

Dual use of biological research and the role of the scientific unions

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Received: 2009.01.07, **Accepted:** 2009.01.28, **Published online:** 2009.06.03

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When the Royal Society was founded 348 years ago, one of its founders, Dr. Robert Hook, stipulated that the “society should not meddle in divinity, metaphysics, morals, politics, grammar, rhetoric or logic” (Martinich 1999). Such an approach continued through the centuries, perpetuating scientists’ detachment from human affairs and relegating them to ivory towers remote from the ultimate goal of their science, science that should be targeted to human welfare. It was once commonplace, and still can be heard, that “science is neutral”, “science has nothing to do with politics”, and “science cannot be blamed for its misapplications”. One reason for this was the difference in time between a discovery and its consequences, between scientific discovery and its applications. Such a distance favored outright absolution from responsibilities, first for the scientists who made the discovery, then by extension to all scientists.

As pointed out by Joseph Rotblat in his contribution to the World Conference on Science of Budapest in 1999 (World Conference on Science 1999), not only in the academic circles, but also in the industrial sector ethical questions about the consequences of applied research were seldom raised by employers and the employees were discouraged from concerning themselves with these issues. The goal of research was just research, or profit as the case may be, and no other questions were encouraged.

The immensely increased role of science in the life of the world community brought about by the great scientific discoveries has resulted in an enormous increase in the magnitude of scientific endeavor, a process of positive feedback in which success breeds further success. Thus we saw exponential growth in the number of scientists and technicians, the number of publications, and the number and size of scientific meetings. In par-

allel with this there has been a radical change in the methodology of scientific research, its scope, its tools, and its very nature. We can truly speak of a scientific revolution. For the field of physics, Rotblat reports that not all of the success was propitious. For example, the success of the Manhattan Project during the Second World War has been the well-known double-edged sword.

Today we are facing another double-edged sword and another challenge, that of the misuse of biological technologies. These are not as expensive as physical technologies and they are simpler to implement. Furthermore, there is little protection of biological discoveries due to the need for publication, both for the realization of a scientific career and as a part of scientific progress. This urgency of publishing and the new concept of open-source publications on the one hand and the increased interest by irresponsible individuals or groups on the other make an analysis of the production, publication, and utilization of sensitive biological information imperative.

Of all the scientific disciplines, the developments in biological research have possibly been the most rapid; however, parallel to the growth of technical achievements and their importance, the possibility of misusing research has increased. Some types of biological research have the potential to be employed for malevolent purposes: it is what is defined as “dual use”. Manipulating the resistance of bacteria to antibiotics is important to understand their mechanism of action and to discover new and more potent antibiotics. However, the same scientific approach can lead to the production of deadly bacteria resistant to all types of antibiotics. Synthetic biology is a novel field of biological research that combines science and engineering in order to design and “synthesize” DNA molecules capable of

exhibiting new biological functions that can be integrated into living organisms. The value of this approach in the cure of genetic diseases is apparent, but the possibility of misuse of this technology to produce deadly synthetic viruses may not be equally clear to the nonscientist. The problem is that technologies developed to achieve rightful goals are the same that can be used to create a bio-weapon. Consequently, the faster and larger the bio-technological development, the greater the chance of its dual use.

Rotblat wrote that “The public does hold scientists responsible for the dangers arising from scientific advance: nuclear weapons are a menace and the public rightly blames the scientists. The general public, through elected governments, has the means to control science, either by withholding the purse, or by imposing restrictive regulations harmful to science. Clearly, it is far better that any control should be exercised by the scientists themselves”.

The dual use of biological research is a potential phenomenon which should be prevented before it becomes reality. However, in the absence of a *corpus delicti* and an offender, the involvement of the research community is needed to thwart the event. As mentioned before, “scientists are responsible for the dangers arising from scientific advance” and, therefore, not only do they have a moral obligation to prevent the misuse of technology or scientific results, but they are in the best position to appreciate the potential for abuse. Scientists should be engaged to ensure that the benefits of the life sciences are maximized while their risks are minimized and to set an appropriate balance between the need for security and the peaceful use of discoveries. To enhance awareness of the issues related to the potential malevolent use of biological research, governments and non-governmental organizations should collaborate, although not to establish and promulgate rules limiting scientific freedom and imposing censorship in the publication of biological discoveries and related methodologies. The goal that should be jointly achieved is rather to raise awareness in the research community of the dangers of dual-use research and the consequences of not maintaining that level of attentiveness “from within” needed to prevent damage.

It is along these lines that at the International Union of Biochemistry and Molecular Biology (IUBMB, <http://www.iubmb.org/>) we are discussing the issue of the dual use of biological technologies, the need for awareness of the implications and alertness to the possible dangers associated with certain biological developments. The IUBMB is able to analyze in detail the dangers associated with certain scientific discoveries in the field of biological technologies, their publication and their possible dual utilization. The IUBMB openly supports biosecurity, intended as any measure aimed at preventing the purposeful misuse of science, including measures to prevent access to dangerous pathogens and toxins as well as raising barriers to the production or use of bio-weapons. Besides such typical security measures, it

includes basic awareness efforts that decrease the possibility of people misusing science from within the academic research. The potential of the IUBMB in the development of world biosecurity lies within its very nature, that of an organization that comprises 54 Adhering Bodies (Argentina, Australia, Austria, Azerbaijan, Belgium, Brazil, Bulgaria, Canada, Chile, China, China (Taipei), Croatia, Cyprus, Czech Republic, Denmark, Egypt, Finland, France, Germany, Great Britain, Greece, Hungary, India, Ireland, Israel, Italy, Japan, Korea, Latvia, Mexico, Netherlands, New Zealand, Nigeria, Norway, Pakistan, Philippines, Poland, Portugal, Russia, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, Ukraine, USA, Uzbekistan) that can be considered full paying members. It also comprises 28 Associate Adhering Bodies (Bangladesh, Belarus, Benin, Bolivia, Cameroon, Cuba, Estonia, Hong Kong, Iceland, Indonesia, Iran, Kazakhstan, Kenya, Lithuania, Malaysia, Moldova, Morocco, Nepal, Panama, Romania, Singapore, Togo, Tunisia, Uruguay, Vietnam, Zambia, Zimbabwe) which, due to their financial situation, do not pay dues and have no votes at the General Assembly. Furthermore, the IUBMB includes four Regional Associated Organizations, i.e. the Federation of Asian and Oceanian Biochemists and Molecular Biologists (FAOBMB), the Federation of African Societies of Biochemistry and Molecular Biology (FASBMB), the Federation of European Biochemical Societies (FEBS), and the Pan-American Association for Biochemistry and Molecular Biology (PABMB), and three Associated Organizations, i.e. the International Federation of Clinical Chemistry and Laboratory Medicine (IFCC), the International Society for Neurochemistry (ISN), and the International Society for Free Radical Research (SFRRI).

The mission of the IUBMB, as indicated in the statutes, is to “foster and support the growth and advancement of biochemistry and molecular biology as the foundation from which the bimolecular sciences (extending from cell biology to neurobiology, cancer biology, environmental biosciences, biotechnology and many others) derive their basic ideas and techniques in the service of mankind.”

In this mission, one of the first and most important aims is that of preventing any undermining of public confidence in the life sciences or life scientists; without the trust of the society in which science develops, no acceptance would imply no financial support and continuing doubt and criticism. The activity of the IUBMB is global and is exerted in the “entire world with particular concern for areas where biochemistry is less well developed, by promoting international cooperation and high standards in research, discussion, application and publication”. Thus the power of the IUBMB is also in its capacity of reaching out and being in contact with a large number of countries and scientists, estimated to be on the order of 100,000. Furthermore “The IUBMB promotes the norms, values, standards and ethics of sci-

ence and the free and unhampered movement of scientists of all nations interested in participation in activities related to biochemistry and molecular biology.”

Particularly relevant to the topic of this discussion are the contents of the Code of Ethics, which the IUBMB Executive Committee approved in December of 2005. It states among the obligations of scientists to the public: “They will not engage knowingly in research that is intended for the production of agents of biological warfare or bioterrorism, nor promote such agents”. Consequently, the IUBMB is committed to the proposition that life science technology not be used for malign purposes, particularly in the field of biology and medicine, and that it be used only for mankind’s benefit, and never to do it any harm.

The activities of the IUBMB comprise the Triennial Congress with a Young Scientists Program, Conferences and Special Meetings between the Congress years with a Young Scientists Forum, Symposia, Plenary Lectures, and Jubilee Lectures, the Wood-Whelan Short-term Research Fellowships, educational activities, publication activities, and standards for a PhD degree in the Molecular Biosciences. How can these activities be used to prevent the dual use of scientific technologies? Support to specific symposia in the field of biosecurity has already been given and this can continue taking place in the future. Ad hoc lectures during large inter-

national events can be planned to inform the largest possible number of scientists about the issue of the dual use of scientific technologies. The next Congress in China would be an ideal platform for such an activity. As indicated above, the IUBMB organizes and financially supports a number of educational events; they can be an important occasion to spread the concepts of awareness and education among young scientists to prevent the improper use of biological technologies. Finally, the publications of the IUBMB, such as *Trends in Biochemical Sciences*, *IUBMB Life*, and *Biochemistry and Molecular Biology Education*, can publish editorials and feature articles dedicated to the problem.

The International Union of Biochemistry and Molecular Biology can be flanked in the above activities by other unions, in particular biological ones. Such an association would render the possibility that the message of biosecurity reaches out much more effective.

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