

Summary

Since the introduction of penicillin in the 1940s, antibiotics have become one of the cornerstones of modern medicine. They are the foundation for the treatment of bacterial infections in humans as well as animals. However, two developments are making it more and more difficult to treat bacterial infections successfully. On the one hand, in recent years there has been an increasing number of antibiotic-resistant pathogens, both in human medicine as well as veterinary medicine. On the other hand, the number of new antibiotics developed since the 1970s has steadily decreased.

According to WHO estimates, the worldwide prevalence of antibiotic-resistances is one of the greatest dangers to human health. According to the experts, the problems related to antibiotic resistances and the lack of antibiotics can only be solved or, at least, alleviated if scientists, politicians, society as a whole and business work together nationally and internationally pursuing diverse, coordinated approaches. The search for new active agents and targets can only succeed if research continues on the causes and mechanisms of antibiotic resistances and if measures for the responsible use of antibiotics are effective.

To reduce the spread of resistances and to develop new antibiotics, firstly more research must be carried out and, secondly, framework conditions are necessary which will allow research discoveries to be implemented effectively. Some starting points are provided in this statement by the Academy of Sciences in Hamburg and the German National Academy of Sciences Leopoldina, the basis for which was the joint workshop “Why do we need new antibiotics (and don’t get them)?” held on February 25th and 26th 2011.

Amongst other things, the recommendations emphasise the importance and the potential of innovative technologies for researching antibiotic resistances and of new active agents. Clinical studies and translational approaches should be pursued more intensively and the prerequisites for their execution and financing must be improved. The path adopted by the German Antibiotic Resistance Strategy DART should continue to be pursued. In view of the urgency of the resistance problem, a rethinking of the certification conditions for new active agents is needed. Last but not least, socio-economic aspects should form an integral part of the research.

Key elements of the recommendations

1. **Increased basic research:** A broad range of basic research on the origin, spread and prevention of resistance as well as on the development of new antibiotics is indispensable.
 2. **Improvement of the structural conditions for innovations:** Of particular importance is the development of a stable product pipeline. One necessary condition is the maintenance and expansion of infrastructure for the research and development of new antibiotics. In addition, it is vital to facilitate and strengthen cooperation between industry and academic research in order to more effectively link basic research resources with the diverse requirements of pharmaceutical product development. It is also essential to continue the international coordination of measures between governments and industry.
 3. **Facilitation for clinical research:** Clinical studies on the duration of effective antibiotic therapies, on the use of different therapy regimes and the effect on the development of resistances should be increased and funded.
 4. **Further development of regulatory framework conditions:** Due to the development of resistances, the proof of superiority of new antibiotics versus currently available substances is too high a treatment aim. Instead, multiple substances with a similar efficacy should be available. In future, a certificate of efficacy should be sufficient as the treatment aim for approval of new therapy principles and new substance classes in particular.
 5. **Restriction of antibiotics use in veterinary medicine and plant protection:** Antibiotics should, if possible, only be allowed for targeted use after clinical diagnosis and based on the results of resistance tests.
 6. **Consistent implementation of surveillance and antibiotics consumption records and reduction as well as promotion of education and training:** Regular surveillance of the resistance rates of important pathogens should be carried out on all levels: locally to globally and across the hospital, outpatient and animal husbandry sectors. The data should be published annually.
 7. **Increased socio-economic research:** The socio-economic, legal and ethical framework conditions for the development of new antibiotics should be investigated more, hindrances should be identified and solutions found. Measures should be evaluated more on a forward-looking as well as a retrospective basis.
 8. **Establishment of a round table to discuss antibiotic resistances and new antibiotics:** The academies recommend establishing a round table to discuss antibiotic resistances and new antibiotics under the umbrella of the Academies of Sciences with the participation of the German Centre for Infection Research DZIF.
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In addition, the academies also propose a research agenda. Research activities should cover a wide range of topics and methods in order to approach the problems of antibiotics resistances from various sides and to allow the widest possible approach to the search for new active agents. The opinion piece also addresses in detail the various research requirements.

Areas of focus of the research agenda

- Identification of new targets through functional genome research and metagenomic approaches
 - Development of new and more effective screening methods and the creation of efficient substance libraries
 - Isolation and culture of microbes from environmental habitats, amongst other things, as a source of new active agents
 - Analysis of the significance of the host-microbiome (metagenome) in the development and transmission of resistances
 - Elucidate the clinical and molecular mechanisms of resistance in vivo
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