



berlin-brandenburgische  
AKADEMIE DER WISSENSCHAFTEN



## INTERDISCIPLINARY RESEARCH GROUP GENE TECHNOLOGY REPORT

Berlin-Brandenburg Academy  
of Sciences and Humanities





More knowledge  
for an informed  
debate



Does genetic engineering present an opportunity to develop better medications, to improve crop yields, and to increase economic growth? Or does it present an incalculable risk to our health, the environment, and social cohesion? Genetic engineering has revived the age-old conflict about progress as a blessing or a curse - more so than any other technological innovation in recent years. The reasons for this are obvious: Genetic engineering affects the most diverse areas of life; it allows us to directly modify genetic material – in the environment and in the human body. This is a frightening notion for many people.

In light of these issues, the interdisciplinary research group 'Gene Technology Report' of the Berlin-Brandenburg Academy of Sciences and Humanities aims to provide a basis for an impartial and open discourse on genetic engineering in Germany. The research group, comprising renowned scientists from the human sciences, natural sciences and social sciences, is acting as an impartial, long-term 'observatory' to provide careful appraisal of the various applications of genetic engineering and to closely monitor its development. The latest technical developments are being studied, alongside the diverse areas where genetic engineering is employed. The economic, ecological and scientific aspects of specific applications of these technologies are being appraised by the research group, as well as ethical, political, and social factors. ■



# Indicators – the tool of the Gene Technology Report



There is a vast amount of data and analyses relating to genetic engineering available, and precisely this complexity proves a hindrance to drawing unambiguous conclusions. In order to shed light upon this tangle of information, suitable indicators have been and will be selected. With the help of those indicators facts can be presented which would otherwise be impossible to gauge directly. For example, the significance of genetic engineering and its various applications can be effectively described and analysed using an array of different indicators and data. The research group 'Gene Technology Report' does not itself produce the required primary data, but uses available publications and data sources for evaluation and analysis.

*"The Gene Technology Report is a monitoring project. Monitoring should not be defined as supervising a relevant development to serve specific interests - it represents a tool for transparency, a 'confidence-building measure'." First Gene Technology Report, page 11*

The research group 'Gene Technology Report' documents its results and recommendations pertaining to politics, science and economics in a series of publications which began with the first German Gene Technology Report in 2005. With its interdisciplinary approach, this series aims to play a role in moderating the public debate. ■



Using an interdisciplinary approach to examine the current state of development of the various branches of genetic engineering in Germany

*"**Genome research** is contributing to a fundamental change in the life sciences: Instead of research on single molecules and biological mechanisms, complex biological systemic correlations are now the focus of attention." First Gene Technology Report, page 149*

Genome researchers analyse the complete genetic material of an organism: They aspire to understand how individual genes function within cells and in the organism as a whole. This forms the basis for application-oriented genetic engineering. Because genome research is decoding the 'blueprint of life' it is often at the centre of public attention. The research group initially describes the organisation of genome research in Germany, primarily the German Human Genome Project, the National Genome Research Network, and the Plant Genome Project, genome research on micro-organisms and livestock genomics. Based on this, an overview of the current state of knowledge and technology of genome research is provided. In addition, its future prospects and potential applications will be sketched out, for example the development of medications and therapies which could be tailored to the needs of individual patients. ■

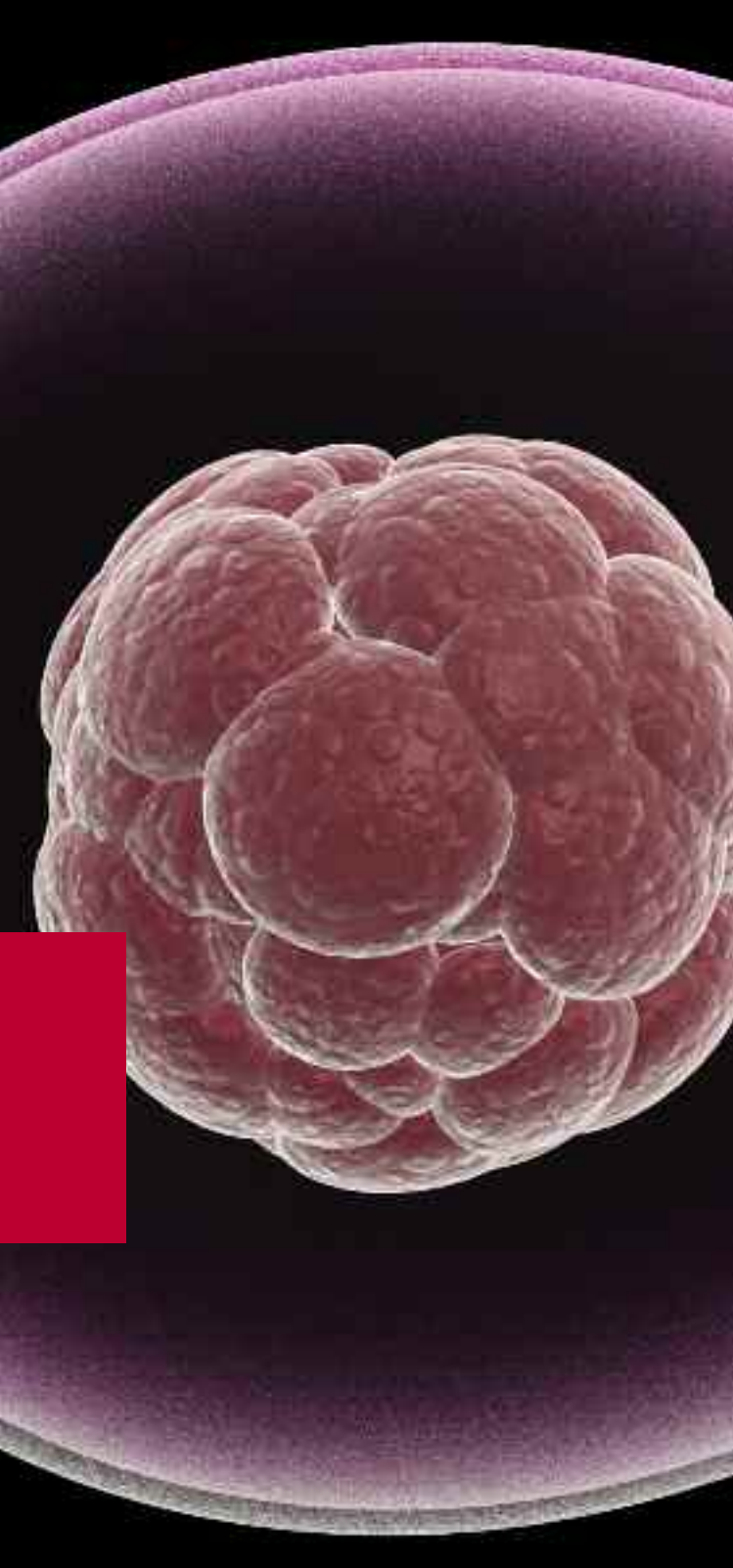
***"Molecular genetic diagnosis is one application of genetic engineering that has acquired a position of prime importance in standard medical practice today. This trend will continue and gain momentum in the foreseeable future."***  
*First Gene Technology Report, page 263*

For example, genetic testing allows us to determine the genetic causes of, or dispositions to, diseases a long time before the potential or actual outbreak. Here a distinction must be drawn between genetic testing to diagnose a specific disease and genetic testing to prognosticate a genetic risk. Genetic testing is currently the most important application of genetic engineering in medicine. This has two main reasons: Firstly, there are very few diseases in which the genes are not involved as a cause. Secondly, genetic testing is developing at breathtaking speed. At the same time, the unforeseeable diagnostic possibilities are causing many people concern, as the debate on prenatal diagnosis has shown.

The research group documents the scientific and technical development of genetic testing and its possible applications including its legal implications. Additional points include: the forensic applications of molecular genetics, preimplantation genetic diagnosis, the health-economical aspects and the possibility of preventive coercion. ■

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CGCACCCCC  
TCCTGCAAATAAAAC  
GCTGCTGCTCTCCGGGGCC  
GAGCATATGCAGGAAGCC  
GGACCTCCCAGGCCAGTG





*"Stem cell research largely belongs to the category of basic research at the present time. Right now, only therapies using adult stem cells are possible – e.g. bone marrow transplants for the treatment of blood disorders - and are being examined in clinical studies. However, therapies using embryonic stem cells are not yet possible, although the first clinical studies have been planned." Supplement 'Stem cell research and cell therapy', page 20*

Over the past 25 years, significant findings have been made in the field of cell biology and developmental biology. 'Dolly', the famous cloned sheep, is just one milestone among many others. Due to the great potential that stem cell research has for future strategies in regenerative medicine, great efforts are required in terms of scientific, financial and organisational considerations. The success of these efforts will depend on the general socio-political conditions and the underlying legal framework. An important factor will be the realization of a responsible discussion of ethical principles and the engagement of informed professionals in order to communicate and establish new technologies in the public realm. The research group's objective remains to process, via indicators, the state of knowledge and technology as well as describing individual fields of application such as basic and applied research, stem cell therapies, or focussing on the ethical implications and legal framework of research using human embryos. ■

*"The question as to whether the implementation of GM plants and GM food will fail due to lack of consumer acceptance has yet to be answered." First Gene Technology Report, page 371*

No other aspect of genetic engineering is so controversial in this country – or in the rest of Europe – as the cultivation and use of genetically modified plants. Nevertheless, genetic engineering for agriculture is continuing to develop globally at breathtaking speed and breeders are already working on second and third generation genetically modified plants. Among these are plants for healthier nutrition (functional food), for medical use (Plant-Made Pharmaceuticals), or those used in the chemicals industry (Plant-Made Industrial Products).

The research group reviews the current state of technological development of genetic engineering for agriculture technology and its applications. The debate on the associated risks in their legal, social, political, economic, ecological and ethical aspects is focused, too. ■





A further important area in genetic engineering is **gene therapy**. This field is considered a promising medical application, which, by introducing genes into tissue or cells, aims to achieve therapeutic or preventive benefits. The latest supplement of the research group is dedicated to this medical option in basic research and clinical application. Over the coming years, the research group will examine the issue of **epigenetics**: The inheritance of acquired traits was for a long time a taboo issue. Epigenetics has once more brought this issue to the fore. However one interesting aspect of this issue – its philosophical dimension – will be extremely difficult to encompass by using objective indicators. ■

Forschungsberichte  
der interdisziplinären Arbeitsgruppen der  
Berlin-Brandenburgischen  
Akademie der Wissenschaften

# Gentechnologiebericht

Analyse einer Hochtechnologie in  
Deutschland

...rche, Klaus Brockhoff, Wolfgang van den Driessche,  
...y, Jens Reich, Hans-Jörg Rheinberger,  
...Röber, Karl Sperling, Anna M. Wabus,  
...en, Melke Kälich



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## **Recent Publications (only in German)**

Hucho, Ferdinand; et al.: Gentherapie in Deutschland. Eine interdisziplinäre Bestandsaufnahme. Dornburg, 2008.

Schmidtke, Jörg; et al. (Ed.): Gendiagnostik in Deutschland. Status quo und Problemerkundung. Supplement zum Gentechnologiebericht. Limburg, 2007.

Müller-Röber, Bernd; et al.: Grüne Gentechnologie. Aktuelle Entwicklungen in Wissenschaft und Wirtschaft. Supplement zum Gentechnologiebericht. Berlin, 2007.

Wobus, Anna M.; et al.: Stammzellforschung und Zelltherapie. Stand des Wissens und der Rahmenbedingungen in Deutschland. Supplement zum Gentechnologiebericht. Berlin, 2006.

Hucho, Ferdinand; et al.: Gentechnologiebericht. Analyse einer Hochtechnologie in Deutschland. Berlin, 2005.

## **Intended Publications**

Zweiter Gentechnologiebericht. Analyse einer Hochtechnologie in Deutschland. Dornburg, 2009.

The current state of the series and certain texts can also be found on our website: <http://www.gentechnologiebericht.de/gen/english-pages>

The website also provides information about current and upcoming lectures, workshops and conferences.

## Members

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