P. Stroppa/CEA

A lab-on-a-chip reservoir, designed around the concept of droplet microfluidics, being filled with a fluorescent solution.

# IV. NANOTECHNOLOGY INTO APPLICATIONS

At nanometre-scale, the crossover from pure science to practical application can take place in a very short time, as is the case with microelectronics which was discussed in section I. Other sectors are also opening up to the nanosciences and nanotechnologies, and they will be addressed, although by no means exhaustively, in this fourth chapter.

The article on micro- and nanotechnologies in life sciences sheds light on a multitude of applications that nanotechnologies will be able to develop in the biology and medical sectors in the more or less near future. Indeed, they have already come to be known as "nanobiotechnologies". The power and potential of microelectronics and information technology will be applied in these fields to identify the huge numbers of components making up a living organism, track organs at work close-hand, and eventually be implemented as part of healthcare strategy.

DNA chips are able to perform the full range of genetic identification tasks equally well in medicine as in the agrifoods business or for bacterial monitoring of the environment. The protein chips currently in development have been designed to carry out identification of the vast array of different proteins in a living organism, or even in a single cell.

Most bioanalysis tasks involve handling liquids. Miniaturization has given birth to a new field of science: microfluidics, or the art of handling very small fluid samples and reagents. Microfluidics has thus justified an article all on its own.

In tomorrow's world, the lab-on-a-chip will have integrated every step from sample processing to results feedback, incorporating microelectronic, optical and software components along the way.

Moving to another field, future perspectives for telecommunications underscore the fact that the revolution in information and communications technologies, which are the first to benefit from miniaturization technologies, is far from over. For instance, every individual terminal is set to become an integral part of a data distribution network feeding other users beyond just the terminal's owner.

This chapter will go on to highlight a perfect illustration of the diverse talents of that extraordinary nano-building-block, the carbon nanotube. Used as an electron gun, it can at the same time help to build new electron emitters for flat-screens, and open up new routes into advanced lithography.

Last but not least, nanomaterials are confirming their status as promising catalysts for the fabrication of "energetic materials", where they can be applied as components in high-powered explosives or solid propellant for missiles and launch vehicles.