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Mainstream—or not To Be? A Plea for Original Fundamental Research

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What are the characteristics of good research? This is a question that we all ask ourselves. And indeed we should, as we live and work for it and, including our teaching duties, we are paid for it.

The answers to this question are diverse, which is generally positive, as the diversity of good research is the key to evolution in chemistry. Recently, however, an increasingly worrying trend in how that question is answered has developed: in many places, good research is only judged by its relevance for applications, or by the size of the corresponding community. In more and more countries, it is practically only such mainstream research that is financially supported.

Where in this trend is the space for the inquiring minds and our (the researchers') own originality? Haven't many of the most exciting and often pioneering discoveries been merely coincidental? Coincidence that stemmed from the courage to test something new, to seize a clever idea, instead of obeying a science policy guideline? One need only think of the discovery of the first superionic conductors, high-temperature superconductors, and single-molecule magnets, of the discovery of fullerenes, Teflon, saccharine, polyethylene, light-sensitive compounds for black-and-white photography, and radioactive elements. Of course the opposite, that only coincidental observations would serve to develop research further, is no more valid. In the end, it is always thorough and analytically sound chemical research that enables our subject to advance. Still, the spark that ignites the emergence of a new class of compounds or analytical techniques is frequently a result of an "alchemistic" desire to discover what will occur when we bring elements together.

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A Plea for Fundamental Research ...

This Editorial takes a stand for original fundamental research—with or without "world-saving" targets. It is meant to make the case for an open and broad scientific discourse. Bit by bit, this discourse is diminished by ever more entrenched specializations, and by the formation of self-serving networks in order to mutually support the enhancement of the number of publications, number of citations, and acquiring of funding. Such (self-)interest cannot be the objective of chemical research! It is our task instead to foster sound and diverse fundamental research, which can ultimately spark the breakthroughs that will allow us to address the problems of our day.

To achieve this, it is reasonable and helpful to collaborate in cooperative research units. Yet, the "science first" principle must also apply to these units! The formation of such consortia should be driven by the desire to elucidate a scientific issue—and not purely by the interests of potential sponsors (in the best-case scenario, the two overlap). Continued scientific freedom will only be feasible in the long run if we manage to convince policy makers across the globe that it is us scientists, with our professional expertise, who should set the agenda for science.

... And against Uninspired Publishing

Alarming in this context is the rigid linkup of quantitative productivity metrics with individual monetary consequences, which leads to the "publish or perish" phenomenon, particularly amongst young researchers. This causes a large number of papers to be published with questionable or at least unexciting contents—leading to the assessment "both novel and original, but neither novel in the original aspects, nor original in the novel aspects". In some places in the world, junior scientists are compelled by their universities, funding agencies, or both to favor quantity over quality in order to advance their careers. What is necessary for them is unfortu-

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nate for science. The struggle for survival of young researchers drives scientific output, rather than an imaginative spirit of research (on the contrary: clever copying may even be viewed as success here).

It is also the case in Germany that both new and established colleagues are more and more frequently pressed to report their output metrics, for instance, as a stipulation of performance-based funding. Here, too, greater credit may be given for numbers and impact than for the scientific depth of a study (in the best-case scenario, the two overlap again). It is extremely difficult to find an impartial way of measuring the merits, but this is apparently not (easily) communicable to those who request the said data, hence leading to the temptation to “polish” them. The wish, or the imperative of national or international competition between universities is the most probable origin of these developments in academia, again, predominantly with respect to numbers instead of substance.

... Yet, Not against Visions for Applications

Without any doubt, the discovery and further development of new materials and catalyst, pharmaceuticals, and analytical techniques, is the purview of us chemists. Still, how to get there must be taken into consideration.

Especially when reviewing manuscripts or project proposals, one recognizes more and more a striking imbalance between allegedly important works (as measured by the type and number of meaningful words in the introductory sections) and relevant results in terms of applicability. Most certainly, the respective authors know this well—unless they convinced themselves in the meantime by their own, recurring explanations. However, the politically or financially induced necessity of producing high-impact papers apparently calls for such selling strategies. Certainly, among such works, there is the occasional significant one. In this regard, a sheer quantity is a statistical advantage; yet, this would preferably be accomplished in a more honest way, without any political pressure, driven by healthy and solid chemical curiosity and knowledge.

A Case for Cognition and Maintenance of the Beauty of Chemistry

Discussions about the motivations and justifications for exploratory chemistry often fail to consider the sheer

aesthetics of our subject. We not only observe and analyze nature's beauty, we add to it. Who beside us knows how to control, understand, and even predict a sublime thing such as the symmetry of a molecule or a supramolecular aggregate, a fundamental thing like bringing atoms together to form a chemical bond, and such a useful thing like the energy content and reactivity of compounds? All of this is impossible without the fundamental knowledge of us chemists and hence this must absolutely not get lost!

... And Last but Not Least: For Good Mentoring

We complain about the drop in originality and of the loss of a reasonable scientific discourse, but ultimately, we chemists are in control of the future of our scientific culture. While we can only indirectly influence political decisions, we can have an impact in a much more fundamental area—the education of the next generation of research chemists. The intense interaction and teamwork that characterizes our field allows the mentor–mentee relationship to have an extraordinary impact. It resides with us to convey enthusiasm for an unbiased and investigative mind, fascination of fundamental chemical research, and to encourage junior researchers to abandon well-trodden paths and not cling to fashionable topics (only). Dedication to the key questions of our time and the performance of application-relevant studies occurs very effectively in industrial research, as well as in academic research units with partners from industries, often built upon knowledge that resulted from fundamental investigations.

**We chemists are in control of
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If we succeed in teaching our academic scholars how much value can be created by studies that may initially seem purposeless or curiosity-driven, then the diversity of chemical research may (again) have good prospects. For this, it is indispensable, however, to support

young researchers to the best of our ability, as free research is only feasible when free of financial constraints. Fortunately, in this country and other, mainly European, countries, there are fantastic programs to support fundamental research done by junior scientists, as long as it satisfies the strict criteria of being high-quality and original science. Yet, we are obliged to ensure that this remains this way, or is expanded. For the sake of young researchers, we should do what we can to alleviate the political pressure wherever necessary.

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