melting point it happens to have. Only gradually can it be optimized for the thermal conditions.

Daedalus is now exploiting these facts. He points out that many pure fats melt at well above the 37 °C of our body. Our fat melts at 17 °C only because it is a mixture, with a melting point lower than its components. So he is adding yet another complication to the current obsession with fats in our diet. As well as saturated, unsaturated, polyunsaturated, *cis* or *trans*, omega-3 or omega-6 fats, the dieter can now choose DREADCO's 'oligomolecular' fatty diet. It will contain only one or two specific fats (perhaps tristearin and tripalmitin), and will melt just below core body temperature.

The user's body fat will soon acquire this melting point, with remarkable thermal consequences. Our fat serves us as a heat insulator — which is why it is stored just under the skin. But oligomolecular high-melting fat will also act as thermal ballast. If its owner is exposed to cold, it will start to solidify. It will stay at its high melting point until it has given up all its latent heat of solidification — equivalent to maybe eight hours of the body's entire metabolic output. For all that time, even in the coldest environment, its owner will feel warm as toast. Then the cold will begin to bite seriously, and he will have to warm up again. A hot bath, or better, a bath with sustained heating, could quickly pump back into him the latent heat needed to remelt his frozen fat.

DREADCO's oligomolecular fat diet will transform our thermal resilience. No longer will we need to wrap up warm for short trips outdoors, even in the coldest weather. Traditional icy British bedrooms will lose their terrors; colds and 'flu, often triggered by sudden exposure to freezing conditions, will plummet. And snow clearers, refrigeration engineers, polar-bear hunters and pornographic film stars will be able to enjoy perfect immunity to cold for a whole working shift.

David Jones