



# Ethics and Scientific Integrity in Biomedical Research. Debates on Trust, Robustness, and Relevance

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# Ethics and Scientific Integrity in Biomedical Research

## Debates on Trust, Robustness, and Relevance

Léo Coutellec

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### Abstract

Because it is directly implicated in major social issues, biomedical research is a paradigmatic field for working in ethics to cross-reference epistemic, social, and political issues. This chapter shows that the ethics and scientific integrity of biomedical research has grasped this challenge by placing the transversal concern of trust at the heart of its approach. This question of trust is put into perspective with that of trustworthiness, which is closely linked to it, and which is described as a way of thinking together with the robustness of methods, evidence, results, and the social, ethical, and contextual relevance of trade-offs about them. In a context of increasing media coverage of scientific misconduct and profound changes in the scientific landscape, the ethics of biomedical research thus invites us to take up the complex question of the links between trust and trustworthiness.

### Keywords

Research ethics · Scientific integrity · Trust · Robustness · Relevance

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## Introduction

Issues about the ethics of biomedical research have focused mainly, since the second half of the twentieth century, on the protection of research participants and human dignity. The enactment of the Nuremberg Code (1947) is its founding act, highlighting from the very first principle the question of consent, which came to be a structuring issue for all medical ethics. These principles were then taken up and refined in 1964 in a World Medical Association text, the Declaration of Helsinki, and then translated into many international texts, in particular the Convention for the Protection of Human Rights and Dignity of the Human Being with regard to the Application of Biology and Medicine, known as the Oviedo Convention in 1997. Medical ethics, and more broadly bioethics (Engelhardt 1986), became institutionalized and developed an important corpus of reflections and practices; the first major work on the subject, the *Encyclopedia of Bioethics*, was published in 1978 (Reich 1978). Mainly disseminated in the form of an ethics of principles (Beauchamp and Childress 1979) and centered on the issue of the care relationship and the protection of individuals, in a context of very rapid techno-scientific development, the field of bioethics gradually embraces broader fields including animal issues, the environment, future generations, and techno-scientific innovations (Martensen 2001).

At the same time, since the 1970s, the issues that we now call “scientific integrity” have developed into shared concerns in the scientific and decision-making communities, thus broadening the notion of ethics in biomedical research to include the question of research practices and the nature of the production processes of scientific knowledge. The first World Conference on Research Integrity (WCRI) was held in Lisbon in 2007 under the impetus of the Office of Research Integrity (ORI), created in the USA in the early 1990s following the revelation of scientific misconduct in the field of biomedical research. Indeed, confronted with a number of cases of proven misconduct that are the subject of media coverage, or questionable research practices (QRP), the global research community is faced with the obligation to regulate in order to maintain public trust and establish clear good practice frameworks at the international level (Resnik and Shamoo 2011). Initially focused on proven misconduct in research (fabrication, falsification, and plagiarism – FFP), scientific integrity has gradually embraced questions whose scope is both epistemological, particularly on the quality of the knowledge produced, and sociopolitical, particularly around questions of social responsibility, values, and the purposes of science. Today, we can affirm that the issues of ethics and scientific integrity in biomedical research are closely linked and must be considered together.

Two elements of contextual analysis have contributed to strengthening this movement since the 1990s: a questioning of scientists’ capacity for self-regulation, a capacity that is considered to constitute the scientific approach; and the observation that the growing entanglement between universities and industry in a context of international competition creates additional incentives for research misconduct (Jasanoff 1993; Nowotny et al. 2010). On the first aspect, the literature on candidate genes confirms this doubt as to the ability of scientists to self-regulate

and self-correct. For example, in 1996, a study showed the direct influence of the SLC6A4 gene on depression. In 2019, scientists at the University of Colorado demonstrated the opposite, finding no evidence of the correlation between depression and SLC6A4 gene, as well as with the 17 other genes most often associated with this psychological state, based on a study of large groups of people (Border et al. 2019). The 1996 publication generated a great deal of interest, generating hundreds of publications and millions of dollars in research expenditures in this direction. As early as 2005, the fragility of the link between SLC6A4 and depression was highlighted (Willis-Owen et al. 2005), but despite this publication, the rate of publication of articles on candidate genes for depression accelerated, with the total number of these articles even quadrupling over the following decade. Thus, if self-correction occurs, the observation is that it often occurs too slowly and reduces the effectiveness and relevance of biomedical research (Ioannidis 2012). On the second aspect, it is also noted that the changing landscape of biomedical research has a number of characteristics that can contribute to generating or at least reinforcing this phenomenon. This is the case with the increasing size and interdisciplinary nature of research teams, the multiplication of public-private partnerships that are developing in the context of international competition, techno-scientific developments which are important particularly in the field of genetics (Chneiweiss et al. 2017), and a massive and heterogeneous collection of data, that is known as the big data phenomenon (Leonelli 2014).

Gradually, these questions have thus become of primary importance on the agenda of the various institutional actors in biomedical research. Increasingly universities, research organizations, and, hopefully, researchers cannot ignore these ethical concerns. Declarations, manifests, guidelines, and charters are flourishing to try to frame practices and contain what could be called a crisis in the production of biomedical scientific knowledge. The signs of this crisis are numerous and now well documented. We find a fairly comprehensive overview in some recent publications that are accessible to both the scientific community and the general public (Stegenga 2019; Harris 2017; Yarborough et al. 2019). While scientific integrity problems are not specific to biomedical research, some of them are particularly problematic in this field where human applications can be rapid.

This is the case for the results of insufficiently substantiated studies, the manufacture or falsification of data, the overestimation of the effectiveness of experiments, and the failure to take into account previous research (Chalmers 2002), resulting in a worrying waste of resources and reinforcing what some authors call a crisis of reproducibility (Ioannidis 2005; Manufo et al. 2017). As a result of these questionable research practices or misconduct, in 2009, a publication estimated that by cumulative effect, 85% of biomedical research investments – or about \$200 trillion per year – were wasted (Macleod et al. 2014). The findings on the existence and prevalence of this phenomenon have been reinforced in recent years by the development of the field of meta-analyses (Chalmers et al. 2002; Pupovac and Fanelli 2015). In response to this situation, many recommendations are made by institutions or directly by some researchers, such as this series of articles published in *The Lancet* in 2014 to improve quality and reduce waste in biomedical research

(Macleod et al. 2014), or this work that attempts to respond to the “crisis of reproducibility” by epistemological work on the heterogeneity of experimental conditions by going beyond the classical normative approach that aims to standardize these conditions (Richter et al. 2009; Milcu et al. 2018). The current “open science movement” for better data sharing and access is also a symptom of this.

More generally, all recent developments lead us to the same conclusion, that of the convergence between research ethics issues, traditionally centered around the questions of principles, values, and purposes of biomedical research, and those of scientific integrity – traditionally centered around the norms and rules of scientific practice. We have reached this point, and what is now called the ethics of biomedical research in the broad sense integrates traditional questions of medical ethics, the issues of scientific integrity, and those of the social responsibility of researchers, in a close link with analyses arising from the philosophy and sociology of science and technology. And that is why, in such a context, such a central question as that of trust, which falls within each of these fields and which could alone summarize the whole issue of the ethics of biomedical research, arises. This is what this chapter attempts to describe, by including this issue of trust in the debates on trustworthiness, robustness, and relevance of biomedical research. Thus, in coherence with its evolution, it will be shown that research ethics builds a fertile relationship with epistemology (Worrall 2010; Hicks 2014; Coutellec 2015). Because it is in direct contact with major social issues, biomedical research is a form of paradigm for working in ethics to cross-reference epistemic, social, and political issues. Finally, it is our conception of science and how to generate knowledge in its links of involvement with society that is at stake.

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## The Issue Around Trust and Trustworthiness

This is one of the main motivations of legislators and research actors for the implementation of research ethics and integrity policies: to maintain, strengthen, or regain trust, both within science itself and with society. Trust has become a central, even vital, issue for biomedical research, and the lack of trust is seen as a threat to its future as this field is so involved in society and dependent on building strong and sustainable research partnerships with the public (Mastroianni 2008). Indeed, behind the question of trust lies the question of consent, a consent that is broadly understood, namely, not only the informed and free agreement to participate in certain research or trials but also a conscious consent to the biomedical research enterprise as a whole. And in the face of this problem of mistrust about the validity and reliability of certain research, and even biomedical research in general, the mere guarantee of the implementation of scientific integrity rules or procedures, with a view to regulating practices, does not seem sufficient (Wright 2010; Kerasidou 2017). Trust is strengthened not only by the existence of rules of good conduct but also by ensuring the virtuous and responsible nature of research actors (Coughlin et al. 2012) and the fairness of institutions (Ricoeur 1992).

These aspects confirm the idea that trust is a form of “encapsulated interest” (Hardin 1996, 2002), i.e., it involves the multiple interests of all actors in a relationship of reciprocity and dependence. Therefore, beyond simple compliance with the rules – a minimum concern for research ethics – institutions are encouraged to engage in more cross-cutting measures, for example, by examining how research priorities are set (Kitcher 2001), by strengthening monitoring mechanisms to ensure that research is conducted in a morally appropriate manner, or by improving the quality of researchers’ training to conduct responsible research. This is the now well-documented challenge in research ethics of moving from institutional compliance to building true informed and shared trust (Yarborough and Sharp 2002). For while the goals of biomedical research appear clear and shared – for example, to reduce suffering and promote human well-being and to contribute to the advancement of knowledge – to translate these goals into research priorities, resource allocation, technology strategies, and partnership building is not so simple. As in many scientific fields where there are multiple and sometimes competing purposes (Elliott and McKaughan 2014), the challenge is to understand that for each of these objectives several research paths or trajectories are possible, and trade-offs are therefore inevitable. And it is the validity and relevance of these arbitrations that are now being questioned. This essential condition of trust invites us to take seriously the contextual (or non-epistemic) value issues of research and the consideration of community needs and/or societal goals in relation to research. One way to make this match between research objectives and community or social objectives possible is to involve as many stakeholders as possible in the design of research orientations and in the research itself (Nordmann 2019).

Another aspect of confidence in biomedical research is the trustworthiness of its methodologies, knowledge, hypotheses, or results. Although the links between trust and trustworthiness are not so easy to establish in practice (Kerasidou 2017), it is usually agreed that trustworthiness is one of the conditions of trust, a condition of competence. Trustworthiness is understood as the ownership of an entity that reinforces an attitude of trust toward it. But it remains unknown what this property really means in the context of science, and particularly biomedical research. The term “epistemic trust” is sometimes used to characterize this field of reflection, but mainly in social epistemology (Wilholt 2013). The first article in the Singapore Statement on Research Integrity refers to this notion of trustworthiness: “Researchers should take responsibility for the trustworthiness of their research” (Resnik and Shamoo 2011); and this is the case for many international declarations in the field of scientific integrity. The question of trustworthiness is a way of bringing the question of trust back to the heart of science: it is no longer just a question of building trust in a researcher, a collective of researchers, or an institution but also and concomitantly in relation to the knowledge it produces. In other words, trustworthiness is no longer only a question of institutional trust or the ethics of virtues but also a methodological and epistemological issue.

We therefore see the emergence of one of the essential characteristics of trustworthiness in science, inseparably epistemic and ethical (Hicks 2014). If I can rely on the results of biomedical research, and therefore ultimately have trust, it is

because I consider it to be solid or robust that it produces knowledge that is verified and related to reality, but also because I consider that this knowledge brings me something and that it is related to objectives that I consider relevant. Trust always implies the possibility of betrayal, and this possibility of betrayal is thus double in science, a betrayal on the robustness of the results and a betrayal on their relevance (Hardin 2002). Thus, trustworthiness refers both to the epistemic norms and criteria of robustness (knowledge, hypotheses, models, etc.) and to the epistemic and non-epistemic values of relevance; a notion that is found, for example, in the Leiden Manifesto (Hicks et al. 2015). The observation was therefore made that the most classic call for the trustworthiness of science, the idea that science can be trusted or that science is trustworthy, is to be understood in a dynamic relationship between the idea of robustness and the idea of relevance. These two concepts are worthy of closer investigation.

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## Trustworthiness and Robustness: The Issue of Evidence

The issue of robustness was introduced by Richard Levins in 1966 around the issue of ecological modeling (Levins 1966) and is now a well-developed issue in the philosophy of science (Soler et al. 2012). Robustness is traditionally defined as the state of an outcome supported by evidence from multiple techniques with independent baseline assumptions (Stegenga 2009; Eronen 2015). Thus, it was agreed to say that the robustness of a hypothesis, argument, theory, or result depends on the plurality of evidence produced relatively independently with respect to it (Lloyd 2015). The consensual idea around this notion of robustness is therefore the benefit of heterogeneity and the idea that the multiplication of sources and registers of evidence contribute to robustness. Today, the argument of the large number of data as a factor of robustness is advanced, with the rise of big data approaches in the biological sciences (Leonelli 2014). However, it is important to note that although robustness strengthens our ability to believe in a hypothesis, its inference to the truth is not assured (Parker and Winsberg 2018) and the risk of error or inductive risk persists (Douglas 2000). Robustness is not a guarantee of truth. This is particularly salient in a predictive context where agreement on the results of our models is not enough because we will only be if the forecasts are accurate or true if we compare the model's forecasts with the actual conditions of the predicted event.

Also, the literature highlights the difficulty of establishing robustness criteria in practice, in particular the approach that aims to generate multiple proofs and the question of their combination and prioritization, especially in the case of conflicting data, which is very common in science. Scientists are often confronted with conflicting data and must therefore decide which evidence is most relevant. This aspect is the basis of many scientific controversies, when some scientists believe that evidence from certain techniques is most relevant to support or demonstrate a hypothesis, while another group of scientists believes that evidence from other techniques is more relevant (Stegenga 2009). This is why, in biomedical research, the generation of evidence, its combination, and arbitration have become a very

important aspect, both epistemological and ethical. Classically, this question has resulted in a formalization of the hierarchy of evidence. In fundamental and clinical biomedical research, this was illustrated by the development of the evidence-based medicine (EBM) movement born in the early 1990s (Daly 2005).

At that time, surveys were carried out among general practitioners and showed that many of them were unaware of the scientific advances in their field and based their practice on routine practices often based on obsolete knowledge that had not been updated or updated since their university education; and the need was then expressed to produce scientific summaries and criteria for identification among the many proofs generated by research. This extends Archie Cochrane's appeal in the 1970s, which defended the idea that medical care is for the most part ineffective and inefficient and then defended the strategy of using "randomized controlled trials" (RCTs) to choose among the treatments (Cochrane 1971). The question is always the same, when does what a researcher, clinician, or doctor do produce more good than harm to the people involved in the intervention? It is therefore the challenge of robustness and its justification that the EBM movement wanted to take in hand.

Although this movement has considerably improved the way in which the links between research and clinical practice are understood, and has had the merit of making a concrete proposal to solve the problem of multiple proofs and their combination, it has raised a number of problems and criticism. Overall, this movement is criticized for its excessive reductionism in its approach to evidence (Daly 2005). And, despite the initial intentions, the difficulty of combining and playing with several registers of evidence persisted. The EBM movement didn't succeed in finding a balance or a compromise between an approach that aims to excessively reduce the variability of situations encountered by trying to put it in the narrow boxes of scientifically established facts, and another approach emphasizing the superiority of clinical experience over any other form of knowledge production but which would neglect to update its methods and treatments. In other words, despite its initial intentions, this movement has clearly failed to overcome the sterile opposition that has too often structured the epistemology of medicine between "art" and "science" (Solomon 2005).

Thus, what the EBM critics (Cohen et al. 2004; Greenhalgh et al. 2014) point out is the paradox of an approach that seeks to strengthen the robustness of medicine but has failed to apply the one central principle of combining heterogeneous evidence, and not simply an accumulation of evidence of the same type (such as from an RCT). For example, it is often reported that in the prioritization proposed by the EBM, including the centrality of RCTs, some of the evidence produced is not appropriate for clinical practice, especially in primary care, where patients often have a complex mix of psychological, physiological, social, and other comorbidities. This last aspect is particularly true in the case of chronic diseases, such as Alzheimer's disease. Statistically significant but clinically irrelevant benefits are exaggerated in large trials, while systematic reviews report relative rather than absolute effects. All criticisms of the EBM, including those that have helped to found and promote it, lead to the same call to return to the foundations of the EBM, namely, that the best research evidence must be combined with patients' values and circumstances, as well as practitioners' expertise.

Also, there was another type of criticism: in this hierarchy of evidence in EBM movement, RCTs are at the top and therefore always at a higher level of evidence than any other evidence however well conducted (e.g., population-based observational studies). RCTs are one of the golden standards of medical evidence (Worrall 2007) whether it is to prove the effectiveness of a treatment, the reliability of a diagnostic test, or that of a prognostic procedure. Consequently, external validation of RCTs against observational population studies has been questioned, as well as the validity of causal claims with a devaluation of theoretical work that makes the EBM a rather rough empirical description (Thompson 2010). That is why, for some authors, in the absence of a “theory of evidence,” procedures for prioritizing evidence according to its supposed quality are problematic (Cartwright 2007; Cartwright and Stegenga 2011). These procedures lack the richness of a combination of evidence. In particular, it lacks a reasonable and achievable understanding of what different pieces of evidence say about a hypothesis and with what relative strength they speak. Thus, after 30 years of developing evidence-based medicine, fundamental questions remain: What is considered evidence? Do some types of evidence carry more weight than others? (And if so, why?) And how should medicine be properly evidence-based (Worrall 2010)?

Another tension arises if the strength of the evidence lies in the evidence itself or in the methodology used to obtain it. For many clinicians, when evaluating the effectiveness of medical interventions, it is the evidence obtained from the methodology rather than the methodology that should establish the strength of the evidence (Mebius 2014). However, the EBM approach has moved practitioners somewhat away from evidence to procedure, which is paradoxical, as the multiplication of evidence has become unmanageable. The following example illustrates this: “One 2005 audit of a 24 hour medical take in an acute hospital, for example, included 18 patients with 44 diagnoses and identified 3679 pages of national guidelines (an estimated 122 hours of reading) relevant to their immediate care” (Greenhalgh et al. 2014). The fact that some treatments are effective, while others are not, is distinct from the presumed quality of the method that determines their causal role.

The EBM approach was based not only on the question of reliability through the robustness of the evidence but also on the question of relevance (Daly 2005). Because when it comes to choosing or prioritizing evidence or levels of evidence, this question automatically appears (Kelly et al. 2015) and, with it, that of the place and role of values.

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## Trustworthiness and Relevance: The Challenge of Values

Between the conflicting data, scientists often choose those data that are consistent with their epistemic tasks (Cartwright 2007); it is the idea that epistemic justification is relative to background assumptions (Longino 1990) or ontological choices (Ludwig 2015) and that these aspects are necessary to establish the relevance of the empirical evidence of a theory or a model. This question of relevance is the second facet of the notion of trustworthiness: a trustworthy science is not only a solid

or robust science, it must also be a relevant science (Cartwright and Stegenga 2011). However, some analyses show a form of de-correlation between these two aspects of trustworthiness. For example, this has been done in the context of studies on the conservation of wild bees in the United Kingdom where a “relevance score” of the knowledge produced was compared to the impact factor of the journals that published this knowledge, impact factor which can traditionally be considered as an indicator of methodological robustness and compliance with an accepted hierarchy of evidence (Sutherland et al. 2011). In public health studies, the question of relevance arises directly, particularly because the health of vulnerable populations is often at stake (Coughlin et al. 2012). To assess the question of relevance, one needs to ask these kinds of questions: is this research well-founded, and does it meet the objectives expected of biomedical research? Is the place of values and their role in scientific approaches, particularly in a context of complexity where data and evidence registers are both multiple and heterogeneous? In the literature, this has been done through deconstructing the value-free ideal of science.

Arguments against the value-free ideal of science have been widely worked on and discussed in philosophy of science (McMullin 1982; Douglas 2009), with a consensus on the idea that science is also a matter of values but with a persistent debate on the place of non-epistemic values in the process of knowledge production (Longino 2002; Douglas 2000, 2009). Indeed, to gain relevance in the choice or hierarchy of a proof, a result, or a theory, it is possible to use epistemic values (i.e., internal coherence, simplicity, explanatory power, empirical adequacy) but also non-epistemic values that can be qualified as contextual, social, or ethical. The discussion around these values focused on their legitimacy and how they can intervene in the epistemic process. Indeed, if non-epistemic values cannot be excluded, can we accept everything and at any time during the process, and if not on which criteria should we decide on the “right” values to consider in making epistemic choices (e.g., a hierarchy of evidence levels)?

Some authors grant priority legitimacy to non-epistemic values of a democratic nature (Schroeder 2018; Lacey 2016), i.e., values that represent the common good and are mainly shared in a society (e.g., this may be the case today for the values of equality or ecological sustainability). It is also possible to decide on the legitimacy of the intervention of a non-epistemic value by conducting an investigation on the benefit of such values in relation to others (Elliott 2011).

According to (Hicks 2014), for example, in the field of archaeology, the influence of feminist values (and in particular the questioning of male domination and gendered hierarchies in the division of labor and specializations) has led to more empirically adequate and coherent theories, and to a better explanatory framework. On the contrary, in the case of research on pharmaceutical products, the influence of non-epistemic values of a commercial type seems to have hindered the production of knowledge, which can lead to distortions, misrepresentations, and gaps in the examination of competing hypotheses. This problem of the place of non-epistemic values is also very present in the field of climate change modeling and simulation (Intemann 2015). Some authors argue that in biomedical research, and in particular when assessing the trustworthiness of accumulated data and their interpretation, the

influence of non-epistemic values is not only possible but necessary to better take into account the context and needs of the persons or communities concerned. In some research contexts, the emphasis on social and ethical values over epistemic values is justified so that research in this specific scientific context can be conducted in a socially relevant manner. This was the case, for example, in the context of the “Ebola ça suffit” trial, where two arbitrations based on non-epistemic values were made regarding the choice of the control group and the choice of randomization, in order to support the social utility and ethics of this trial (Varghese 2018; World Health Organisation 2019). Without weakening the robustness of the test, conventionally mobilized epistemic values such as simplicity or efficiency were exceeded, and non-epistemic values such as distributive justice, care for the needy, and social utilities of containing and mitigating Ebola virus disease transmission have been mobilized rather than only by the epistemic feasibility of these methodologies (Varghese 2018).

The judgment on relevance invites us to be attentive to the effects of knowledge as much as to its nature. In other words, ensuring the relevance of a research project means adding to the idea of robustness the concepts of context relevance and consequence assessment. Relevance is associated with a knowledge production process that assumes its involvement (in a context, with values and for certain purposes), and not the only claim of robustness associated with a knowledge production process that claims neutrality within the framework of a “decontextualizing methodological approach” (Lacey 2015). Addressing the quality or trustworthiness of research through its relevance also makes it possible to undo some epistemic hierarchies built on the basis of methodological reductionism (which seems to be the case for EBM). This desire to design knowledge that is both robust and relevant is significant in the co-production of knowledge in the health field. The history of AIDS research is a paradigmatic example (Epstein 1996), as well as public health research that aims to build knowledge with communities and not only about them (Chatfield et al. 2018). In the latter cases, cardinal values are defended – fairness, respect, care, and honesty – in the design and conduct of public health research. It is the determination, more broadly, of user groups that seek to co-produce relevant knowledge about their disease, like the Dingdingdong collective for Huntington’s disease, whose primary requirement is to pay as much attention to the nature of a knowledge as to its effects (Hermant and Solhdju 2015).

Finally, and beyond these debates on the legitimacy of particular values in research, the most cross-cutting hypothesis that has been made in the literature is that one way to increase the relevance of knowledge is to welcome the greatest diversity into the process that generates it. Thus, robustness is no longer what is obtained by a movement of reduction of the object or specialization of the scientific field to apprehend it but, on the contrary, by a movement of extension and pluralization. It is a position in epistemology defended by the philosophers Miriam Solomon and Helen Longino who consider that diversity is not only desirable but also necessary to increase the relevance of knowledge and do “good science” (Longino 2002; Solomon 2006). Diversity reinforces the fertility of the scientific approach (through the questioning allowed by offbeat or dissenting views), extends

the reality with which we have to confront ourselves (which is no longer the only reality of the laboratory or experimental plan), and broadens the observational basis and concerns of the knowledge production process (i.e., what we consider worthy of being considered). This is why scientific pluralism (Kellert et al. 2006; Ruphy 2017) is a factor of trustworthiness, reinforcing both the robustness and relevance of research. This aspect is one of the most significant contributions to the evolution of the ethics of biomedical research, understood as the encounter of epistemic, ethical, and political concerns.

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## Conclusion

Because it is directly involved in major social issues, biomedical research is a form of paradigm for working across the whole field of ethics on epistemic, social, and political issues. In this contribution, it has been shown that the ethics and scientific integrity of biomedical research have grasped this challenge by placing the generic concern of trust at the heart of its approach. Recent institutional mobilizations around scientific integrity are the most visible symptoms. We have put this question of trust in perspective with that of trustworthiness, which is closely linked to it, and which we have described as a way of thinking together and dynamically the robustness of methods, evidence, results, and the social, ethical, and contextual relevance of arbitrations about them. From an essentially ethical questioning on the impact of scientific advances on the care relationship (with an approach to the ethics of rights or the ethics of virtues), biomedical ethics as well as scientific integrity have considerably expanded and become more transversal to embrace an increasingly complex reality. In a context of increasing media coverage of scientific misconduct and profound changes in the scientific landscape, the ethics of biomedical research thus invites us to take up the complex question of the links between trust and trustworthiness. What we have sought to highlight in this chapter is the importance of a generic approach to this issue, combining ethics and epistemology.

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