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Editorial

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After being shaped over millions of years in a slow but continuous evolution, our species *Homo sapiens* has suddenly been confronted with a revolution. Following *millennia* of more or less constant life expectancy, the average life expectancy of *Homo sapiens* has suddenly doubled, in a mere 150 years (between 1830 and 1996, an average Dutch male saw his life expectancy rise from approximately 36 to 76 years of age). This enormous increase in life expectancy has major consequences for our society and the individuals of which it is composed. First of all, the amount of elderly in our soceity is bound to rise significantly as partially demonstrated by the growth of the Dutch population of 65 years and older from 130,000 to 2,200,000 in the same 150 year interval. This phenomenon obviously has distinct socio-economic consequences and both scientists and politicians are well aware of this phenomenon. Less well known is the effect of this sudden increase in age on the quality of our life. A recent study by the Dutch RIVM institue investigated the relation between age and severe physical disability and these data were very revealing. Although relatively healthy during the first 40 years of our life (our evolutionary age), our life quality starts to deteriorate after this time. Females of 90 years have a 75% incidence of severe physical disability, which is roughly 45% for the male part of our population. Evidently, nature has not prepared us for this sudden boost in life expectancy. It would seem that in this case man does not differ from a man-made piece of machinery, in that parts will have to be replaced if the term of use distinctly exceeds the original design. In other words, if we want to fully enjoy our prolonged life expectancy, some of our tissues and organs are quite likely to require replacement. In view of this, the 21st century will be the century of substitution medicine much more than the accuracy of life saving medicine.

The urgency of the need for substitution parts is illustrated by the fact that it will not be long before the world medical device market will total 100 billion US$ annually. Furthermore, the general costs associated with a lack of donor tissues and organs is estimated to be 400 billion US$ in the US alone. We can learn two things from these data. First, there is a tremendous need for substitution parts and second, so far, science has only been able to solve part of this need. Since, obviously, solving this need is the primary responsibility of our scientific community (biomaterials science), it might be worthwhile to spend some time here on why it is so difficult to replace tissue. The main reason would seem to be the inherent difference between materials that were made by man and materials that were made in man. In the first case, the materials are characterized by an almost complete lack of the ability to adapt to changing circumstances whereas, in contrast, living manner is specialized in adapting to ever changing circumstances. It is exactly this lack of dynamics, which makes implants fail. They will in most cases not actively adapt to changing circumstances. If we want to be really successful in substitution medicine we, as scientists, will have to focus on adding these dynamic aspects to the devices that we are developing. Early examples of this are bioactive materials, but new approaches have emerged. A useful strategy to achieve this goal is to use our current materials science as a basis to which we can add more dynamic aspects by three different technologies, thus creating a hybrid technology basis. The first approach would be to mimic the way nature makes its own materials and abandon the current highly non-physiological processing techniques. This approach is gradually becoming more popular and is generally referred to as biomimetics. Since this approach is still largely material oriented and is generally bound to lack a biological regulatory mechanism, it can be further improved by adding biologically active factors as are currently provided for by biotechnology. Although this latter approach is certainly promising, it still has the disadvantage that adding some biologically active factors is at best a very rough approximation of nature's complexity. This complexity would be much better mimicked by creating hybrid constructs of biomimetic materials and living *in vitro* expanded cells. These new research strategies mean that our biomaterials science is going to be even more multidisciplinary and the role of biological techniques will more and more shift from purely evaluative to therapeutic.

The program of the 14th European Conference on Biomaterials already clearly reflects these new research strategies although the proportion of such contributions is still relatively low and perhaps too low for Europe to be in the forefront of substitution medicine. More focus on hybrid technology (e.g. tissue engineering) in the major European research programs, such as Brite-Euram, may further increase the proportion of hybrid technology research. Even with sufficient European hybrid technology programs, there is still another aspect to be fulfilled. This concerns the relative lack of co-operation between physicians, industry and materials science. This co-operation is essential for the proper advancement of our field and is stimulated in several ways, but so far has not

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resulted in an acceptable attendance of physicians and industry at the European Conference on Biomaterials. At the 14th conference, we have taken the initiative to organize parallel conferences on clinical subjects of interest to our field, to stimulate the attendance of physicians and simultaneously attract industry. We distinctly hope that this concept will work and that the term hybrid technology will not only reflect the future techniques in substitution medicine but also the close co-operation between biomaterial scientists, physicians and industry.