Progress expands bioethical boundaries

Bioethics is a rich and continually evolving field. In the broadest sense, bioethics relates to the way human individuals treat any form of life. The issue of whether human beings have the right to do whatever they want goes way back. However, rapid progress in genetic engineering and cell biology means that it is now necessary to look at certain issues in a new way and recognise that not everything that is technically feasible should actually be carried out. The bioethics dossier covers some of the most urgent current questions.

Bioethics has become a public issue. The photo was taken at a public hearing of the German Ethics Council in April 2013.

The debate on bioethical issues struggles to keep pace with scientific progress. This has been the case for years and will continue well into the future, as the most recent example clearly shows. A genetic test for the diagnosis of Down's syndrome and other foetal chromosomal disorders has been shown to be more reliable than ultrasound examinations. It is therefore highly likely that the test will not only be offered for high-risk pregnancies, but become standard in prenatal screening. Professional societies in Germany have already expressed their concern, but there is little chance it will not happen.

Debates, especially those on embryonic and stem cell research, revolve very much around human dignity, the understanding of which is crucial in evaluating moral options. Attempts to restrict human dignity to living people, for example, stand in opposition to Christian theological understanding which categorically rejects euthanasia, abortion and embryonic research.

Reproductive research drives ethics

American researchers (Tachibana et al., 2013) recently successfully established the first cell line of human embryonic stems cells derived from somatic cell nuclear transfer. This has turned the rather theoretical debate on the reproductive cloning of humans into a concrete issue of ethics in science and research. Christiane Woopen, chair of the German Ethics Council, has said that this gives rise to the immediate need for a review of German law, particularly the Embryo Protection Law, to make it more precise. She considers the law unclear on the issue as to whether cloned embryos are on the same level as normal ones, and whether they should be given the same moral value and protection. Experts believe that cloned humans may have a high risk of genetic diseases and reduced life spans. However, what will happen when nuclear transfer methods are further developed and refined using animals and stem cells? Will this then raise the issue of an acceptable risk-benefit ratio?

Research and industry place great expectations on individualised or personalised medicine into which they are investing large amounts of money. However, nobody knows whether these expectations are realistic. Despite initial successes, individualised diagnostics, prevention and therapy are still in a very early stage of development. In addition, some critics believe that this type of biomedicine will lead to a number of health-political and economic problems that make the comprehensive application of individualised medicine in the near future rather unlikely.

Towards genetic healthcare

High-throughput sequencing methods are becoming increasingly common in clinical settings where they are used for the diagnosis of diseases (rare monogenic diseases in particular) (Ropers et al., 2013). The emergence of genetic healthcare, i.e. knowing our susceptibilities to disease before illness strikes, taking prevention measures and making decisions about the prescription of drugs, cannot be stopped. However at present, the general public knows far too little about genetic diagnostics, and, worse still, medical professionals lack the necessary knowledge and training (German Ethics Council, April 2013). Even, the approximately 300 human genetics specialists in Germany are not enough to deal with the growing demand for their expertise and the increasing amount of genetic data that needs to be analysed.

So the question is, how do researchers, doctors, patients and actors in the public health sector deal properly and responsibly

with genetic information? How can data security be guaranteed (for example when comparing genetic patient data with those stored in biobanks)? What about new kinds of informed consent? How can the right to not know be guaranteed? Ethical concerns may have to be discussed 'ex post' in cases when a method such as the aforementioned genetic test progresses so rapidly that it drives other established methods out of the market. Ulrich Bahnsen (Die Zeit, 13th June 2013) discussed this market-driven acceleration of innovation following the publication of a study comparing the non-invasive genetic test with traditional ultrasound investigations.

How long does an animal remain an animal?

The bioethical debate on hybrids is also very much a current issue: transgenic mice with human disease genes have long been established as model organisms for research into human disease. Such experiments increasingly lead to questions about the biological species boundary between human beings and animals. Greater clarity is needed with regard to the ethical challenges associated with the creation of animal-human hybrids and where the limits have to be drawn.

American researchers have once again challenged bioethics through the engineering of human-mice chimeras (i.e. mice with human brain cells (astrocytes)) aimed at finding out whether human astrocytes make the mice smarter, rather than using the transplanted mice for studying human disease (Han et al., 2013).

Bioeconomy and green genetic engineering

The growing interest in bioeconomic issues also puts green genetic engineering back on the agenda. Green genetic engineering or genetic modification, which is the direct manipulation of genomes using biotechnology, has been hotly debated for years, particularly in Europe. Indeed, there is a controversial debate going on about whether and to what extent a biobased economy requires genetically optimised industrial raw materials (see review by Wydra et al., 2013). The potential advantages in terms of production methods stand in opposition to concerns about the safety and potential long-term consequences resulting from the cultivation of genetically modified plants. The outcome of this discussion on this politically highly sensitive issue will be interesting.

Does synthetic biology learn from the mistakes of the past?

As the rumbling on the bioethical horizon dies down, the new research field of synthetic biology has already become a cause for concern. Headlines like "living machines", "Homo creator", "Life 2.0" stir up a poorly informed public. It is unclear whether researchers, in the same way as engineers, will succeed in synthesising tailor-made creatures that are able to reliably produce pharmaceutical substances or biofuels in the quantities required.

Debates as to whether synthetic biology, with the claim that it is able to create completely novel life forms, will change our attitude to life and lead to an understanding of human individuals as "Homo creator" are just beginning. Critics like Peter Dabrock, deputy chair of the German Ethics Council, have identified a deep cultural malaise and caution against an expertocratic, paternalistic transfer of knowledge to the public as well as against apocalyptic protest communication. The debate will show whether society has learned from the green genetic engineering communication disaster.

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