

# Biomolecules targeted



The research team headed by Professor Griesinger.

**Obtaining images of complex biomolecules from the magnetic properties of atomic nuclei is the forte of Professor Christian Griesinger. He is regarded as the father of 3-D nuclear magnetic resonance spectroscopy, a technique that allows observation of organic macromolecules and biomacromolecules in action. In September 2003, he was awarded the Otto Bayer Prize in recognition of his achievements (see also page 8).**

"I was lucky in that time and again I was offered both tremendous support and enormous challenges." A modest explanation indeed for the meteoric rise of a scientist who, on his appointment to the chair of organic chemistry at the University of Frankfurt in 1990 at the age of 30, became the youngest professor in Germany at that time. It was there that he established a center for nuclear magnetic resonance spectroscopy. Eight years later, Griesinger was awarded the Leibniz prize. For the past three years, he has headed the Department of NMR-based Structural Biology at the Max Planck Institute of Biophysical Chemistry in Goettingen. Even as a student, he had shown particular interest in elucidating the structure of proteins. These substances resemble a tangled mass of wool, yet have a decisive influence on processes in biological systems in the form of enzymes, hormones or cell membrane constituents.

It is thanks in particular to the research of the Nobel Prize winners Professor Richard Ernst (1991), under whom Griesinger held a postdoctoral position, and Professor Kurt Wüthrich (2002) that it is now possible to determine the fine structures of many biomolecules by means of nuclear magnetic resonance spectroscopy. This method is based on the fact that the nuclei of some molecule-specific atoms rotate. The amount of energy required by these atomic nuclei to change their direction in a magnetic field is determined by their position in the molecule and thus allows conclusions to be drawn as to its structure. The advantage of this method is that molecules can be examined in physiological fluids that resemble their natural environment. The only drawback is that the larger the molecule and therefore the more atoms it contains, the less clear is the result. "The effects blot each other out," explains Professor Griesinger.

He achieved a major breakthrough almost 20 years ago with the development of "three-dimensional nuclear magnetic resonance spectroscopy". This method reverses the spin of three usually different types of atomic nucleus in the magnetized biomolecule specimen. The method also works equally well, however, with nuclei of

the same kind that differ only in terms of their neighboring molecules. The wealth of data thus obtained can then be spread over three dimensions. With this high-resolution method, Professor Griesinger and his team can now view live images of, for example, changes in the structure of proteins, folding of the prions suspected of causing BSE and the degree of binding of medicinal active ingredients to their target molecule.

Reason enough for the trustees of the Otto Bayer Foundation to honor Professor Christian Griesinger with the Otto Bayer Prize 2003. This award is highly regarded in the scientific community. Otto Bayer, who for many years was head of research and a member Management Board at Bayer AG, bequeathed a significant proportion of his estate to a foundation aimed at furthering the careers of natural scientists. For Professor Griesinger, there is no end in sight to his own research into the detailed structure of molecules. There are still sufficient biomolecules to be visualized with his nuclear magnetic resonance imaging.

<http://medusa.nmr.mpibpc.mpg.de>  
The website contains wealth of background information on the work of Professor Griesinger and on structural biology with NMR in both German and English.

Computer model of the "target", the complex molecular structure of tubulin, under attack from a potential anti-cancer drug (yellow).

