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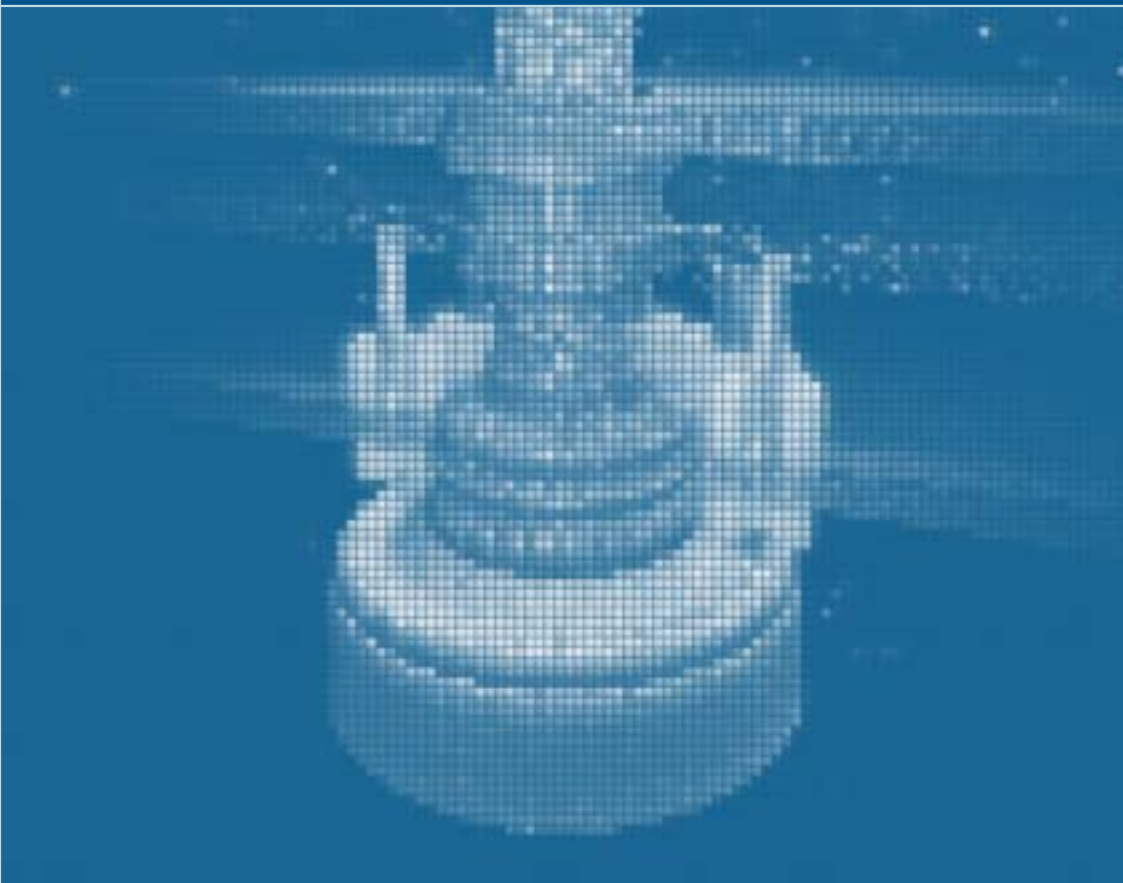

FERENC VONDERVISZT

# Prospects of Molecular Nanotechnology

The ability to control the arrangement of atoms lies at the foundation of technology. Our modern technology builds on an ancient tradition. We still rely on macroscopic manufacturing, in which atoms and molecules are handled in bulk amounts. Until now, technological progress has involved making things smaller and smaller approaching the sub-micron level. But instead of miniaturizing current technologies there is another possible approach building molecular devices from atoms and molecules. This new technology, called molecular nanotechnology, will handle individual atoms and molecules with control and precision, creating highly complex systems on the nanometer scale.

Nanotechnology is still in an exploratory phase. On the other hand, it is a proven technology. Living organisms have been using molecular nanotechnology over the past 4 billion years with great success. Molecular machines of living cells are mainly made of proteins, have the capability for self-assembly and can fulfill complex functions in a highly con-

trolled fashion. Enzymes are molecular machines that make, break, and rearrange chemical bonds at a rate of up to a million per second. Muscle fibers work like molecular-scale linear motors. DNA serves as a digital data storage medium, directing ribosomes in manufacturing proteins.

How to develop molecular nanotechnology? Given their key role in natural molecular machines, proteins are obvious candidates for early work in self-assembling artificial molecular systems. The operation of many naturally occurring molecular machines has been elucidated. Based on this knowledge, one promising approach would involve designing new protein-based devices. Observing examples from nature indicates that protein-based nanotechnology has an enormous potential.

To achieve molecular manufacturing, there is a lot of work still ahead. But there are great promises as well. Nanotechnology may provide humanity with unprecedented control over the material world changing our life in more ways than we can imagine.

**Ferenc Vonderviszt** studied biophysics at the Eötvös University in Budapest. After graduation he joined the Structural Biophysics Group at the Institute of Enzymology of the Hungarian Academy of Sciences. He obtained his Ph.D. In 1989. As a postdoctoral fellow, he spent several years in Japan working on the structure and self-assembly of bacterial flagellae. He was appointed associate professor at the University of Veszprem in 1992. He received his Habilitation in Biology at the Eötvös University in 2002. His research interest is focused on molecular machines working in living organisms, like bacterial flagellum, which is the organelle of bacterial motility.

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