



Leopoldina  
Nationale Akademie  
der Wissenschaften

# Leopoldina news

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## Personalised medicine

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Paul Crutzen named  
honorary member  
Leopoldina honours service  
to the academy

# Editorial

Dear members  
and friends of the Leopoldina,



The Ebola epidemic in West Africa has been a major news topic in recent weeks and months. And, unfortunately,

it is a topic that is set to stay with us for a good while yet – in the scientific community just as much as in politics and the media. The Ebola virus was first recorded in 1976, and since then there have been regular outbreaks with several hundred deaths. But the unexpected virulence of the current outbreak in a region that had not been affected before also took me by surprise. The high numbers of sufferers and deaths are truly alarming. In response to the Ebola epidemic, the Leopoldina published a statement in mid-October in cooperation with the Union of the German Academies of Science and Humanities and acadtech (National Academy of Science and Engineering). On page 7 you will find a report on the statement, which emphasises the precautionary principle. Even once the current epidemic seems to be over, basic research into the dangerous pathogens must continue and progress must be made in developing effective drugs and vaccines. Once these are available, they need to be stockpiled in sufficient amounts in preparation for the next epidemic.

In producing this statement, the Leopoldina is pursuing its duty, as the German National Academy of Science, to provide policymakers and society with advice on science-related topics. It is able to fulfil this obligation thanks in large part to its members, who regularly seize the initiative and contribute their expert knowledge to our statements. I would like to take this opportunity to thank everyone who has contributed.

We wish you a thought-provoking read!

*Jörg H. H.*

## Stefan Hell awarded Nobel Prize

### Distinction for breakthrough in optical microscopy

It's a formula that is quite literally carved in stone. Engraved on the monument to physicist Ernst Abbe in front of the University of Jena's main building, the formula shows the diffraction limit of traditional optical microscopes. Resolution is restricted by the wavelength of the light, which means that a structure that is smaller than around 200 nanometers cannot be imaged.

Striving to break this barrier, Prof. Stefan Hell ML invented a groundbreaking technique. Stimulated emission depletion (STED) microscopy enables the immediate imaging of even single molecules in maximum resolution. For his discovery, Hell is now being awarded the Nobel Prize in Chemistry along with US scientists Eric Betzig (Ashburn) and William Moerner (Stanford).

"This Nobel Prize acknowledges a great breakthrough in the field of optical microscopy. And it is particularly gratifying that an active member of the Leopoldina is being honoured by the Nobel Committee for this pioneering research," said Leopoldina President Prof. Jörg Hacker ML, congratulating Hell, who is the Leopoldina's 172nd Nobel laureate.

STED microscopy is of great im-

portance to biomedical research, as it allows processes in living cells to be observed in great detail. It facilitates crucial discoveries, for example relating to the origin of cancer cells or in cell signalling.



Physicist Stefan Hell is the Leopoldina's 172nd Nobel Prize winner. Photo: MPI

Hell has been Director of the Max Planck Institute for Biophysical Chemistry in Göttingen since 2002 and was elected a member of the Leopoldina in 2013. The Leopoldina awarded him its Carus Medal in September 2013 and he received the corresponding Carus Award from the city of Schweinfurt in April 2014. In his lecture, "Grenzenlos scharf: Lichtmikroskopie im 21. Jahrhundert" ("Infinite sharpness: optical microscopy in the 21st century"), Hell spoke about the great potential of super-resolution microscopy.

He will be presented with the Nobel Prize in a ceremony in Stockholm on 10 December. (mik)

## Cooperation with Turkey

### Joint series of expert discussions begins

"Networked Challenges: Tectonics – Megacities – Urban Planning" is the title of the first German-Turkish science dialogue, which the Leopoldina and the Humboldt Foundation hosted in Istanbul on 24 October. The event at Istanbul Technical University's Taşkışla campus was part of the German-Turkish Year of Science and kicked off a joint series of expert discussions between German and Turkish experts.

The programme of the symposium addressed diverse topics such as plate tectonics in the zone of collision between Europe and Arabia, sustainable building in megacities, and urban planning. The conference location, Istanbul, is itself a good example of the challenges that were un-

der discussion, as Istanbul is in an active seismic zone and is also a city of millions with corresponding challenges in urban development and human-environment interactions.

Speakers included Leopoldina members Prof. Frauke Kraas ML and Prof. Wolfgang Franke ML, Humboldt fellow Prof. Aral I. Okay, and expert practitioners such as urban planning team Selva Gürdoğan and Gregers Tang Thomsen, and Prof. Thomas Gries of RWTH Aachen.

The German-Turkish science dialogues foster discussion among researchers based in Germany and Turkey. The Leopoldina is also participating in the bilateral steering group for German-Turkish scientific cooperation. (lb)



*The presentation of the statement on personalised medicine in Berlin was received with great interest.*

Photo: David Ausserhofer

## Tailor-made therapy

### Academies present statement on the potential of personalised medicine

Doctors have always adapted treatments to suit the needs of individual patients. Personalised medicine represents a further development of this approach as it combines medical achievements with the findings and methods of life sciences.

This December, the Leopoldina, academy (Germany's National Academy of Science and Engineering), and the Union of the German Academies of Sciences and Humanities issued a statement on personalised medicine. The statement "Individualisierte Medizin – Voraussetzungen und Konsequenzen" („Personalised medicine – premises and consequences“) analyses the development potential of personalised medicine, addresses the challenges involved in its implementation, and identifies possible courses of action.

#### **Better understanding and treatment of diseases**

Personalised medicine – also known as individualised treatment or as genomic, stratified or precision medicine – focuses on improving the effectiveness and quality of medical treatment through systematic prevention and diagnosis and by using

tailored treatments that reflect the individual needs of patients. This is intended to limit undesired side effects and facilitate more cost-effective care.

For many centuries, sick people have been receiving medical treatment based on empirical methods. This tried-and-tested medical approach has now been extended by the targeted use of, above all, molecular analysis techniques such as DNA sequencing. The new insights and techniques have led to a much-improved and scientifically verified understanding of the causes and development of diseases. New indicators – so-called "biomarkers" – are being increasingly incorporated into treatment processes so that doctors can precisely quantify and objectify a patient's individual biological characteristics that are of relevance when making therapy decisions.

Many decisions on how to tackle malignant tumours are already being made on the basis of additionally gathered molecular biological findings. DNA analyses are also already being applied, for example in the diagnosis of diseases caused by the mutation of a single gene (monogenic

disorder) and of certain infectious diseases. One example is the immunodeficiency caused by the HI virus.

At present, it is still very difficult to assess the societal impact of the comprehensive implementation of personalised medicine. Some of the greatest challenges to such implementation are working out how to standardise and secure ever larger amounts of personal data, and how we can derive reliable results and viable courses of action from them. We also need to consider how to integrate new organisational processes into existing healthcare structures and how to ensure that ethical, legal and economic parameters receive due consideration.

#### **Public presentation of the statement in Berlin**

The statement was discussed on 4 December during a parliamentary breakfast with members of the German Bundestag and representatives of the relevant ministries and organisations. Afterwards, it was presented to media representatives in a press conference. An English version will soon be available. (kh/jf)



# “The energy transition is technologically feasible”

Ferdi Schüth is this year’s recipient of the Carl Friedrich von Weizsäcker Award

On 16 December, Prof. Ferdi Schüth ML will be presented with the 2014 Carl Friedrich von Weizsäcker Award. Following the award ceremony, Prof. Schüth will give the Leopoldina Christmas Lecture entitled “Unser zukünftiges Energiesystem: Herausforderungen an die Wissenschaft” (“Our future energy system: challenges for science”). Caroline Wichmann met Prof. Schüth for an interview.

*Prof. Schüth, you have been named the recipient of this year’s Carl Friedrich von Weizsäcker Award. What does it mean to you to win a prize that mainly recognises the societal relevance of your research?*

**Schüth:** Scientists normally operate within the bounds of their own branch of science. An award that honours something that has an impact beyond this realm is truly extraordinary. I believe science also has a duty to ensure that its findings are used for the benefit of society. Science – not society alone – is responsible for ensuring that this happens.

*Storage technologies play a key role in your research. Why are they so important?*

**Schüth:** Because they’re going to be instrumental in securing our future energy supply. Being heavily reliant on renewable energies causes the amount of electricity fed into the grid to fluctuate. The wind doesn’t always blow, and the sun doesn’t

## CARL FRIEDRICH VON WEIZSÄCKER AWARD

The Carl Friedrich von Weizsäcker Award is a science prize of the Stifterverband für die Deutsche Wissenschaft. It is endowed with €50,000 and is awarded jointly every two ye-

ars by the Leopoldina and the Stifterverband to scientists or research teams who have made a significant scientific contribution to tackling the great challenges facing society.

always shine. There are various ways to address this issue: we can create backup capacity; regulate energy consumption with a demand management system; or expand the grid. A fourth possibility involves storage systems. According to predictions, systems capable of storing huge amounts of energy are going to be necessary in about 20 years. Scientists today have to start focusing their efforts here so that this technology will be available 20, 25, 30 years from now when we need it.

*What is crucial to the success of the energy transition?*

**Schüth:** The most decisive factor is actually not even related to technology. Many of the technologies that we need for the energy transition are already available – even if they are not yet fully developed. The biggest obstacles often lie in our regulatory system. Legal requirements and market conditions play a major role – as well as the challenge of getting the people on board. In theory, people think the energy transition is a wonderful idea, but the problems start when new power masts

are put up in their vicinity. The energy transition is technologically feasible. Ultimately, however, it will be a question of costs and acceptance, plus devising a suitable regulatory framework.

*Optimising chemical reactions through the use of catalytic methods is a major focus of your work. Could you please explain how people benefit from this in their everyday lives?*

**Schüth:** Catalysers are used in nearly every chemical process. The catalyser usually makes it possible to carry out a reaction at both lower temperatures and lower pressures and with higher yields of the target product. This means that every catalytic reaction is more resource-sparing and environmentally friendly than a non-catalytic reaction. Improved catalysers also result in more efficient use of resources during chemical production; for instance, less energy is needed for heating or compressors.

*What do you see as key issues when it comes to effectively communicating scientific findings to politicians and society?*

**Schüth:** I think there are two main problems. The first is that people have relatively little background knowledge of scientific topics. Most people are pleased if they can even spell the word “catalyser”. They might know that catalysers are found in cars, but that’s about as far as their knowledge goes. The second is that the relationships involved are extremely complex. You can’t easily explain them in two or three sentences. Many people are accustomed to receiving information in 30-second sound bites. This is not really suitable for the complexity inherent in scientific and technological concepts. These are the biggest challenges, in my opinion. They also apply equally to interactions with politicians and society alike.



Ferdi Schüth has been a member of the Leopoldina since 2008.

Photo: Manuel Frauendorf

## Champion of the ozone layer

Paul J. Crutzen is Nobel Laureate and one of the pioneers of research into the ozone layer

It was a stroke of luck for humanity that Paul Crutzen worked as a programmer for a chemist in his younger years; otherwise things would look even bleaker for us and our environment. Without Crutzen's important discoveries, we would not have realised how urgently we need to protect the ozone layer, we would not have banned CFCs, and we would not understand the risks of greenhouse gases. Crutzen is one of the pioneers who began researching the hole in the ozone layer in the stratosphere. This is where, at a height of 12 to 50 kilometres, ozone molecules protect life on Earth from UV radiation.

For a long time, scientists thought they knew everything about this big sunshade in the sky; they knew how ozone was formed and understood the related processes. "But I had my doubts. It seemed to me like everyone was just writing what everyone else was writing," said Crutzen, talking to Leopoldina news about those early days in his scientific career. Despite the prevailing certainty in the field, Crutzen looked into the matter and discovered hitherto unidentified reactions that explained ozone depletion. He came to the conclusion that emissions of nitrous oxide, produced naturally but also by man, were responsible.

In 1970, Crutzen spoke out against supersonic aircraft as his studies revealed that these planes had dramatically increased the concentration of nitrous oxide in the lower stratosphere. Following up Crutzen's research into the aeroplanes' fuel, which contained chlorine, his colleagues Sherwood Roland and Mario Molina got to thinking about chlorofluorocarbons (CFCs). The three researchers quickly realised that CFCs were the main culprit. At that time, CFCs were used in millions of aerosol cans, fridges and freezers. In 1974 the trio warned the world



Paul J. Crutzen will be appointed an honorary member of the Leopoldina.

Foto: Kurt Henseler

about the consequences of all those CFCs – but not everybody was willing to listen: "The chemicals industry wasn't so thrilled about it," recalls Crutzen. But even some scientists treated the findings with scepticism at first.

That all changed when the hole in the ozone layer over Antarctica was found to be growing at an alarming rate. It was a wake-up call for science, industry and the general public. Many people began to accept that human activity was having an impact on natural processes. "Even as a student it used to annoy me when someone said that human influence was negligible," says Crutzen. But the scientists still had a long battle ahead until the Montreal Protocol on Substances that Deplete the Ozone Layer was finally signed in 1987 and the use of CFCs was banned.

In 1995 Crutzen, Molina and Rowland received the Nobel Prize in Chemistry. This was the first time that the award honoured research into an environmental topic. The Nobel Committee said the three scientists had "contributed to our salvation from a global environmental problem

that could have catastrophic consequences".

Now, the ozone layer is slowly recovering. "But I am still pessimistic about the climate," says Crutzen. He points out that ensuring that the consequences of global warming don't get even worse would require the amount of CO<sub>2</sub> being emitted into the atmosphere to sink by 70 percent each year. Yet greenhouse gas emissions are increasing. Throughout his career, Crutzen has been convinced that our way of life is having an impact on natural biological, geological and atmospheric processes. We humans are over-exploiting the seas, over-occupying and over-using the land, and are responsible for the emission of too much carbon.

In 2000, Crutzen proposed a new term for our epoch that reflected this impact of human activity: the Anthropocene, or "age of humans", a name that neatly sums up Crutzen's research and convictions. The term is still informal, but the Geological Society of London is currently debating making "the Anthropocene" a formal geological epoch. This pleases Crutzen, but he points out that he would be even happier if the term encouraged people to change their behaviour and actually do something to help stop climate change. "We must all do our part to protect the climate," he says.

The Leopoldina will appoint Paul Crutzen an honorary member on 16 December (see additional information). (cw)

### PAUL J. CRUTZEN NAMED HONORARY MEMBER

On 16 December, Paul J. Crutzen will be appointed an honorary member of the Leopoldina. The Leopoldina Honorary Membership is the academy's highest honour, reserved for members who are particularly deserving

due to their scientific merits and their service to the academy. There have been 68 honorary members of the Leopoldina to date, including chemist Otto Hahn (1956) and theoretical physicist Werner Heisenberg (1967).

## Prevention efforts must be intensified

### Academies publish statement on Ebola outbreak in West Africa

The Ebola virus is spreading rapidly and on an unexpected scale, and the renewed outbreak is not following the patterns experienced in the past. The virus is also emerging and spreading quickly in regions where it had not been seen before. In a statement published in October, the German National Academy of Sciences Leopoldina, acatech (National Academy of Science and Engineering), and the Union of the German Academies of Science and Humanities highlight the lessons that must be learned from the epidemic.

The statement expresses the urgent need for vaccines and antivirals to combat the Ebola epidemic. To meet this need, the further development of experimental vaccines and medicines for clinical application must be accelerated.

Even if the pathogen should temporarily disappear again, research must continue into prevention methods as another outbreak is highly probable. Prevention measures also include ensuring that suf-



*The Ebola virus (symbolic illustration) has been spreading unexpectedly rapidly in West Africa since early 2014.*

Photo: Giovanni Cancemi - fotolia.com

ficient quantities of vaccines and antivirals are stockpiled in case of a new outbreak. Medical and social science research must also be intensified so that we are better

prepared for future outbreaks, the statement suggests. (hdk)

■ THE STATEMENT IS AVAILABLE HERE.

## Water supply solutions in urban regions

### Young scientists from Germany and Brazil compile policy report

The Leopoldina, the Young Academy and the Brazilian Academy of Sciences organised a symposium entitled “Water Issues and Ecological Sustainability in Areas of Urbanization” from 5 to 8 May 2014 in the city of São Carlos, Brazil. The event, hosted as part of the “Germany + Brazil 2013-2014” year, allowed young German

and Brazilian scientists to discuss future research needs in the areas of health, ecosystem services and land use.

The results have now been put together in a policy report entitled “Water in Urban Regions”. (jn)

■ THE REPORT IS AVAILABLE HERE.

## EASAC presents report on European space exploration

On 15 and 16 September 2014, the presidium of the European Academies Science Advisory Council (EASAC) met at the Académie des sciences in Paris. The purpose of the meeting was to discuss the council’s future strategic orientation, particularly with regard to cooperation with the new European Commission and European Parliament.

In connection with this meeting, a presentation and discussion on the new EASAC report “European Space Exploration” took place at the Swiss Embassy in Paris. A number of space researchers and representatives of the European Space Agency (ESA) took part in the event. One of them was German astronaut Gerhard Thiele, who was part of the Shuttle Radar Topography Mission in 2000. (csd)

■ THE REPORT ON EUROPEAN SPACE EXPLORATION IS AVAILABLE HERE.

## SAB recommendations on climate change

The Policy Brief for the UN Climate Summit produced by the UN Secretary-General’s Scientific Advisory Board (SAB) underscores the contribution science can make to tackling climate change.

In its brief, the SAB, of which Leopoldina President Prof. Jörg Hacker ML is a member, emphasises the enhanced legitimacy of political decisions that are based on recognised scientific fact and says that

policy-makers depend on research to find solutions to challenges such as global warming, maintaining biodiversity, and conserving natural resources.

The SAB thus urges politicians and scientists to work together more closely, and points out that the relevant research areas require adequate funding. (mik)

■ THE POLICY BRIEF CAN BE FOUND HERE.



## Eurasian Transfer



What was the effect of the transfer of knowledge from Europe to China in the second half of the 19th century? In early October, historians from Germany, Japan and China sought answers to this question during the symposium “Wissenstransfer und Modernisierungsprozesse zwischen Europa und Ostasien” (“Knowledge transfer and modernisation processes between Europe and East Asia”). The symposium took place in the Leopoldina’s Study Centre. In the photograph, Leopoldina Secretary-General Prof. Jutta Schnitzer-Ungefug can be seen with sinologist Prof. Li Xuetao.

jk/Photo: Markus Scholz

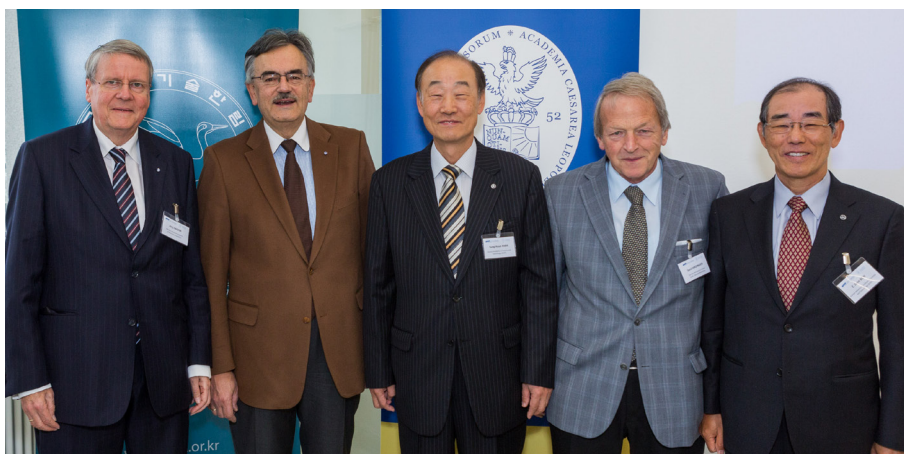
## Human-machine interaction

### Joint symposium with Korean academy on Human-Centred Assistive Robots

As part of its collaboration with the Korean Academy of Science and Technology (KAST), the Leopoldina held a joint symposium on 27 and 28 October 2014 in Munich on the topic of assistive robotics. The lectures covered a broad range of topics, but at the centre of the discussions were the various requirements for assistive robot capabilities in the face of ever-closer interaction between human beings and machines. Assistive robots should be able to learn, easy to programme, mobile, and should also meet high safety standards.

Also under discussion were practical applications for assistive robots outside of industrial production – for example in the care and rehabilitation sector and in medicine. The programme included a visit to the laboratories of Technische Universität München (TUM) and the German Aerospace Center (DLR) in Oberpfaffenhofen.

In his opening speech, KAST President Prof. Sung Hyun Park stressed the high



Jörg Hacker, Wolfgang A. Herrmann, Sung Hyun Park, Gerd Hirzinger and Z. Zenn Bien (left to right) at the symposium in Munich.

Photo: Oliver Bodmer

relevance of the topic, particularly in view of demographic change. Prof. Wolfgang A. Herrmann ML, President of TUM, and Leopoldina President Prof. Jörg Hacker ML spoke about how the event was an example of successful interaction between two

academies, a university of excellence, and a non-university research institute.

Prof. Gerd Hirzinger ML (DLR) and KAST member Prof. Z. Zenn Bien were responsible for coordinating the event; partners were TUM and the DLR. (rn/sc)

# People

## Deceased Members

### ■ Bogdan Baranowski ML

**27 October 1927 - 29 June 2014 | Warsaw**

#### Chemistry

During his scientific career, Baranowski proposed a theory of electrothermodiffusion and demonstrated its practical application in separating chemical substances. He also developed high pressure methods for the synthesis of hydrides such as nickel, chrome, manganese and aluminium, and researched chaos in electrochemical systems. He was elected to the Leopoldina in 1976.

### ■ Hans-Georg Bohle ML

**3 March 1948 - 20 September 2014 | Bonn**

#### Earth Sciences

Bohle's scientific research focused on development problems in rural and urban areas of South Asia. He was particularly interested in problems facing marginalised groups in especially high-risk areas relating to food and livelihood security and health. He made significant contributions to social science concepts such as vulnerability, human security, and social resilience. The Leopoldina made him a member in 2007.

### ■ John Barry Dawson ML

**19 June 1932 - 2 February 2013 | Edinburgh**

#### Earth Sciences

Dawson was elected to the Leopoldina in 1994. In his work as a geologist, Dawson focused on the petrology of the Earth's upper mantle and its derivatives, such as kimberlite and various rock inclusions known as xenoliths. During his research on volcanology, he investigated the properties of the rock in the East African Rift in Tanzania and discovered natrocarbonatite lava flows.

### ■ Georg Dhom ML

**16 May 1922 - 7 November 2014 | Homburg**

#### Pathology and Forensic Medicine

In his work as a pathologist, Dhom focused on endocrine pathology and cancer epidemiology. He conducted research into

the prostate as an endocrine gland and was actively involved in the founding and management of a Saarland association for researching and fighting cancer as well as the Saarland Cancer Registry. It was for this that he was elected to the Leopoldina in 1971.

### ■ Fred Lembeck ML

**4 July 1922 - 22 October 2014 | Graz**  
**Physiology and Pharmacology/Toxicology**

Lembeck's research focused on signal transmission pathways. The subjects of his investigation included endocrine glands and nerve cells. Through his work, he made significant contributions to understanding the effect of serotonin in carcinoid tumours of the small intestine and investigated the role of substance P in the central nervous system. Substance P is a neuropeptide that is released following the stimulation of pain receptors and acts as a modulator of inflammation. His work earned him membership of the Leopoldina in 1983.

### ■ Günther Panzram ML

**23 December 1923 - 30 October 2014 | Erfurt**

#### Internal Medicine and Dermatology

Throughout his long-term studies into diabetes, Panzram recorded and evaluated all long-term diabetics in the GDR in an attempt to identify the causal and accompanying factors of the disease. He also investigated lipoprotein metabolism in diabetics and compared the findings for both short-term and long-term sufferers. Günther Panzram was elected to the Leopoldina in 1976.

### ■ Ekkehard Winterfeldt ML

**13 May 1932 - 11 October 2014 | Hannover**

#### Chemistry

The primary focus of Winterfeldt's research was the synthesis of organic matter. He found new possibilities for the synthesis of alkaloids and terpenoids and analysed the reactive intermediates, with a particular interest in the creation of cyclic compounds during the reaction. The Leopoldina elected him a member in 1996.

### ■ Hans Wondratschek ML

**7 March 1925 - 26 October 2014 | Karlsruhe**

#### Earth Sciences

Wondratschek's research was concerned with topics in crystallography. He conducted experimental investigations into the properties of various materials such as sanidine, orthoclase and apatite when heated to different temperatures. He also carried out theoretical research on the mathematical group and subgroup structure of crystals, enabling him to classify symmetries regardless of dimension. Wondratschek established a relationship between symmetries and the physical properties of the crystals. He was appointed to the Leopoldina in 1989.

### ■ Pieter Adriaan van Zwieten ML

**20 May 1937 - 17 September 2014 | Amsterdam**

#### Physiology and Pharmacology/Toxicology

In his work as a pharmacologist, van Zwieten conducted research into the cardiovascular system and hypertension. He placed particular importance on the clinical relevance of his pharmacological research, always working with a view to developing new therapeutic approaches and improving existing treatment methods. It was for this that the Leopoldina elected him a member in 1998.





## Leopoldina

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#### Abbreviations:

ML = Member of the Leopoldina