Biomedical Knowledge in the Service of Man: Social Responsibility of the Scientist

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Abstract

My title is the paraphrase of a document presented to the US Senate being the transcript of a conference on Biomedical Knowledge, held in October 1966 for the Committee on Government Operations US Senate. A year when president Lyndon B Johnson set the task for the "systematic assessment and evaluation of the ways in which new knowledge can be best translated into better health and fuller life for the American citizens and for all mankind." In his opening statement the Chairman of the Conference Senator Fred Harris, Chairman of the Subcommittee on Government Research said "Expectations are high that this conference may add new dimensions and bring new perceptions to bear on the problem which has been erroneously termed, in some quarters, "basic versus applied research".

Many distinguished scientists, University Presidents, Directors of Institutes, Captains of Industry and Government officials contributed much wisdom to the 250 page document but the arguments were largely about what I call the "linear model" of science: research (basic), technology development (translation) and exploitation of knowledge (applied).

It is amazing that 47 years later we are still debating the same issues. I shall develop the "circular model" for the 21st Century Biomedical Continuum based on the cornerstones of modern Biological sciences. The first is "The Golden Age of Biochemistry" (1900-1950), the second the "Molecular Biology Revolution" (1950-2000), the third "the Genomic Revolution * (from 2000) and the 21st Century Biology, variously described as "Integration" requiring the "Convergence of Life Sciences, Physical Sciences and Engineering", Molecular Networks as Sensors and Drivers of Common Human Diseases or in my shorthand "Molecular Physiology". The latter is linked to molecular biology through genomic and metabolic networks (rediscovered in the last ten years) we need new technological and engineering advances to solve the problem of molecular physiology of the system, culminating in Human Biology.

Of the many technological advances needed to solve this problem Molecular Imaging has a key role through which the dynamics of chemical and biological processes can be observed with minimal invasion. While the techniques for this have become more and more sophisticated and expensive, thanks to new engineering principles and applications, my vision for the future goes in the opposite direction. With the use of clever chemical and biological detectors and nano-instrumentation (chips, nano-wires for measuring electrical, magnetic and optical signals) the challenge is to access the Human Physiome experimentally so that it can be combined with detailed computational approaches. The notion of "Body Area Networks" is currently limited to electrical signaling. I would like to see it extended to "Molecular Body Area Networks".
The scientist is responsible for choosing the right problem and knowing that advancing fundamental knowledge is as important as applying it to the benefit of society. The distinction is not basic or applied but good or poor science. Biologists should learn from Engineers how to work in teams but to maintain creativity the right environment must be provided by the science funders.