

Editorial

The discoverer of vaccination was the British physician Edward Jenner, who in 1796 observed that milkmaids who had been infected with cowpox (vaccinia) did not get smallpox [1]. Through experimentation he discovered that a deliberate infection with cowpox gave people protection against human smallpox.

Louis Pasteur made the observation that chicken cholera bacteria (*Pasteurella multocida*), which were cultured in the laboratory over long periods of time and were therefore weakened, caused only a mild illness which however protected against a subsequent severe infection. He formulated the idea that causing mild infections with weakened strains may protect against infection with the real, serious, ‘virulent’ pathogen. Very soon he obtained weakened strains of anthrax, swine erysipelas and rabies that could be used for vaccination.

Sir Almroth Wright (1897) found that injection of large doses of killed bacteria had a similar effect, provided the structure of the bacteria changed as little as possible (by heating at 56°C, or killing with formaldehyde, etc.). He thus developed an effective vaccine against typhoid fever.

When it was discovered that the symptoms of diphtheria (Pierre Roux and Alexandre Yersin) and tetanus (Shibasaburo Kitasato) were due to exotoxins, it was discovered that people could be immunized against these diseases using toxoid, i.e. toxin detoxified with formaldehyde.

Apart from dead vaccines, vaccines that consisted of only those parts of a pathogen that have optimal capabilities to activate the immune system were also developed. For example, an antigen of hepatitis B virus that is produced by yeast cells is an effective vaccine against hepatitis.

Mild side effects such as redness and local (muscle) pain at the site of vaccination, light fever and some listlessness on the day after the vaccination may occur in perhaps half of the vaccinations. However, severe symptoms shortly after vaccination, in which the intervention of a physician is necessary, are very rare. In the Netherlands 2.1 million vaccinations are given annually within the framework of the national vaccination program and possible severe or unusual adverse events following vaccination are reported in less than 0.07% of the cases. It is also plausible that some of these reported symptoms are not caused by the vaccination, but are seen just by coincidence following vaccination.

The small probability of side effects provides just a fraction of the risks to which unvaccinated children are exposed. Furthermore, the safety of the different vaccines is constantly monitored.

Nevertheless, there are always discussions about the usefulness and safety of vaccinations, discussions that are often quite unbalanced and which can sometimes be rather aggressive [2]. In the Netherlands relatively few people oppose all vaccinations for their children. One of the reasons for not wanting any vaccination may be because their religion does not allow it. Some Christians believe that God is the only one who can decide on questions related to health and disease. There are also people who refuse vaccination because they believe that the immune system becomes stronger by letting children get the disease. However, there is no scientific evidence for this belief.

Some opponents of vaccination believe that there is an association between vaccination and diseases like autism, multiple sclerosis, diabetes and asthma. While in recent years there has been a considerable amount of research focussed on this subject, a relationship between vaccination and these diseases has never convincingly been demonstrated.

The majority of vaccines are still aimed at protecting the body against infection. However, increasingly vaccines are used in other diseases, especially cancer. Cancer preventive vaccines target infectious agents that cause or contribute to the development of cancer. The vaccines against human papillomavirus are the best known examples.

Among the treatment (or therapeutic) vaccines, which are intended to treat an existing cancer, are antigens that have been used to vaccinate metastatic melanoma patients. Another example is K-ras vaccination in colorectal carcinoma. However, producing effective treatment vaccines has proven much more difficult than developing cancer preventive vaccines.

The use of vaccination methodologies has also been studied in other non-infectious diseases. For example, DNA vaccination has shown some efficacy in allergic patients and immunization with plasmid DNA expressing islet antigens and IL-4 or IL-10 helps to prevent type 1 diabetes in mice.

It is clear that there are several reasons for an increased Public Health interest in vaccination. In the first decade of this century over 30 candidate vaccines were introduced or are waiting to be introduced. The target groups have been expanded to include adolescents and the elderly. New vaccines can protect against RSV (respiratory syncytial virus), Rotavirus, HPV (human papillomavirus), Group B haemolytic streptococci and VZV (varicella zoster virus, the cause of chickenpox and shingles). In the Netherlands it was decided in 2009 to vaccinate girls at the age of 12 against human papillomavirus types 16 and 18, in an attempt to prevent a large proportion of the deaths from cervical cancer.

For the *International Journal of Risk and Safety in Medicine* these developments were reason to invite a Vaccine Safety Specialist as a member of our editorial board and also to devote most of the pages of this issue of the Journal to vaccines.

References

- [1] A.M. Stern and H. Markel, The history of vaccines and immunization: familiar patterns, new challenges, *Health Aff (Millwood)* **24**(3) (2005 May–June), 611–621.
- [2] R. Wolfe and L. Sharp, Anti-vaccinationists past and present, *BMJ* **325**(7361) (2002), 430–432.