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ISR 18/3 *Interdisciplinary Small Science* Title 389

This was a sponsored issue for the Karlsruhe Nuclear Research Center, better known perhaps as the *Kernforschungszentrum Karlsruhe.* Its change of policy and function, from only nuclear research to more general interdisciplinary subjects, was typical of the world with its wide decline of interest in atomic energy. Similar changes had occurred in England at the Harwell Research Center and also at the Lawrence Livermore Laboratory of the University of California.

I had an introduction to the Director of the Karlsruhe Center, Dr M. Popp, and we agreed that after general introductions by him and by me, there would be sections on the environment, on energy, on microsystem technology and basic research. I followed the, by now well established, practice of letting the sponsor suggest the detailed subjects of the contributions and their authors, while I retained the final decision, ensuring that the articles reached the usual academic level of ISR.

My Editorial which I entitled "Interdisciplinary Big Science" gave me a chance to refer to the history of 'Big Science' as first defined by Derek de Solla Price in 1963 in his book *Little Science, big Science* in which he also plotted the exponential growth curve of science. He defined 'Big Science' as a discipline which doubled every 15 years, measured predominantly by Price through the growth of the relevant scientific literature. I drew attention in my Editorial to the recent contraction of some fields of science, as for example atomic science, manned space flight, and supercomputers which were often replaced by numerous smaller ones of equivalent total power.

Dr Popp in his Introduction laid down the new tasks for Big Science, the sustained development for interdisciplinary technologies of which the articles in the issue were the examples, especially for non-polluting high technologies. For me, and I assumed for many of my readers, the most interesting and novel subjects in the special issue published in September 1993, dealt with microsystems on the nano scale.

Using the techniques of microelectronics, such as deep X-ray lithography, the research scientists at Karlsruhe produced microturbines with a diameter of only 100 micro meters. (1 micro meter is 10 to the power of minus 6) rotating at 150000 revolutions per minute and electric micromotors of only 0.25mm diameter as well as microsensors. So far the most important developments in this field are microspectrometers, chemical microsensors and microanalysers. Already well known and often used is the new technique of 'Minimally Invasive Surgery' which depends on a stereo-video-endoscope of minute size, which can be inserted through a very small incision into the human body, as for example for gall bladder removal.

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