



# EUROPÄISCHE AKADEMIE

zur Erforschung von Folgen wissenschaftlich-technischer Entwicklungen  
Bad Neuenahr-Ahrweiler GmbH

Direktor: Professor Dr. Dr.h.c. Carl Friedrich Gethmann

## NEWSLETTER 102

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### FOCUS

#### Outlining ethical issues in medical application of nanotechnologies

Dorothee Dörr and Felix Thiele

Nanomedicine is an emerging scientific discipline that aims at integrating nanoscale technologies into medical practice. So far obtained results of research and development of nanodevices hold the potential to enfold a significant impact on main fields of medicine. Though nanoparticles are endowed with enormous chances for medical innovation and economic revenue, this technology also bears potential risks that may cause considerable social, ethical and legal problems. The use of nanosize tools for diagnostic and therapeutic purposes is deemed to be the next revolutionary turn in health care and outlines one key issue in the development of medical technology: in oncology, for example, there is proof of principle that drugs can be delivered directly to a tumor through functionalized nanoparticles. In future, nano-therapeutics might help to replace risky and complicated or unfeasible operations by the use of minimal or non-invasive techniques. Another main field of current research in nanomedicine is diagnostics where nanotechnology might open up new avenues for detecting disease-related changes earlier and more efficient than today.

Effectiveness, utility and safety aspects of nanomedical applications should be carefully analysed before moving from laboratory testing to clinical surveys and subsequently to implementation in medical routine. Thus, a sound knowledge of techniques and products used in nanoparticle research is crucial for a competent evaluation of the medical impact of these new scientific approaches. This includes attainments of the operating principle, notions of the methods for functionalizing and synthesizing different particles and knowledge of physico-chemical properties and pharmacokinetics. Since there still are numerous undefined variables, concerning the systemic distribution of nanoparticles in complex biological organisms, their degradation process and the elimination after systemic application, the impact of nanomaterials on human health is very difficult to predict. Nanoparticles might induce cytotoxicity and cause short- and/or long-term adverse effects as they accumulate in various organs and cellular systems.

Frequently, modern technologies have been object of emotionally charged moral debates (for example on nuclear energy or green biotechnology). No doubt, moral problems of introducing nanotechnology into our lifeworld need in-depth discussion parallel to the basic research in this field. Applied ethics is an indispensable tool for mastering these conflicts through argumentative methods. The analysis of the effects of nanoparticle application demands an accurate differentiation of the multiple scopes pursued in medical contexts. Nanomedicine is used for comprehensive monitoring, control, construction, repair, defence and improvement of human biological systems, following an approach from the molecular level, using engineered nano-devices and nanostructures. On broader terms nanomedicine is the science and technology of diagnosing, treating and preventing disease and traumatic injury, of relieving pain and of preserving and improving human health, using molecular tools and molecular knowledge of the human body.

This capacious summary could delineate a starting point for normative considerations, although due to rapid incessant development there may be the need for further defining, based and adapted on the results of research findings. The effects of nanoparticles cannot be extrapolated from the known effects of the same substances at micro- or macro-level. Due to their smallness these particles show novel physical properties that affect their toxicological behaviour. These properties are only partially known so far, so that a risk evaluation – balancing medical benefits versus adverse effects – is methodologically demanding, since it has to be performed under partial ignorance. Grounded on a basic scientific evidence and plausibility examination, the risk-evaluation process should allow to set standards in regard to individual and public safety including environmental aspects of the use of nanomaterials. Quantitative measures of the probability of damage through risk-benefit analysis should help balancing different types of risks versus different types of benefits. A special issue addresses the procedure of *informed consent* that relates to the patient's right to know the presumed side-effects of nanomedical therapy and the practice of information transfer for enabling the involved parties for competent decision-making. Further questions relate to adverse health effects on third parties, for example medical personnel, animals used for trials and environment pollution. Risk analyses and management should lead to the development of a system of decisions to identify and select risk-reducing measures, with the scope to reduce unacceptable risks. In this context, the implementation of a precautionary strategy that applies to challenges of nanotechnology application could be helpful for a responsible handling with potential hazards. Defining and specifying the trigger for precaution and the precautionary measures that should be employed emerge as a key issue in nanomedical risk assessment.

Another central point of risk assessment deals with risk communication, concerning communication between various stakeholders and the disclosure of information about the risks of new and potentially dangerous technologies to the public. Besides, the criteria that are used to determine the relevant aspects for public deliberation and the transfer of knowledge between academic and public have to be analysed. The public perception and opinion in regard of the application of nanoproducts in a medical context is essential for the acceptance and acceptability of this technology on a broad societal level. As the determination of real or perceived risks of nanoparticles depends on the information the public is given by experts and policymakers. The goal should be to provide a transparent and unbiased overview of possible chances and potential dangers of nanobiotechnology in order to foster the so-

cial judgement through public replicability of the issues associated with nanoscale techniques. Once a doubtful public opinion has been settled due to scenarios grounded on claims far from reality, it will be difficult to correct. Therefore, the analysis of current public opinions and the examination of the accomplishment are essential requirements for developing an adequate informational network that meets societal needs. This implicates a responsible handling in providing information between diverse research fields and a good communication between researchers, physicians and patients, including the support and establishment of interdisciplinary networks and substantiated social platforms.

The possibility of linking information of an individual patient's metabolism and nanomachines enables highly individualised diagnostic and therapy but also facilitates the use of these methods for the purpose of human enhancement. Applying nanomedical procedures beyond a therapeutic context for enhancing physical and mental capabilities, for example by creating man-machine interfaces obliterating limits between technology and life or by enabling personal utilisation of nanotechnological tools for self-diagnostic and self-treatment, may require a rethinking of the concepts of health and disease. This might influence the current understanding of health as *well-being* rather than merely *normal functioning*.

Besides any breakthroughs from the medical point of view, the widely predicted economic impact is one of the driving forces for the development of nanomedicine. As the pressure for pharmaceutical industry to perform profitable research for new and innovative products is rising, economical goals might drive the speeding of development of nanotechnology-based tools. The enormous influence of national and international funding programmes acts as incentive for an investment in the development of new medical achievements. Thus, good strategies should be forwarded for a responsible guidance of nanomedicine evolution, avoiding the promotion of scarcely reasonable scientific goals. The prognosticated impact of nanomedicine on the healthcare system evokes the development of new cost models, encompassing decisions of reimbursement of diagnostic and early interventions and the evaluation of the cost-effectiveness of nanotechnological innovations. Given that nanomedical therapy might improve morbidity, mortality and quality of life, questions of distributive justice may arise, as a restricted availability might lead to a preferential treatment only for wealthier patients of predefined countries. Further questions are related to the marketing of nanotechnologies on a commercial level. Valorisation and commercialisation of possible obtainable results of research should

be integrated in the scientific development and the regulation of patent activity for protection and commercialisation of intellectual properties have to be considered. Further issues with reference to privacy concerns arising from the storing of medical information (database) on implanted chips and medical recording that could be used to track and surveillance purposes are not only futuristic visions. The difficult differentiation between plausible predictions and speculative promises has to be considered for a responsible interpretation of nanotechnology potentials and concerns.

Hence a competent survey of the most important ethical issues of nanotechnological developments in medicine should reflect the potential that derives from functional units integrated in the human body on a nanoscale. The aim should be the development of recommendations and standards for acceptable risks induced by nanoparticles on a general and on a context-related level. The implementation of rationally based decision-making procedures for recommendations requires sound scientific data about effects and mechanisms of the properties of these particles and a thorough reflection of the methodology that is used to detect possible risks arising at different stages of application.

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*Dr. med. Dorothee Dörr, M.A., is member of the scientific staff of the Europäische Akademie GmbH and co-ordinator of the academy project group "Nanoparticles for medical purposes. Technical, medical, and ethical aspects" (duration 5/10–9/12), a work package of the EU project NanoDiaRA.*

*Priv.-Doz. Dr. med. Felix Thiele, M.Sc., is chair of the academy's project group "Nanoparticles for medical purposes. Technical, medical, and ethical aspects". Since 1999 he has been deputy director of the Europäische Akademie GmbH.*  
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## PROJECT GROUPS

### Working group on interdisciplinarity

■ On 9/10 September 2010, the working group on interdisciplinary research and transdisciplinary claims of validity ("Interdisziplinäre Forschung und transdisziplinäre Geltungsansprüche") held its third regular meeting in Ahrweiler. Martin Carrier (Bielefeld) gave a paper on the specific value of expertise generated and offered by commissions of experts for policy advice. Within their arrangement a crucial point seems to bridge the gap from and towards transdisciplinarity. Further presentations were given on the role and justification of participation in policy advice from different perspectives. The different positions were represented by Carl

Friedrich Gethmann (Ahrweiler) and Matthias Kaiser (Oslo). The lectures were also discussed with the Polish philosopher Krzysztof Michalski (Rzeszów) who visited the Europäische Akademie and attended the meeting as a guest.

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#### Scarce material resources

Successful innovation towards high technologies in modern transport, communication and medicine often depends upon the lasting availability of certain rare materials. The Focus section of the last Newsletter picked up this issue, using the example of electric mobility. The Europäische Akademie currently plans a corresponding project on innovation, scarce materials and sustainability while also focusing on related questions. On 28 September 2010 a working group constituted itself at the Europäische Akademie. Cooperation commitments were given by Frank Behrend (Berlin), Alex Bradshaw (Munich), Ottmar Edenhofer (Potsdam), Rolf Emmermann (Potsdam), Margarethe Hofmann-Amttenbrink (Pully/CH), Franz Jürgen Säcker (Berlin) and Karl J. Thomé-Kozmiensky (Neuruppin) among others. The group planned to specify the topic and its scientific tasks within the upcoming project meetings. The results of this early project phase will be a landscaping of the issue to be reported at a later event.

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#### NEWS

##### Ahrtal talk 2010

On 17 November 2010, the Europäische Akademie's Sponsors' Club and the City of Bad Neuenahr-Ahrweiler invite to this year's Ahrtal talk at the Town Hall in Bad Neuenahr. Professor em. Dr. rer. pol. Karlhans Sauernheimer (formerly chair of international economics, Johannes Gutenberg-Universität Mainz) and Professor Dr. jur. Dr.-Ing. E. h. Dieter Spethmann (formerly chairman of the board of management, August Thyssen-Hütte AG) will dispute about the question "Will the Deutsche Mark come back?" ("Kommt die D-Mark wieder?"). Following an introduction by Professor Dr. Dr. h.c. Carl Friedrich Gethmann, director of the academy, there will be a disputation between the two speakers and a discussion with the audience which will be led by Gethmann.

*Date: 17 November, 2010, 19.30hrs*

*Venue: Town Hall Bad Neuenahr-Ahrweiler*

#### Publication on ambient intelligence

The Graue Reihe No 50 (September 2010) has been published: "Die Zukunft der Räume. Gesellschaftliche Fragen auf dem Weg zur Ambient Intelligence" (The future of spaces. Societal implications of ambient intelligence). Editors are Dr. Stephan Lingner (Europäische Akademie GmbH), Professor Dr. Bernd Lutterbeck (Berlin) and Dr.-Ing. Frank Pallas (Karlsruhe Institute of Technology). The booklet documents the results of a corresponding workshop on this theme held at the Europäische Akademie in November 2009.

#### Download:

[www.ea-aw.de/publikationen/graue-reihe.html](http://www.ea-aw.de/publikationen/graue-reihe.html)

#### New chairman of the Sponsors' Club of the Europäische Akademie e.V.

During its last general meeting held on 2 September 2010 the Sponsors' Club of the Europäische Akademie e.V. elected the mayor of the city of Bad Neuenahr-Ahrweiler Guido Orthen to be new chairman of the club. Orthen who is looking forward to his tasks within the academy's Sponsors' Club takes a great interest in continuing the successful work of his predecessor Dr. Hans-Ulrich Tappe. The first event he will be involved in as new chairman will be the Ahrtalgespräche which are planned to take place in the Rathaussaal of the city of Bad Neuenahr-Ahrweiler on 17 November 2010.

#### PUBLICATIONS

##### Dorothee Dörr

"Quality of life judgements in geriatric intensive care", in: Journal für Anästhesie und Intensivbehandlung 17(3)2010, Pabst Science Publishers, 37

##### Thorsten Galert

Thorsten Galert. 2010. [Review] K. Lieb: "Hirndoping", Mannheim: Artemis & Winkler 2010, in: Gehirn & Geist 7/8 (2010), 80–81

Thorsten Galert. 2010. [Review] H. Fink, R. Rosenzweig (eds.): "Künstliche Sinne,

gedoptes Gehirn. Neurotechnik und Neuroethik", Paderborn: Mentis 2010, in: Gehirn & Geist 11 (2010), 79

##### Carl Friedrich Gethmann

"Die Wissenschaft darf ihren Wahrheitsanspruch nicht aufgeben". Wolfert von Rahden stellt Fragen zu Wissenschaft und Kunst", in: Gegenworte 23 (2010) 1, 29–33

"Wissenschaft und Medien: ein prekäres Verhältnis", Newsletter of the Europäische Akademie GmbH No 100, 8/2010

[Reprint] "Wunscherfüllende Medizin: Kontingenzbewältigung oder Kontingenzbeseitigung?", in: Martin Momburg and Dietmar Schulte (eds.), Das Verhältnis von Arzt und Patient. Wie menschlich ist die Medizin? Paderborn: Fink 2010, 233–245

##### Carl Friedrich Gethmann/Stephan Lingner

"'Ambient Intelligence' zwischen Entlastung, Selbstbestimmung und Vertrautheit. Ethische und anthropologische Aspekte", in: Stephan Lingner, Bernd Lutterbeck, Frank Pallas (eds.), Die Zukunft der Räume. Gesellschaftliche Fragen auf dem Weg zur 'Ambient Intelligence', Graue Reihe of the Europäische Akademie Bad Neuenahr-Ahrweiler, vol. 50, 2010, 23–30

##### Ulrike Henckel

Together with Thomas Engel: "Menschenbilder in Philosophie und Technik", in: Michael Bölker, Mathias Gutmann, Wolfgang Hesse (eds.), Menschenbilder und Metaphern im Informationszeitalter, Berlin: Springer 2010, 237–261

##### Georg Kamp

"Mediation als Konfliktbewältigungs-Instrument", in: Erwägen, Wissen, Ethik 20 (2009), 539–541

##### Ruth Klüser

"Degussa", in: David H. Guston (ed), Encyclopedia of Nanoscience and Society, Thousand Oaks, CA: SAGE Publications, 2010, 141–142

"Federal Agency for Occupational Health (Germany)", in: David H. Guston (ed) Encyclopedia of Nanoscience and Society, Thousand Oaks, CA: SAGE Publications 2010, 233–234

#### CURRENT PROJECTS OF THE EUROPÄISCHE AKADEMIE

- **Deep brain stimulation in psychiatry. Guidance for responsible research and application** (duration 10/08–9/11)
- **Energy storages and virtual power plants for the integration of renewable energies into the power supply. Potentials, innovation barriers and implementation strategies** (duration 1/09–6/11)
- **Clinical research on vulnerable populations** (duration 12/08–6/11)
- **Radioactive waste. Technical and normative aspects of its disposal** (duration 10/08–spring 2011)
- **Development of novel nanotechnology based diagnostic systems for Rheumatoid Arthritis and Osteoarthritis (NanoDiaRA)** (duration 2/10–1/14)
- **Nanoparticles for medical purposes. Technical, medical, and ethical aspects** (duration 5/10–9/12)
- **Long-term planning. The relevance of social and cognitive resources for sustainable economic activities** (duration 9/10–2/13)

**Stephan Lingner**

- “Asbestos”, in: David H. Guston (ed) Encyclopedia of Nanoscience and Society, Thousand Oaks, CA: SAGE Publications, 2010, 31–32
- “Climate Change”, in: David H. Guston (ed) Encyclopedia of Nanoscience and Society, Thousand Oaks, CA: SAGE Publications, 2010, 92–96

**Katharina Mader/Georg Kamp**

- “Die Ethisierung der Technik und ihre Bedeutung für die Technikfolgenabschätzung. 10. Österreichische TA-Konferenz, 31. Mai–1. Juni 2010”, in: Technikfolgenabschätzung – Theorie und Praxis, 19 (2), 7/2010, 101–104

## LECTURES

**Margret Engelhard • 28/9/2010**

- “Die synthetische Biologie geht weit über die klassische Gentechnik hinaus”  
Tagung “Was ist Leben im Zeitalter seiner technischen Machbarkeit?”, Philipps-Universität Marburg

**Thorsten Galert • 22/10/2010**

- “Doping fürs Gehirn – Neuro-Enhancement als neue ethische Herausforderung”  
5th Ambulance Day, AstraZeneca, Frankfurt

**Carl Friedrich Gethmann • 10/9/2010**

- “Partizipation in der interdisziplinären Forschung?”  
Project group “Interdisciplinary research and transdisciplinary claims of validity”, Europäische Akademie GmbH, Bad Neuenahr-Ahrweiler

**21/9/2010**

- “Die Krise des Wissenschaftsethos und die Regeln guter wissenschaftlicher Praxis”  
ProFor (Promovierendenforum), Universität Duisburg-Essen, Duisburg

**22/9/2010**

- “90 Jahre VGB – Praktische Vernunft in einer technischen Kultur”  
Lecture at the opening of the VGB-congress “Kraftwerke 2010”, Essen

**29/9/2010**

- “Ist Vorsorge immer besser als Nachsorge? Ethische Überlegungen”  
Lecture at the opening of the 7<sup>th</sup> conference “Deutsche Vereinte Gesellschaft für Klinische Chemie und Laboratoriumsmedizin” (DGKL), Mannheim

**5/10/2010**

- “Ethische Fragen der Langzeitverantwortung im Zusammenhang mit der Entsorgung radioaktiver Abfälle”  
Foundation Brandenburger Tor, Berlin

**7/10/2010**

- “Was sind und zu welchem Ende braucht man wissenschaftliche Disziplinen, und warum muss man ihre Grenzen überschreiten und in welche Richtungen sollte man das unter welchen Bedingungen tun?”  
Autumn Conference of the Europäische Akademie GmbH, 10/2010, Academy of Sciences and Literature, Mainz

## PERSONALITIES



- Christian Rehtanz holds a diploma (1994) and a Ph.D. degree (1997) in electrical engineering of the TU Dortmund University, Germany. In 2003 he received the *venia legendi* in electrical power systems at the Swiss Federal Institute of Technology in Zurich (ETHZ). From 2000 he was with ABB Corporate Research, Switzerland. He became head of technology for the global ABB business area of Power Systems in 2003 and director of ABB Corporate Research in China in 2005.

Since 2007 Rehtanz has been head of the Institute of Power Systems and Power Economics at the TU Dortmund University. In addition, he also has been scientific advisor of the ef.Ruhr GmbH since 2007, a joint research company of the three universities of Bochum, Dortmund and Duisburg-Essen (University Alliance Metropolis Ruhr). In 2010 he was offered a chair of Distributed Electrical Systems at the École Polytechnique Fédérale de Lausanne (EPFL) in Switzerland.

Rehtanz' research activities in the field of electrical power systems and power economics include technologies for network enhancement and congestion relief like stability assessment, wide-area monitoring, protection, and coordinated network-control as well as integration and control of distributed generation and storages. He holds the MIT World Top 100 Young Innovators Award 2003 and is author of more than 110 scientific publications, three books and 17 patents and patent applications.

*Professor Dr.-Ing. Christian Rehtanz is Professor of Electrical Power Systems at the TU Dortmund University. Currently, he is member of the project group “Energy storages and virtual power plants for the integration of renewable energies into the power supply. Potentials, innovation barriers and implementation strategies” of the Europäische Akademie (duration 1/09–6/11).*

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