## Foreword

The decision by the Editorial Board to dedicate the present issue of the *Journal* to the topic of (scientific) integrity was taken in recognition that no longer is its inculcation indisputably at the core of every scientist's education and development. Certain trends in science, perhaps especially the "post-normal science" movement championed by some as representing the way forward, are inimical to integrity. If integrity is an inalienable part of science, "post-normal science" cannot then be science at all. In order for meaningful discussion about these issues to be possible, it is no longer sufficient to tacitly assume what integrity is; it needs careful exposition so that its merits and indispensability can be understood.

Richard Ernst has clearly asserted that "without unlimited honesty, science loses its right of existence" [1]. Richard Feynman has pointed out that scientific integrity goes beyond honesty; it is at a still higher level [2]. He illustrated this with an example of an advertisement claiming that "Wesson Oil doesn't soak through food". This is a true statement, but omits to mention that *no* oils soak through food, if operated at a certain temperature; and at another temperature, *all* oils will, including Wesson Oil. Hence, the *implication* that is being conveyed by the advertisement is wrong [2]. Scientific integrity involves giving as complete an explanation as our present knowledge allows, and ensuring that any implications that might follow from the facts presented are correct.

Integrity may be considered to be the essence of science, much as Herbert Butterfield's famous words "Hold to Christ, and for the rest be totally uncommitted" [1] may be considered to be the essence of Christianity. While one could scarcely imagine better pieces of advice to the young scientist than those from Ernst and Feynman, most scientists nowadays are working within more or less large organizations, both state and private, and in so far as these organizations are themselves entities, not least in the juridical sense, one needs to consider whether the concept of integrity applies to them as well. Furthermore, the individual scientist is more or less strongly influenced by his or her environment, which may include relationships between his or her "home" institution and others. This may be one of the reasons there have been attempts to codify the ethics of the scientist, perhaps most notably by the sociologist R.K. Merton with his "Mertonian norms"—institutional imperatives often taken to comprise the ethos of modern science [4].

Indubitably, it seems, the scientist is a professional, not least because of the long years needed for induction into its mysteries, above all the "scientific method" (for which the PhD or DPhil is an apprenticeship). This is in spite of the fact that it is quite hard to pin down exactly what the scientific method is, although any mature scientist (indeed, mastery of the method is a hallmark of maturity) will follow it as unerringly as if it were something purely intuitive. The true scientist is not, however, a professional in the sense of a technocrat; that is, someone who has mastered a complex body of technical knowledge and has one or more professional accreditations attached to his or her name. The ethos of the scientist, rooted in integrity, goes far deeper than that, and allows us to understand why such distinguished contributions to science have been made by people (perhaps Henry Cavendish is the most outstanding example) whom the technocrat would consider to be a "mere" amateur. It also allows us to understand the disregard of the true scientist for the vertical compartmentation of knowledge into more or less artificially defined "disciplines"; such compartmentation is a vital part of the ethos of the technocrat.

As a professional in the sense that is thus defined, the scientist will readily accede to Douglas Altman's proposition that a badly planned clinical trial, or a poorly interpreted set of findings, constitutes an ethical breach [5]; in other words, a breach of integrity. The fact that Altman's series of papers was needed at all, however, points to widespread deficiencies among scientists (or would-be scientists) in the appreciation of what integrity is and implies in practice. Especially telling is the conclusion of the final paper of the series: "it is essential to have higher standards for published papers". Likewise, one can point to unnecessary obscurity, prolixity and inappropriate citing as further breaches of integrity.[2] It is somewhat disquieting that about a hundred years ago Bertrand Russell opined that only 10% of scholars are interested in truth, and 90% in popularity. If so, that explains a great deal.

Nevertheless, it is only recently that "integrity" has become a topic of frequent discussion among scientists, and even a topic of papers and conferences.[3] Until now, attention has chiefly been focused on research fraud, which seems to be a growing problem. Legislation, and paralegislation such as the *Concordat* in the UK (see the paper by Evans in this issue[4]), are mainly concerned with that problem.

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[1] With which he ended a lecture series originally given at Cambridge, and subsequently published [3].
[2] Wilfully ignoring relevant work, especially when it debunks one's favourite theory, also constitutes a breach of integrity. See [6] for an example, also the paper by Cuhra in this issue (pp. 137–138).
[3] Such as the *World Conference on Research Integrity* (WCRI) series.
[4] See pp. 139–144.



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Whether legislation can ever be the answer is, however, a moot point. The practice of law in the English tradition is firmly rooted in advocacy (unlike on the main European continent, where the law tends to be more or less precisely codified and any dispute is in principle resolvable algorithmically). One of the most difficult questions for the scientist is whether, in propounding a new viewpoint, it is permissible to adopt the approach of the barrister, who selects those facts that suit his or her case and marshals them accordingly for the judge. Although this seems like a cavalier approach to "the truth", and even contrary to the principle of integrity as declared by Feynman, one should remember that the degree to which the selection is made is always tempered by the possibility that a deliberately ignored fact brought to light by the opponent could effectively completely demolish the advocate's case. In that regard it is very different from the advertisement described by Feynman, which is passively received by listeners, or television viewers, without any possibility of critical response. The scientist-advocate has innumerable judges, all of his or her peers who have some interest in the matter, and this should give the scientific community some confidence in not condemning scientific advocacy out of hand. There are, of course, distorting features—some scientists may have preferential access to the media, or work in prestigious institutes, which may result in undue weight being given to the opinions of some, regardless of the intrinsic merit of the opinions. It might be considered that the greater evil is showing such partiality, rather than the advocacy itself.

It is useful to distinguish between integrity at the level of the individual, and at the level of the institution in which the individual works. The temptation for the individual to commit research fraud is usually straightforward—above all, perhaps, the lure of fame, but given the now very widespread "Leistungsorientierte Besoldung", not only in Germany but in many other countries, fame is very often linked to financial remuneration from the institution in which the individual is employed. The institutions themselves nowadays typically apply great pressure to their individual researchers to bring in funds, which is of course greatly helped by prominent publications and the like. Furthermore, the proliferation of research assessment exercises has made the funds allocated to universities by the State heavily dependent on scientometrics, such as the number of papers published in high impact-factor journals. It is especially disquieting that the prevailing spirit seems to be epitomized by the comment "There is no cost to getting things wrong, the cost is not getting them published".[5] If that is so, individual researchers may perceive it as a very small step from "genuine" mistakes (be they methodological or of interpretation—in themselves quite possibly breaches of integrity) to deliberate fraud and falsification. The universities are in turn under great pressure from their funders, namely the State, to secure research contracts from industry [7], and from government, allowing the direct allocation of State funding to be reduced. There are clearly some deleterious consequences from this linkage between academia and industry [8, 9]. I suspect that in many cases the greatest pressure comes from the university administrators, mindful of the financial state of their institution, and whose own salary may depend on the amount of external funding being brought in to the area under their managerial supervision.

The above applies especially to individual academics and universities. The position of scientists working in a private company is covered in Ramsden's paper in this issue.[6] The third category of institution is the state laboratory or agency.

The great flowering of state institutions of scholarship, especially those devoted to scientific research, began in the early 19th century in France under Napoleon. Britain and Germany had their advocates as well (Matthew Arnold and Wilhelm von Humboldt, respectively). The notion of the selfless public servant, selected by competitive public examination (thereby creating a meritocracy) came from China but it was enthusiastically adopted in Europe. This "mandarinate" was secular, essentially humanist by default despite the contradiction between the primacy of individual freedom that it implies and devotion to the splendour of the State, implying the primacy of social harmony and the corresponding laws, in a very Confucian sense.

Moving on almost 200 years to the early 21st century, we find that the urbane, cultured civil servant setting an admirable example to the mass of the population has been replaced by an uncouth technocrat—the "expert", marvellously trained in one narrow field but both unwilling and incapable of perceiving any relationships between the field of his or her specialization and any others, which largely negates the value of any professed expertise. The unwritten ethical principles of the predecessor of the technocrat which, although secular, nevertheless absorbed a good deal of the ethical ideas of the prevailing religion, have been replaced by a code of

[5] Brian Nosek, a psychologist at the University of Virginia, quoted in *The Economist*, 19 October 2013.
[6] See pp. 155–162.

conduct—the Nolan principles ("Seven Principles of Public Life") in the UK.[7] As so often happens, alas, when (but not because of—rather, the code is symptomatic) a code of conduct is introduced, it is honoured more in the breach then in the observance.

The sole motivation for action appears to have become plutolatry; hence venality is rife.[8] An egregious contemporary example is the European Food Safety Authority (EFSA) [10], which was reprimanded by the European Court of Auditors in 2012. An example from several decades ago in the USA has only recently come to light [11–13]. In the case of EFSA it appears that it is usually the individual advisers to whom pressure is applied by external companies (typically in much more subtle ways than simply offering bribes), but the agency seems to inculcate an atmosphere where this is tolerated.

In conclusion, integrity is by no means an issue confined to the life and work of the scientist; it can equally well be applied to any form of scholarship.[9] But, the issue is especially acute regarding scientific research. The bottom line is the question whether research conducted with integrity is better than research conducted without it. The answer would appear to be an unequivocal "yes": research conducted without integrity is, ultimately, unreliable [14].

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[7] The UK Government has developed a *Code of Practice for Scientific Advisory Committees* (including a *Universal Ethical Code for Scientists*), especially aimed at the Food Standards Agency (FSA).

[8] In the United Kingdom, a measure of protection is provided by the Public Bodies Corrupt Practices Act (1889), the Prevention of Corruption Acts (1906 and 1916), and the Bribery Act (2010).

[9] See the paper by Braithwaite in this issue, pp. 163–166.