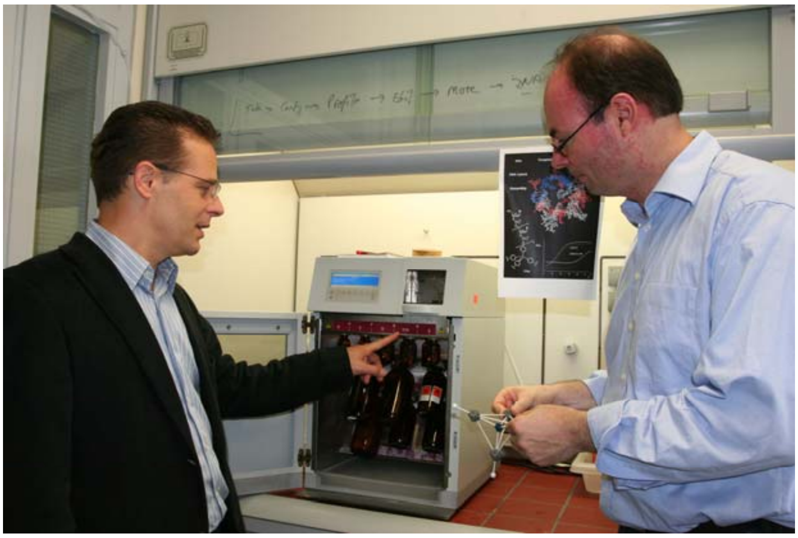
# Genetic Glue

**Researchers from Karlsruhe Synthesize Nanomaterials with DNA**



*Using the DNA synthesizer, Professor Clemens Richert (left) and Professor Stefan Bräse (right) produce their "adhesive" for new materials. (Photo by: Gabi Zachmann)*

**This is the dream of every engineer who needs regularly structured materials with smallest pores: An adhesive that not only keeps tiny particles together, but autonomously brings them into contact at the correct distance. Scientists working in the groups headed by Professors Clemens Richert and Stefan Bräse at the Karlsruhe Institute of Technology (KIT) have now developed such a material in the form of a "bioadhesive". The results were published in the ChemBioChem journal (2009, 10, 1335-1339).**

To set up three-dimensional lattices with pores in the nanometer range (1 nanometer = 1 millionth of a millimeter), extremely short pieces of single-stranded deoxyribonucleic acid (DNA), originally developed by nature to carry genetic information, are attached to a star-shaped molecule. As in the genetic material of living organisms, two DNA strands each, which are complementary due to the sequence of their components, form a double strand. Four of these

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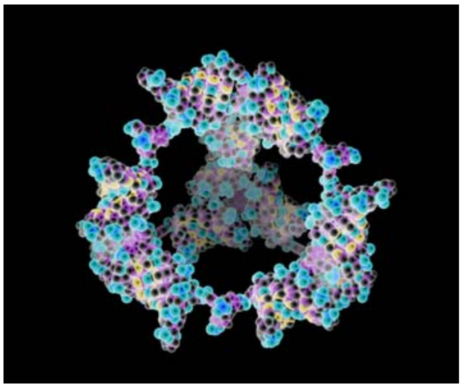
"sticky" DNA ends are fixed to every core molecule like the corners of a tetrahedron. Consequently, they can link to four other molecules. As a result of self-organization, a complex spatial lattice structure with new properties develops.

Porous materials play an important role as catalysts, storage media, or structuring components in engineering or medicine. "For the first time, we succeeded in demonstrating that quasi-infinite structures for such applications can be set up with the help of short DNA pieces," says Richert to describe the work carried out at KIT's Center for Functional Nanostructures (CFN) in cooperation with the working groups headed by Bräse (chemistry), Wenzel (physics), and Puchta (biology). DNA strands of two nucleotides length only are sufficient for the formation of lattices in aqueous solution. Nucleotides are the letters of which DNA consists. The lattice material then assembles into nanoparticles when it is cooled down.



*Structure of an "elementary cell" with a core molecule and DNA double strands modeled on a computer. It is the basic unit of the porous solid. (Graphics by: CFN)*

The extremely short DNA double strands have the advantage that a relatively small activation energy is required to break down imperfect structures again. "This allows for a dynamic assembly and disassembly process," explains Richert, who will continue this project with his colleagues in Karlsruhe even after his recent move to the University of Stuttgart. "In this way, we obtain large lattices with purely synthetic material, which is a big advantage."

**Literature:**

**Two Base Pair Duplexes Suffice to Build a Novel Material. M. Meng et al., ChemBioChem 2009, 10, 1335-1339.**

**The Karlsruhe institution is a leading European energy research center and plays a visible role in nanosciences worldwide. KIT sets new standards in teaching and promotion of young scientists and attracts top scientists from all over the world. Moreover, KIT is a leading innovation partner of industry.**

**This press release is available on the internet under: www.kit.edu**

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