One can envisage many additional applications for this polyketal, particularly for diseases with an inflammation component. For example, acute inflammatory diseases such as liver failure and lung disease — which lead to millions of deaths annually — could potentially be treated by the localized delivery of anti-inflammatory agents. Polyketal microspheres could be administered by direct portal vein injection to treat liver disease, or inhaled for lung disease. Other inflammatory diseases, such as rheumatoid arthritis, could benefit from the polyketals through localized intra-articular injection, thereby reducing systemic exposure to certain medicines that have unwelcome side effects. Further modification of the polyketals, to render them bioadhesive and stable in the gastrointestinal tract, could also help to advance treatments for inflammatory bowel disease.

Although the results reported here are very promising for the potential treatment of myocardial infarction, the development of controlled-release devices is not without its challenges. For example, the data presented by Davis and co-workers focus on a relatively short timeframe, and it is not clear what will be the long-term effect of this mode of intervention on the overall post-infarction health of the myocardium. Another challenge is how the treatment will be administered. Accurate injection will be a principal concern and specialized techniques may be necessary to administer the treatment precisely at the site of infarct, a difficult prospect particularly for an infarct on the back of the heart. Moreover, the administration of new biomaterials to humans requires the costly process of approval by the Food and Drug Administration. Nevertheless, this route to drug delivery represents a unique and creative approach for the potential treatment of myocardial infarction, an important prospect for millions of individuals.

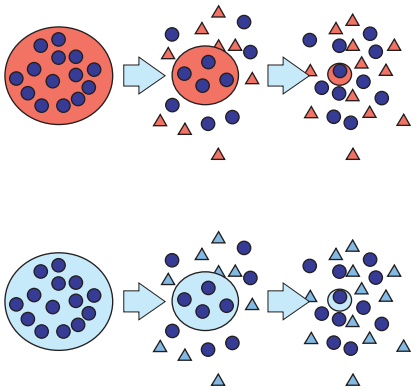

Figure 2 The embedded drug and matrix degradation products are released as the matrix erodes. **a**, From a PLGA matrix (red), the embedded drug (dark blue) and acidic matrix degradation products (red triangles) are released. The latter can lead to a local inflammatory response. **b**, From a polyketal-based matrix, the degradation products are neutral (blue triangles) and have no adverse effects on the surrounding tissue.

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MATERIAL WITNESS

A twisted tale

What do the crystal structure of strontium disilicide, liquid crystals used for electro-optics and the wings of the Green Hairstreak butterfly have in common? All can be mathematically described with reference to a three-dimensional network structure known as srs, as Stephen Hyde and his colleagues explain in a recent paper (*Angew. Chem. Int. Ed.* doi:10.1002/anie.200801519; 2008). The apparent unlikelihood of these connections — between very different kinds of materials structured at scales ranging over at least three orders of magnitude — is part of the point Hyde *et al.* seek to make. For the history of the srs structure is as tortuous as the system of interwoven passageways it can be used to describe, illustrating how understanding in one discipline could profit others if only their practitioners could find ways to talk to one another.

For crystallographers, srs is an old story: it was they, after all, who labelled the network after the strontium compound. The pioneer of crystal chemistry, Alexander Frank Wells, noted it in 1954, but the crystallographers Fritz Laves and Heinrich Heesch identified it 21 years previously when studying the packing of spheres. The structure, sometimes called a Laves net, is easier to look at than to describe: a periodic arrangement of linked vertices, its framework corkscrews through space, exhibiting fourfold symmetry along some axes and threefold along others. This twist makes the structure chiral, and the net of opposite chirality can be perfectly interwoven with it, as Wells recognized.

That's where the next element of the story enters. In the 1960s, NASA physicist Alan Schoen discovered a labyrinthine, curved surface that divides space into two interconnected systems of channels, whose centres turn out to correspond exactly to the entwined srs nets. Schoen's surface is a so-called periodic minimal surface, which everywhere has zero mean curvature, and is known as the gyroid or G surface. And at much the same time Vittorio Luzzati, a crystallographer working at the Centre for Molecular Genetics in France, found that surfactants form ordered sponge-like phases whose structures could be rationalized with the srs net, and which in fact correspond to membranes with the gyroid structure.

Then in the 1980s, Kåre Larsson and co-workers in Sweden made this connection explicit, and went on to identify gyroid phases in the membranes of some living cells. Meanwhile, Charles Kresge and colleagues at Mobil Research in Princeton discovered that self-assembling surfactant mesostructures can be used to template ordered porous forms of silica, one of which, called MCM-48, has the gyroid structure. Block copolymers can organize themselves this way, too.

Thus, crystallographers, biophysicists, chemists and materials scientists gradually revealed a remarkable natural pattern that mathematicians seem curiously to have overlooked. And Doekele Stavenga and Kristel Michielsen have recently shown that hardened cuticle structures in some butterfly wings, probably also templated by soft membranes, are based on the gyroid structure, which here may produce optical interference effects responsible for wing coloration (*J. R. Soc. Interface* **5,** 85–94; 2008). Nature always seems to get the last word.

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