wheat needs to be separated from the chaff. If not, the wheat could just as easily be thrown out with the chaff.

Uncritical acceptance of alternative medicine allows dubious and questionable therapies to gain credibility and acceptance on the coat-tails of effective therapies and other factors

For example, sales of herbal remedies in the US grew dramatically throughout the 1990s, but declined in 2000 (Blumenthal, 2001). A Consumer Reports (2000) survey showed low patient satisfaction with herbal remedies, even those shown to be effective. Indeed, the fickle market may once again turn against herbal remedies, with the neglect of those herbs that are effective and safe for specific conditions, unless manufacturers agree to market only high-quality products that have been scientifically tested. The current regulatory situation in the US allows products of poor quality to flood the market.

CAM is addressing more than just the Western thirst for health: it also addresses its thirst for spirituality. Medicine and religion have been intertwined throughout human history, except in the modern era. The proper role of spirituality in health care will be more difficult to resolve. Sloan *et al.* (1999) have pointed to an appropriate way to address these issues: 'There is an important difference between "taking into account" marital, financial, or religious factors and "taking them on"

as the objects of interventions'. Hence, CAM can remind conventional medicine of its humane side and help restore the value of caring for people as whole persons. But CAM without respect for scientific evidence would return medicine to an era in which it was little more than magic.

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A plea for funding 'small' basic research in Europe

Practical proposals for the next EU Framework Programme • by *André Goffeau*

Science for *Homo economicus* and *Homo faber* is flourishing, while Science for *Homo sapiens* is diminishing. (Takashi Tachibana, 1998)

Over the last two decades, the European Commission (EC) has become a major player in the European science landscape. Through its Framework Programmes (FPs)

it has supported biological research, among other fields, generally according to top-down priorities set in Brussels by the Commission. And as the economic

and medical exploitation of biological research became more important, its nature changed, and so did the EC's funding strategy. While the early FPs provided some funding for the strengthening of basic research in Europe, the recent trend that started with the presently running FP5 promotes applied research almost exclusively. In the upcoming FP6, large European infrastructures and aggregated 'Centres of Excellence' will be given priority. As a result of these changes in strategy, some European biologists fear that basic science in Europe is endangered, particularly when it is carried out in small laboratories at universities.

The fact is that a strategy that prioritises large infrastructures might not meet the real demands of biological research in Europe. Apart from the legal and social constraints that are characteristic of European culture, the quality and quantity of basic science, something that has not been given funding priority for more than a decade, could become the limiting factor for the further development of biotechnology. There are already plenty of structures at regional and national levels to facilitate the industrial exploitation of biological knowledge. It is hard to imagine that anything more could

excellence. My experience from the Human Frontier Science Programme and numerous European projects has led me to conclude that the intensity of interac-

infrastructures often claim that increased funding will make them more competitive. History shows that this is rarely true.

I believe that, instead of, or in addition to, increasing the size and numbers of large infrastructures, European research needs more and better small university-based laboratories dedicated to carrying out 'avant-garde' basic science by their PhD students. In the long term, the quality of teaching, the overall level of science in Europe and the emergence of scientific vocations—now in alarming decline—depend on these small laboratories that today often suffer from limited funding. They are not promoted by organised lobbies and might not be labelled 'Centres of Excellence', but their overall creativity and social importance are unquestionable. I dispute the unproven concept that large infrastructures are more creative, per Euro invested, than small university-based laboratories. It might even be detrimental to European biological science to increase the funding and the dominance of large centres at the expense of the promotion and improvement of small laboratories.

If we want to maintain and increase the competitiveness of biological research in

Looking for excellence among European scientists.

tion generally decreases (with interesting exceptions) when the number of partners increases. It is true that biological sciences increasingly use large and

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be achieved in this respect. It is time to realise that European biotechnology industries might not need increased EC interventions. They usually have efficient support at national and regional levels—which often provides flexible links to national and sometimes international academic laboratories—and often requires less paperwork and provides sizeable funding more rapidly than EC grants.

The draft of FP6 concentrates on the support of large transnational infrastructures as well as establishment of networks of 'Centres of Excellence'. But this vision is hampered by a severe birth defect: it is difficult both to define excellence as well as manage large virtual centres. The most annoying fact, however, is that large infrastructures will not necessarily increase

sophisticated equipment (the European synchrotrons, for instance, have proven to be extremely useful). But many biological facilities could be decentralised, such as informatics, mouse clinics and even structural biology facilities. One should remember that it is difficult to disengage from large infrastructures, even if they

One should remember that it is difficult to disengage from large infrastructure, even if they become obsolete

become obsolete, and it is unfortunately easy to find European examples of such situations. It is a fact of life that inefficient

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Europe, and its exploitation in biotechnology, I would suggest that the EC modifies its funding strategy and provides more support for basic science, which is the very basis of applied research.

But, first of all, many of the bureaucratic hurdles that scientists have to climb when applying for research grants from the EC have to be simplified. This is crucial for the future of the EC's role in funding research. If the bureaucratic workload of scientists further increases with FP6, it will eventually reach a self-destructive level. However,

this important topic deserves an independent analysis of its own.

Overall, it would be fair to propose that half of the EC research budget is devoted to open-ended basic research. 'Bottom-

brilliant young scientists. It also remains to be seen whether EMBO is the best agency for fair and efficient channelling of such grants. Its members and its selection committee do not represent all areas of biol-

genome sequence data produced in the US. This situation is especially disabling for smaller countries. This problem is exacerbated by the fact that numerous European scientists are working on 'bizarre' species, such as lichens, non-conventional fungi, *Podospora*, *Paramecia*, anaerobic ciliates, psychrophilic or piezophilic bacteria, Diatomeae, proctost arthropods, molluscs, algae, plants and insects, that are not obviously related to health and food. Some of these species are studied for sheer scientific curiosity with the only short-term aim of understanding all levels of the biosphere. Others are considered as model systems for the investigation of biological mechanisms conserved in the human species, such as DNA recombination in *Paramecium*, ageing in *Podospora*, biogenesis of mitochondria in yeast, etc. The recent Nobel Prize for medicine/physiology awarded for pioneering work on the cell cycle carried out in yeast, is a good example of the usefulness of exploring model species. One of the most obvious advantages of sequencing such species will be the study of the mechanisms of biological evolution. But at present there are few ways to get the sequencing of genomes done quickly in Europe, which would provide the basis for creative science. What is lacking is money, not new infrastructure. A network of laboratories and companies specialised in sequencing small genomes could efficiently sequence and analyse genomes of specific interest to European scientists, while the three national centres could focus on larger and more complex genomes. In this regard, a

It might be detrimental to European biological sciences to increase the dominance of large centres at the expense of the promotion and improvement of small laboratories

up' proposals should have no other requirements attached than being of good quality and being multinational. Fair review and efficient administration procedures similar to those used by the Human Frontier Science Programme or the US National Institutes of Health might be adopted

Apart from this proposal, I would like to present five examples of directive measures that could contribute to maintaining and promoting 'small' basic science in Europe within the next FP, which will be in operation until 2007. There are, however, many other ways to achieve that objective and, like all scientists, I am inevitably biased by my own field of competence.

(i) More support could be given for international post-doctoral fellowships with no requirements attached other than that they be awarded for training in laboratories with proven scientific output and accompanied by generous bench fees. This would be an efficient way to promote basic science. It must be acknowledged that the EC, through its Marie Curie Fellowships and other training initiatives, has a very good track record in this area.

(ii) The European Molecular Biology Organization (EMBO) recently launched a grant scheme to help young scientists establish their own laboratories. These research grants do not set priorities for certain research topics, nor do they need to be justified in terms of potential applications. As this programme has been shown to attract applicants very successfully, it could easily be expanded to increase the number of grants. Such a scheme on a European level, with an appropriate budget, would be a very practical way to channel more funding into basic science. However, some thought should be given to the long-term fate of the grantees and also to the danger of increasing the hegemony of leading countries and institutes that will inevitably provide the best justifications for hosting

ogy equally, which could result in an unwanted bias towards or against some fields.

(iii) A simple and rather inexpensive way to strengthen European biological research would be to invest in the sequencing and analysis of small genomes, as these have proven to be a major resource for the discovery of new knowledge. Although Europe, thanks to EC funding in the early 1990s, enjoyed a transient leadership, further funding for sequencing genomes has been halted during FP5. Moreover, there is no provision for genome sequencing in the draft of FP6, despite a budget of Ecu 2 billion for 'functional genomics' (whatever that means), largely restricted to the major multifactorial human diseases. There is a large deficit of public sequencing capacity in Europe. The Sanger Centre in the UK has a capacity of about 30 Mreads per year, (equivalent to ~1.5 billion of non-assembled nucleotides) Genoscope in France 3 Mreads per year and the sequencing facilities in Germany contribute another 3 Mreads per year. None of the other European countries have large

If the bureaucratic workload of scientists further increases with FP6, it will eventually reach a self-destructive level

sequencing facilities, and overall the European sequencing capacity is considerably less than in the US. The few European large-scale facilities are nearly saturated by their work on human, mouse and other large genomes. To analyse small genomes, Europe is thus becoming more and more dependent on the US, which fortunately gives generous access to the sequence data generated there. However, it would be utopian to assume that, without sequencing new genomes, Europe will be able to master all facets of genomics and competitively exploit

budget of only Ecu 200 million for a total of 5 years would do much to improve the promotion of European basic science, as well as the promotion of small European 'genomic' companies.

(iv) Many small laboratories have no access to commercial facilities, such as human and mouse genome databases, DNA microarray experiments of large two-hybrid screens or proteomic analysis, because they are too expensive. But the competitiveness of small laboratories often depends on access to such commercial tools. Therefore, the EC

could help small laboratories to obtain cheap access to such commercial facilities in an efficient and fair way, without creating expensive and ever-binding infrastructures.

(v) One of the present limitations of biological research seems to be access to

Many scientists have mailed additional arguments that were not presented above. It is doubtful that their letters have been taken into consideration or have even been read by any member of the European Parliament, and no short-term impact is expected.

For the very first time, basic scientists have attempted to interfere with their own fate as it is decided at the European level

protein structure facilities, for which Europe had a long tradition of leadership. Due to large new investments, the US has caught up in this field. Meanwhile, many small European laboratories have purified proteins of interest in hand without the means to determine their structure. The EC could help those small laboratories to analyse the structure of these proteins without indulging in blind funding to the presently dominant infrastructures that might be tempted to increase their size and comfort but not necessarily their efficiency.

A document with these and other arguments has been presented to members of the European Parliament by dozens of established scientists from all European countries. Jean-Luc Souciet from Strasbourg and Claude Gaillardin from Grignon have personally explained it to Gerard Caudron (France) from the parliament and to several other members of the European Committee on Industry, External Trade Research and Energy that is in charge of approving and amending FP6. Most of the 118 members of this committee have been alerted by one or more scientists. Finally, two European parliamentarians, Michel Hansenne from Belgium and Dominique Vlasto from France, have agreed to deposit an amendment proposing increased funding for the sequencing and analysis of small genomes.

It would be interesting to see whether their opinion is reflected in Brussels.

But these reactions from European scientists demonstrate the necessity for European society to find the right balance between two extreme trends described by Ladislav Kovác (2001): 'With cultural sciences underrated and undervalued, there are two dominating cultures at the beginning of the 21st century, a culture of science that aspires to understanding of the world and a culture of technoscience that strives for intervention into the world, for manipulation with it and for its remodeling'. For the very first time, basic scientists, many of whom share the view that 'small is beautiful', have attempted to interfere with their own fate as it is decided at the European political level. This new type of lobbying might announce the start of a movement that will, in the future, drive EC funding towards increased support of 'small' but creative basic biological research.

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