

Basic and applied science at the time of COVID-19

Governing Council of the Italian Society of Biochemistry and Molecular Biology and Board of the Italian Professors of Biochemistry¹

¹ Member names are listed in the Appendix section

During the last 6 months, the world has been unsettled by the diffusion of a virus that has peculiar properties, causing alarm not only for the direct pathologic effect of the virus on affected individuals, but, mostly, for its only partially clarified ways of propagation [1,2]. The medical, social, and economic impact of the new disease is extraordinary and also deeply touches our ethical and moral values. The public confidence in science is perturbed because the medical response is dominated by uncertainty, and the requests to science for a fast remedy are left unmet [3,4].

This is probably the perfect time for a revision of the epistemological framework in which we envision medical practice as well as applied and fundamental research. The following short descriptions can be used to define them: (a) Basic/Fundamental research: curiosity-driven research aiming to understand phenomena; (b) Applied research: research with a focus on immediate needs-driven applications; (c) Medical practice: a wide range of skills and technologies with a focus on the care of the patients and society health needs. It is certainly true that these three activities are more and more interconnected, even though each one of them maintains a strong and unique identity. The risk for a semantic and epistemological confusion between these three activities is very high and can generate misleading social expectations, as well as skepticism about science and the scientific method.

Claiming from scientists quick and definitive answers on complex phenomena is unrealistic and bears the risk that the honest response of researchers about their limits and unfamiliarity with new complex problems is read as a failure of the scientific community. The pressure for obtaining conclusive comments from scientific authorities, that sometimes become 'celebrities' through the attention of the media, potentially tickling their individual narcissism, is also frequently a harbinger of further trouble in the science–society relationship, because the theory of one scientist is often disputed in the public arena by another scientist. In a time in which short announcements are privileged over extensive dissections of complexity, and in which news is rapidly consumed, there is often no time and space in the media for presenting the critical discussion between scientists as a physiological and unavoidable step for the progress of knowledge. In fact, in order to make progress on complex

matters, the scientific community needs to openly discuss theories and evidence via the common scientific approach involving hypothesis, evidence, confutation, and continuous rectifying of mistakes and misinterpretations. The turbulence generated by dispute among scientists, which may even be harsh at times, represents the only way to generate new knowledge. It must be acknowledged that scientific hypotheses provide only an approximate description of reality and that this approximation may initially be insufficient for the technological applications sought after. On this matter, we urge a new alliance between the media and the scientific community for the appropriate communication of the scientific process in its entire complexity.

Medical practice, as well as science-based medical research, may respond more quickly than fundamental research to the complexity of an unknown disease. This is particularly true for medical practice, as it is confronted with patients' needs on a daily basis.

Similarities between a new disease and diseases faced in the past can suggest old remedies for the new disease, and there is an ethical imperative to try these treatments even without a reasonable certainty about their efficacy and/or mechanism of action. However, we should always remember René Descartes' remark '...whenever people notice some similarity between two things, they are in the habit of ascribing to the one what they find true of the other, even when the two are not in that respect similar' [5]. Therefore, after the first immediate medical response, the inconsistencies observed between similar but different diseases, that is, the micro-heterogeneities observed on what may be initially considered a single pathology, should be re-addressed to basic science, which in the long run can provide effective tools necessary to move toward precision medicine, and cure of specific diseases.

The timing and progress of basic research are significantly different from those of applied science but, in the absence of a robust background in basic science, the perspectives of applied science are crippled and the risk of failure of therapeutic approaches is increased. It is also worth noting that many advances in clinical practice have their roots in basic scientific research in a way that is totally unrelated to the medical need.

In Italy, as in many other countries, the lockdown has caused the suspension of major experimental scientific activities. Forecast of what comes after the pandemic cannot leave aside a serious discussion about the role of science in our countries.

We think that society should become fully aware of the crucial role that fundamental and free research should have in our countries and recognize it as a social interest shared and supported not only by scientists but also by the public and by politicians. Scientists should make an effort to explain the scientific method to the public, in order to prevent the risk of underestimating the importance of debate within the scientific community when solving complex challenges. Indeed, in Italy and elsewhere, there is an increasing and diffuse distrust of science, a phenomenon that must be counteracted, as it causes the public opinion to follow unjustified and misplaced hypotheses and theories that may definitely be harmful. As an example, we noticed that distrust of vaccines has not been overcome even during the peak of the Sars-CoV-2 pandemic. We strongly encourage scientists to consider a regular participation in the activities of Scientific Societies that organize qualified technical discussions between specialists and contribute to the involvement of society in such discussions. In this way, the public may be made more aware of issues raised by Scientific Societies, which is of utmost importance. The political leadership, as direct representatives of our societies, should learn more about the complexity of the different facets of scientific progress, becoming ready to accept not only the success but also the failures of projects that challenge problems of high complexity. They should be much more aware of their responsibility for the quality of the scientific profile of their country, be ready to implement financial investments in basic research and a simplified management of the resources guided by extensive, open and transparent interaction with the scientific community.

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References

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Appendix

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