Jörg Hacker

A lecture on combating infectious diseases and the role of science academies in this initiative was jointly organized by the Indian National Science Academy and the Indian Academy of Sciences on 4 December 2017 at the Indian Institute of Science, Bengaluru. The talk was delivered by Jörg Hacker, President of the German National Academy of Sciences Leopoldina.

Hacker is a microbiologist whose research area focuses on the molecular analysis of pathogenic bacteria and host–microbe interactions. He was professor of microbiology at the University of Würzburg and headed the Würzburg Institute for Molecular Infection Biology. Hacker was Vice-President of the German Research Foundation and President of the Robert Koch Institute. During 2014–2016, he was a member of the Scientific Advisory Board set up by the UN Secretary-General, Ban Ki-Moon. He also has vast experience in the area of science policy, science administration and sustainable development of science. Since 2010, he has been the President of the German National Academy of Sciences Leopoldina.

Hacker opened his lecture by talking about infectious diseases in the past and focused on scientists such as Robert Koch, Louis Pasteur, Paul Ehrlich, Joseph Lister and Alexander Fleming. He pointed out that over the past years, the global emergence of infectious disease outbreaks has revealed that new approaches to fight and prevent the spread of pathogens are urgently needed. He touched upon the need for new antibiotics and antimicrobials; vaccines against malaria, HIV and tuberculosis; faster and more reliable diagnostics, and new techniques in the field of molecular biology. The need for robust infrastructure and effective surveillance systems to monitor and combat outbreaks in different countries was emphasized. Novel approaches of anti-infective products such as new natural products, antimicrobial peptides, phage therapy, pathoblockers and gene drive techniques were discussed. Other novel approaches such as treatment using antibodies, host-based therapy, small RNA, and CRISPR-Cas (clustered regularly interspaced short palindromic repeats) were also discussed.

The talk included examples from the work being carried out by the German National Academy of Sciences Leopoldina in the areas of infectious diseases and antibiotic resistance in India and other countries. In the context of Germany, the Academy published a statement on antibiotic research problems and perspectives that included, for instance, agendas on genome research, research into natural products and ecological aspects of antibiotic resistance. This report was shared with the public and the Government, which has resulted in the establishment of a round table consisting of industry, research organizations and administration. It was also introduced in the 2013 coalition agreement of the German Government and in the antimicrobial resistance strategy DART 2020 by the German Federal Ministry of Health. Furthermore, in 2017 an International Advisory Council on Global Health Policy was set up in Germany by the Federal Minister of Health.

In the international context, Leopoldina has played an active role in advising heads of governments for the annual G7 and G20 summits. In recent developments, a statement on different aspects of global health policy on communicable and non-communicable diseases was published. This has played an important role in the communiqué of the last G20 meeting.

Hacker, in his concluding remarks, emphasized the need for more effort in basic and applied sciences, actions across all government sectors and society in areas of education, advice, economy and media along with new models of interaction and cooperation among science, politics and society. In a one-on-one interview, Hacker addressed the following questions that were posed to him.

Your research interests have been in the area pathogenicity of bacteria. Can you briefly talk about your work carried out in this area?

One of the major questions in infectious disease research is which molecules are important for the disease and which vectors are important for the spread of pathogens from one individual to another? On the other hand, it is also important to know which genes or blocks of genes encode for these vectors. As a microbiologist, I have worked on these questions, especially on pathogens of the urinary tract and the blood system – also known as sepsis-causing bacteria. Together with others, I discovered that virulence genes of these pathogenic bacteria can be part of particular regions on the bacterial chromosome, termed pathogenicity islands. These results allowed further research on the evolutionary mechanisms that form the basis for the creation of new pathogens and on other processes of disease-related topics.

G7 science academies submitted a statement on infectious diseases and antimicrobial resistance in 2015 and this was taken to the World Health Organization as well. What actions have been taken on these recommendations and how have they contributed to policy formulation?

Infectious diseases and combating them are a major topic of my work. The UN Sustainability Development Goal 3 (good health and well-being) is strongly related to infectious diseases. We brought the topic of antimicrobial resistance and infectious diseases on the agenda of G7 and G20 forums and transferred the recommendations to the heads of states. During the G20 process in 2017, we had a discussion with the German chancellor Angela Merkel and explained the areas of interest to her. The topic on infectious diseases and antibiotic resistance was part of the communiqué of the final G20 statement. Since infectious diseases are a global problem, it is important to have international focus. WHO followed the recommendations of the science academies. Other actions have resulted from these topics on a national level in different countries. In Germany, an action plan by the Federal Government was developed and a research programme on the discovery of new antimicrobials to fight infectious diseases was established. At the level of the European community, a Centre for Disease Control and Prevention was further set up that collects data from different member states and provides recommendations. Hence, there are a lot of developments on this topic nationally and internationally.

What are your suggestions for addressing the problem of drug-resistant tuberculosis? What is the direction for development of science in this area?

On the one hand, it is necessary to work on new antimicrobials. On the other, it is important to have proper systems to analyse the microbes. Therefore, test models, DNA-related as well as other techniques are required for diagnosis. The most important task is to develop vaccines against tuberculosis. Theoretically, tuberculosis can be eradicated just as small pox, which has been eliminated through a global vaccination drive. Poliovirus is also on the verge of extinction and we hope that in due course will be eradicated. It is my hope for tuberculosis as well. There are some groups that have received international grants from organizations such as WHO, the Bill and Melinda Gates Foundation, etc. The Max Planck Institute for Infection Biology in Berlin is one such group which is already conducting clinical studies and I hope that in a reasonable time-frame, we have vaccines and vaccination campaigns in place.

Malaria is returning in countries where it was brought under control. Is there a way to eradicate the vectors causing this?

This is an important question. On one hand, cases of malaria went down because the drugs were quite effective; however, resistance is a growing problem now. Vector control is an important strategy to fight against malaria. There are new approaches like gene drive techniques to reduce vectors or the number of vectors in a certain ecosystem. However, before testing gene drive in the field, it is necessary for researchers to study the long-term consequences of the changes, such as their stability and potential to spread to other species, as well as methods to control them. I am optimistic that we will overcome this gap. Since malaria is a public health problem, it is also important that proper precautionary measures are taken in case of malaria.

In your talk, infectious disease has been used as a case study to develop an interface between science and science policy. What other factors impact science policy?

Since infectious disease is a topic that is always present in society, it is important to give policy advice on this matter. We have published a number of statements on infectious diseases and believe that policy makers will take this advice. There is growing interest in this field. This is especially true regarding a report launched on antimicrobials and antimicrobial resistance by the Leopoldina and the Academy of Science in Hamburg. This report was included in the announcement of new programmes by the German Government and was responsible for an increasing awareness on infectious diseases. In the G7 and G20 science forums, we transferred our message to the heads of states through the German Chancellor.

We work in other fields as well, and one such area is demography. As society is growing older, it is important to understand what this means to the social system. Lifelong learning is an important topic. There is a shift in society in Germany and other European countries. We have increased life expectancy, more than 80 years for men and 83 for women. The second topic is on how to handle the fact that we have fewer children than we did before.

We also give advice to the Government on energy and climate change. While we agree that renewable energy is necessary, one also needs to focus on the price of energy and ensure that this is not so high that it has a negative impact on economy.

Digitalization is another topic. Germany has a general agenda on this and two recently constituted working groups have organized workshops on the same.

New techniques in biomedicine, especially genome-editing techniques as CRISPR-Cas, started a debate that covers both a discussion of the potential benefits of the methods and concerns about potential risks and ethical questions. We sent out a report regarding this to the Minister of Science and Research and the Minister of Health in the German Government.

Regarding the science system, we published a report four years ago on the challenges of the science system in Germany along with certain recommendations for a change in the structure of the research system and an increase in budget. In Germany, the responsibility for teaching and research at universities is mainly with the Länder (states). It is necessary to find a balance between the Federal Government and the Länder in the development of the education and research system. These are five topics representing the strong interaction between the Academy and the political world.

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