For the relief of man's estate?

Francis Bacon famously wrote in 1605 that "Science discovery should be driven not just by the quest for intellectual enlightenment, but also for the relief of man's estate," arguing that public support of science helped to bring about the latter effect, adducing the immense global power of Portugal and Spain in his day as evidence of the politically beneficial effects of such a policy. Despite controversy over the nature of the link between science and society, which has continued up to the present, this Baconian idea continues to drive public science policy in many countries. In the UK, for example, the mission of the state Engineering and Physical Sciences Research Council (EPSRC) is to "Promote and support, by any means, high quality basic, strategic and applied research and related postgraduate training in engineering and the physical sciences; and advance knowledge and technology (including the promotion and support of the exploitation of research outcomes), and provide trained scientists and engineers, which meet the needs of users and beneficiaries (including the chemical, communications, construction, electrical, electronic, energy, engineering, information technology, pharmaceutical, process and other industries), thereby contributing to the economic competitiveness of the United Kingdom and the quality of life." A similar sentiment is reflected in the European Union's Framework Programmes for Research, which have two main strategic objectives, namely, "to strengthen the scientific and technological base of European industry; and to encourage its international competitiveness, while promoting research that supports EU policies."

It seems that many scientists tacitly support this view, for one often reads, at the very beginning of a research paper, sentences such as "Microporous polymer films are attractive materials with potential applications in the fields of electronics, photonics, and biotechnology," "Blends of conjugated polymers are frequently used as the active semiconducting layer in light-emitting diodes and photovoltaic devices," and "The adsorption of proteins ... at the solid-liquid interface is important in, for instance, industrial applications such as the fouling of food processing equipment, and in medicine, in the determination of biocompatibility (i.e., the suitability of materials for medical applications".[1] As a rule, such statements are formulated in the vaguest of terms, and it is entirely left to the imagination of the reader to work out in more precise and concrete detail how the particular results that the paper goes on to report would actually impact the listed areas of application. The only purpose of including such sentences would appear to be to demonstrate allegiance to the Baconian ideal, for to anyone working in the field with a serious interest in concrete applications, they would be immediately apparent upon reading the paper.

Stepping back and looking at the bigger picture, it is glaringly obvious that our world—more specifically, the Earth—at the beginning of the 21st century is suffering problems of an extreme and global nature. These include climate change, the food shortage, rising fuel prices, nuclear proliferation, and faltering development, especially in Africa. They dominated the agenda of the recent G8 meeting at Lake Toyako, Hokkaido; one could also add demographic explosion (combined with swiftly aging societies), life-threatening pollution of the environment, rampant unemployment among youth in the Middle East and elsewhere, and global financial chaos. In the face of these real, urgent, and immense challenges, it might seem (and be thus perceived by the layman) that to occupy oneself with the possible improvement of light-emitting diodes (for example) is akin to fiddling while Rome burns. The scientist could, of course, reply that the introduction of more energy-efficient diodes (and even more directly, better photovoltaic devices) in principle addresses several global concerns, including fuel shortages and climate change. The problem is, however, a matter of scale, in the sense that rather than accepting the current increase in the use of light emitting devices as an inexorable and immutable trend, to which the best response is indeed simply to increase their efficiency, one needs to address the larger (and much more difficult) issue of the reasons behind the increase. Goethe already pointed out that scientists all too often preferred to notice only what they could explain, rather than attempting to explain what we—everyone—notice, and a similar sentiment was expressed by Elspeth Huxley when she visited the University at Legon, Accra.[2] On the other hand, some scientists are preoccupied with the wider implications of science and technology. J.D. Bernal is said to have remarked, in order to excuse his time-consuming engagement with the Pugwash movement, "the scientific work I can do can be done, and will be done, by others, but unless the political work is done, there will be no science at all."

[1] These quotations are taken at random from, respectively, *Langmuir* **19** (2003) 60 97; *Nature Materials* **2** (2003) 616; and *Langmuir* **11** (1995) 3542.

[2] Huxley, E. *Four Guineas, a Journey to West Africa*. London: Reprint Society (1955).

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Evidently, one can assert with equal confidence that there will be no science at all if scientists occupy themselves exclusively with political work. However, the almost indisputably extreme urgency of the current problems, which would seem to threaten the very continuation of human civilization, compels a careful appraisal of the situation. It is possible to suppose that the matter will regulate itself; rather like a small commando group ordered from high above to carry out what seems to its members to be a pointless action, but which fits well in to the bigger picture comprising countless such actions, one can suppose that detailed work on some aspect of the molecular rearrangement in organic photovoltaic cells, even if solely motivated by a detached interest in phenomena confined to the atomic scale, well fits into a larger picture envisaging a dramatic transformation of the mode of generating electricity. On the whole, though, there does not seem to be much empirical support for the success (measured in terms of solving acute lower problems) of such an approach. For one thing, there is no real "high command" in the world of science. Some influence is perhaps exerted by funding policy, which at present is overwhelmingly in the hands of governments, and therefore subjected to many distortions, as well as frequent changes of direction.

What does not seem to have been tried (at least, not very seriously or sustainedly) is to apply the disinterested rigour of the scientific method to the problems of political economy. If the deeply rooted creativity that the scientist applies to his or her investigations of phenomena often remote from everyday perception were extended to pressing problems affecting the lives of millions of people, who knows what might emerge? This would be the foundation of a true "knowledge-based economy", in which people who (to quote J.H. Newman) "mistake the point in argument, waste their strength on trifles, misconceive their adversary, and leave the question more involved than as they find it" would have little place.[3] At the very least, let us ask that scientists, though perhaps not of the world, are at least in the world (to recall a remark of another well known figure), and manifest their presence by taking a lively interest in these current problems.

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[3] It is particularly regrettable that the extreme compartmentalization of the contemporary academic world militates very strongly against, for example, the novel idea of a physicist for solving an economic problem being published in an economics journal, and hence being brought to the attention of, and discussed by, the community of professional economists. Conversely, fanciful schemes for the introduction of novel technologies may undergo considerable development in an academic environment, despite an often extreme unlikelihood of their cost-effective realization on a large scale.