EDITORIAL

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Ethics in pace with scientific progress

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The rapid growth in the number of scientific publications from China has been accompanied by increasing incidents of scientific misconduct, particularly in biomedical sciences. Most notably in April 2017, the journal *Tumor Biology* retracted 107 papers from China, based mostly on a fraudulent peer-review process. In response to this incident, the Ministry of Science and Technology (MOST) and China Association for Science and Technology (CAST) issued a stern instruction for punitive measures to all relevant organizations, including all forms of misconduct in publications.

It has often been asked whether China lacks the same ethical standards in scientific research as those in more advanced countries of the West. The answer to this question may be complex. 'No', there are strict rules at the level of government agencies—both the National Natural Science Foundation of China and Chinese Academy of Sciences (CAS) have long established detailed regulations and guidelines, in which misconduct in 'fabrication, falsification, and plagiarism' is clearly defined and punitive measures are listed. However, the answer could also be 'yes', because these rules have seldom been rigorously executed.

Many research institutions in China have not established objective and reliable mechanisms to investigate cases of alleged misconduct, and are often reluctant to deliver a definitive verdict on cases of misconduct and to impose appropriate punitive measures. This institutional tolerance and the lack of punitive measures, together with the system that evaluates a researcher mainly by the number of publications, could have contributed to the high frequency of misconduct in scientific publications (see *Natl Sci Rev* 2015; **2**: 122–5). The timely instruction of MOST and CAST that specifically addresses punitive measures, if further enforced by governmental oversight mechanisms, will have a long-lasting effect in ensuring ethics in scientific publication.

One area in which progress remains slow in China is the requirement for graduate-school education to include courses on scientific ethics. It is important for beginner researchers to have clear ideas not only on the definition of scientific misconduct, but also on proper practices in data collection, analysis and all forms of scientific communications. Regulations on scientific ethics must be combined with educational efforts in order to develop a culture of scientific integrity in research institutions.

Aside from misconduct in scientific publications, there are ethical issues concerning whether and how experimental studies should be regulated in certain research areas, such as the application of gene-editing methods on human embryos for correcting genetic disorders, the use of stem cells for therapeutic purposes and, more recently, the cloning of a primate species. In terms of gene manipulation and stem-cell therapies, current ethics rules in China are in line with those of international communities, in both the safety issue and the restraints on experimentation with human tissues and embryos (see *Natl Sci Rev* 2016; **3**: 257–61). We note, however, that society's attitudes and government regulations are evolving, and one such recent examples is approval for the genetic modification of mitochondrial DNA in human embryos in several countries, beginning with the UK.

Progress in frontier science and technology has greatly improved the quality of life for human societies, but consideration of ethical issues accompanying the progress have not always been kept in check. This is not limited to biomedical sciences. Rapid progress in artificial intelligence (AI) and neural modulation technology, among many other areas, has raised urgent ethical concerns: whether and how the society may regulate AI technologies that infringe upon human rights and livelihood. It would be useful to have international discussion and consensus on these issues at the level of the United Nations.

Cultural factors will influence the extent and pace at which each society adapts to the international consensus. Even within a society, religious beliefs have caused a major split of opinions over issues such as induced abortion. As Chinese science increases its weight on the world scene, Chinese scientists ought to participate fully in the international discussions on issues of scientific ethics, in order to reach international consensus. We foresee a future in which Chinese scientists are not only conformers, but also active contributors to the international consensus on ethics in scientific exploration and technological development.

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