# 5 HEALTH AND NUTRITION

Good health is the result of complex interactions between ecological, behavioural, social, political and economic factors. The aims of research into health and nutrition are to live more healthily, longer and more actively, in keeping with the motto "Die young, but as late as possible!" The chances of ageing healthily are better than ever today. Advances in medicine mean that average life expectancy has increased continuously over the last 100 years, and is now over 80 years for women and 75 years for men in the Western industrialised world. In the last 20 years alone, life expectancy has increased by an average of 5 years.

Initially, hygiene, safer food and better working and living conditions created the pre-conditions for a healthy and longer life. Advances in medicine, such as new drugs, new methods of diagnosis and intensive care, have also contributed to this trend. It is not just a case of optimising the health care system from the viewpoint of offering the best technically feasible services. Aspects of cost also play a large role in the roadmaps of the future in medical and *pharmaceutical research*.

The highest costs by far are associated with expenses incurred in the final year of life – particularly for in-patient treatment and *intensive medical care*.

The health policy of this century will in this respect be determined by ethical issues. Will we be able to make every conceivable medical treatment available to every citizen, or will cost/benefit analyses determine medical treatment? Medical research is progressing, but will it remain affordable?

The term "*theranostics*", which combines the terms diagnosis and therapy, describes a new approach in medical care. It is principally based on the fact that each person is different. In the same way that each person looks different, each person varies in their predisposition to illnesses, and the medication dose required to achieve an effect will vary. In future, diagnoses at an early stage, and establishing a predisposition to illnesses (if necessary, by means of gene tests), will mean that illness can be treated before it "breaks out". The technological drivers of this are genome research combined with rapid *genome sequencing*, as well as compact analytical equipment (*lab-on-a-chip*): substances (markers) indicating an imminent illness can be identified at an early stage. Pharmacogenomics is the branch of pharmacology which deals with the influence of genetic variation on drug response in patients by correlating gene expression with a drug's efficacy or toxicity. By doing so, pharmacogenomics aims to develop rational means of optimising drug therapy, taking into account patients' genotype.

Human wellbeing is supported not only by health research but also, in particular, by the latest developments in medical engineering. One of the subdomains of this field is clinical engineering, which deals with medical devices used in hospitals. These include pacemakers, infusion pumps, heart-lung machines, dialysis machines and artificial organs, for example.

Devices for imaging diagnostics are among the most frequently used and most complex medical products encountered in hospitals. Imaging processes are being developed toward more flexibility, greater resolution, faster evaluation and fewer stressful procedures for patients.

► **The topics**. Advances in the areas of molecular biology, genome research, bioinformatics, screening and process technologies have revolutionised *drug research*. Nowadays, the starting point for this research

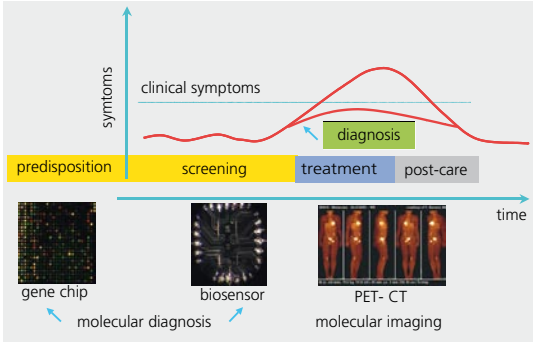
is our knowledge about changes at a molecular level which are relevant to the illness. This results in the characterisation of pathogenic, endogenous factors (targets), which can then act as sites of action for future medication. High throughput screening is used to search for inhibitors of pathogenic factors. Millions of chemical substances are tested, with a daily throughput of 200,000 test substances. These target-oriented processes lead to the discovery of selective and highly effective agents. Precise knowledge of the molecular course of an illness also allows detection of the characteristic biomarkers, which, on the one hand, help to diagnose illness in the early stages and, on the other hand, help to predict how successful the effect of the medicinal agent will be.

Whereas nowadays the patient only goes to the doctor when experiencing symptoms, and only then can a diagnosis and treatment be initiated, it is expected that advances in molecular medicine will enable risks or current illnesses to be detected at a much earlier stage. These can then be specifically treated at a molecular level or preventive measures can be taken.

The use of information technology in medicine is resulting in fundamentally new applications, such as telemedicine and *assistive technologies* in patient and old-age care. Barrier-free mobility for maintaining independence is particularly important to old and disabled people. This includes building measures, user-friendly equipment and availability of information. The networking of information technology and the integrated processing of data also play a major role in the running of operation rooms and throughout clinics. Further developments in IT also mean that data extracted from imaging procedures can be evaluated much more quickly and clearly, supporting doctors in their work. It would now be impossible to imagine intensive care, which is concerned with diagnostics and the treatment of life-threatening conditions and illnesses, without information technology. The control units and monitors on an intensive care ward are powerful evidence of this.

Research in *molecular medicine* is resulting in new insights into the interaction mechanisms between biological systems and artificial materials on a molecular level. This, combined with findings about new materials, is leading to developments in the area of prostheses, implants and tissue engineering. In tissue engineering, the use of stem cells will also herald the start of a new generation of autogenous implants. Ultimately, it is hoped that this will result in the replacement of complex organs.

Minimally invasive and *non-invasive medicine* is another area of great potential for the future. Diagnoses and treatment can be carried out by means of minor, or even without incisions. This means that patients can have the operations as out-patients, under local anaesthetic and with less post-operative pain, and convalescence will be correspondingly quicker.




Theranostics with molecular medicine: The combination of molecular diagnostics and molecular imaging will help to detect illnesses at an earlier stage. Treatment can then start as soon as possible, before symptoms have appeared. Molecular diagnosis using biochips provides evidence of illness-specific biomarkers or of a genetic predisposition to specific illnesses. Molecular imaging makes it possible to localise sites of illness (e. g. inflammations or cancer) in the body. Source: Philips Research Europe

Technology fields such as nanomedicine offer great advantages for pharmaceutics, *implant medicine* and *medical imaging*. Many promising agents cannot be considered as medicines, as they can only partly reach their sites of action despite their high pharmacological potential. It is expected that nanoscale agent carrier systems will protect agents from disintegration during transport to the target tissue, take them through biological barriers such as the blood-brain barrier and enable their controlled enrichment in the target tissue.

There is still much to be clarified about the interaction between nutrition and illnesses. However, the findings are becoming more and more clear – there is, for example, an obvious risk relationship between the mode of nutrition and the occurrence of circulatory illnesses. We can all choose the food that we eat, but not the way that it is prepared. Industrial *food technology* has a significant influence on the quality and safety of food. New foodstuffs, enriched with additional ingredients (e. g. vitamins, minerals, unsaturated fats) are being developed, which are expected to have a positive effect on health. The term for these foods, "nutraceuticals" (a combination of nutrition and pharmaceutical), suggests that the border between food and medication is becoming increasingly blurred. ■