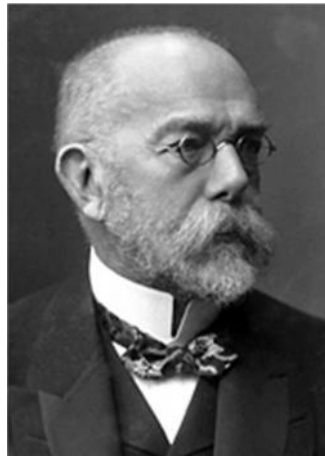


Nobel Prize in Medicine 1905



Robert Koch

The Nobel Prize in Physiology or Medicine 1905 was awarded to Robert Koch "*for his investigations and discoveries in relation to tuberculosis*".

RESEARCH INFORMATION:

The Staff of the Royal Caroline Institute takes great pleasure in giving this year's Nobel Prize for Medicine to the man who takes precedence among those now alive as a pioneer in bacteriological research, the prize being awarded to Geheimrat Robert Koch for his work and discoveries concerning tuberculosis.

This work comprises only part of his activities, through which he has rendered such great, indeed unique, services to medical progress during the last decades. Even if it is only the part mentioned which is the object of this year's award, I must still briefly enumerate the main features of his activities as a whole. The meaning of his work on tuberculosis is brought out more vividly and powerfully if this is seen in the context from which it took its origin.

To make Koch's significance in the development of bacteriology clear, one must take a look at the situation with which Koch was confronted when he made his appearance. Pasteur had indeed already published by then his epoch-making work, which laid the

foundations of bacteriology, and medical art had already gathered in one very beneficial fruit which stemmed from this work, namely the antiseptic method of treating wounds proposed by Lister. However, the trail was yet to be blazed, which bacteriological research has followed with such success during recent decades, to discover the causes of individual diseases and to look for the means of combating them. Koch was a pioneer in this.

For two diseases namely anthrax and typhus recurrens in which micro-organisms of a particularly characteristic appearance were relatively easy to demonstrate, it was agreed that the latter were the causes of these diseases. Otherwise the causal relationship between bacteria and diseases was obscure. It is true that there were good grounds for *supposing* that certain other diseases were caused by micro-organisms. But detailed knowledge concerning this was lacking, and experimental findings were very divergent. So, for instance, it was not established whether normal healthy organs contained bacterial germs. This was certainly contested by various prominent investigators, but on the other hand this view was defended by other also prominent authors. Then the question still remained open of whether bacteria observed in a disease were also its cause, or whether their development should rather be considered a result of the pathological process. In addition, in studying one and the same type of disease various investigators looked in vain for bacteria in the organism, while others, however, found them. Moreover, bacteria, which various investigators had observed in a particular disease, were often of a different appearance, so that there was reason for doubting that they were the specific and genuine cause of the disease. On the other hand, in widely differing types of disease, bacteria were met with which, as far as was known, were of one and the same kind, and this gave still more cause for adopting a position of doubt with regard to the causal relationship between these bacteria and the pathological process. It was indeed difficult to imagine that the bacteria discovered had to be regarded as the essential causes of disease, since it looked partly as if the same disease could be caused by different bacteria, and partly as if the same bacteria could produce different diseases. It was easier to suppose that the bacteria all had the property of facilitating the development of the disease by exercising an influence on the

organism. The uncertainty was that much greater since the experiments which were carried out often could not demonstrate whether a real bacterial invasion of the organism had taken place.

In 1876 Koch entered the field of bacteriological research with an investigation of anthrax, and two years later he produced his classical investigations into diseases from wound infections. With the views set out there and the way he formulated the questions, he had a fundamental effect on the further development of bacteriology, and the ideas he expressed there recur as a leading motive in his subsequent research and form the foundation of modern bacteriology, as they do of the axioms of hygiene which are derived from it.

He stressed that, if bacteria caused a disease, then they must always be demonstrable in it, and they should develop in a way such that this would account for the pathological process.

He further stressed that the capacity to produce disease could not be a general property of bacteria or one common to them all. On the contrary it should be expected in this respect to find specific properties distinguishing individual bacteria. Even if they resemble other bacteria in their form, etc. they must still be different from one another by virtue of this biological property: in other words, every disease must have its special bacterium, and to combat the disease, it would be necessary to look for clues in the biology of the bacterium. Koch therefore not only set himself the task of examining the problem of whether diseases were caused by bacteria, but also endeavoured to discover the special micro-organisms of the particular diseases and to get to know more about them: this was a problem which, in the circumstances then prevailing, seemed to offer very little hope of being solved. In the way Koch solved this problem he was just as much, if not more, of a pioneer, then he already was in the abovementioned precision which he had given to the formulation of the problem.

To start with, developing a general methodology is as valuable as finding the correct technique for every special case. Koch's genius has blazed new trails in this respect and has

given present-day research its form. To give a detailed description of this is beyond the scope of this account. I only want to mention that he had moreover already given a significant development to techniques in staining and microscopic investigation as well as in the field of experiment in his earliest work. Shortly after this he produced the important method, which is still generally the usual one, of spreading the material under investigation in a solid nutrient medium to allow each individual among the micro-organisms present to develop into a fixed colony, from which it is possible, in further research, to go on to obtain what is known as a pure culture.

Shortly after the publication of his investigations into diseases from wound infections Koch was appointed to the new Institution, the «Gesundheitsamt» (Department of Health), in Berlin. There he started work on some of the most important human diseases, namely, tuberculosis, diphtheria and typhus. He worked on the former one himself. The two latter investigations he left to his first two pupils and assistants, Loeffler and Gaffky. For all three diseases the specific bacteria were discovered and studied in detail.

To give an account of the work which Koch carried out, or accomplished through his pupils, and also to mention the work which derives more indirectly from Koch, would nearly be the same as describing the development of bacteriology over the last few decades. I will content myself with naming some of the most important discoveries and items of research which, in addition to those already named, are more directly linked with Koch's name. At the head of the German Cholera Commission Koch investigated the parasitic aetiology of cholera in Egypt and India, and discovered the cholera bacillus and the conditions necessary for its life. Experience thus gained found practical application in the development of measures taken to prevent and combat this devastating disease. In addition Koch made important investigations concerning plague in humans, malaria, tropical dysentery, and the Egyptian eye disease (trachoma) among others, and now finally concerning typhus recurrens in tropical Africa. He has also carried out work of exceptional importance, concerning a host of destructive tropical cattle diseases, such as rinderpest,

Surra disease, Texas fever, and finally concerning coast fever in cattle and the trypanosome disease carried by the tsetse fly.

Through the perfection he gave to methods of culturing and identifying micro-organisms, he has been able to carry out his work with regard to disinfectants and methods of disinfection so important for practical hygiene, and advice concerning the early detection and combating of certain epidemic diseases such as cholera, typhus and malaria.

Now I move over to a brief account of the series of investigations which is the object of the present award.

The idea that tuberculosis is infectious goes back a long way to Morgagni. Already before Koch had started his investigations into this disease, it had been possible to show that tuberculosis may be inoculated into animals. It was not, however, proved that it was caused by a micro-organism, and such an interpretation was contested by very distinguished investigators.

Koch made his first communication concerning his research on tuberculosis in a lecture given on March 24, 1882 to the Physiological Society of Berlin. This lecture covers scarcely two pages of print, yet in it are given the proofs of the discovery of the tubercle bacillus and the description of its chief characteristics. The method for staining it in the affected tissue is described there, its constant occurrence in tuberculous processes in man and beast is mentioned, the procedure for producing pure cultures of it is described, and information is given concerning typical and positive results of inoculating the bacillus in animals. It was emphasized there, in addition, that the bacillus is dependent on the living organism for its development and multiplication, and that hence tuberculous infection is derived primarily from the excretions of consumptives, and that it can probably also be caused by cattle suffering from «pearl disease».

By this epoch-making discovery, which immediately established the characteristic features of the bacteriology of tuberculosis, a broad field for further research into this disease was disclosed. Until recently Koch has continued his investigations into this disease with his invincible enthusiasm for research, and has endeavoured to solve the difficult

questions which have presented themselves. During the 1880's he was, however, hindered in this for a long time by public duties. His next striking piece of work appeared in 1890, when he published his investigations into the effect which certain materials, so-called tuberculin, formed in cultures of tubercle bacillus, have on the organism. They provoke, that is, a strong reaction, which it was also intended to use for therapeutic purposes. It is true that, as a cure for tuberculosis, it did not live up to what was hoped of it, which had been exaggerated out of proportion by the strong desire of the public and probably also of doctors for a cure of this disease. Despite all that, it has attracted attention again of late, and, in the form in which it is now obtained, it is thought that it can be used advantageously in the curative treatment of tuberculosis; and for this purpose it has had an application, albeit a limited one. It has continued to retain great importance as a means of diagnosing tuberculosis in the early stages or in a concealed form, and for this purpose it has an extensive application in the struggle against tuberculosis in cattle. This work has also been of great significance as a precursor to serum therapy, which has been so successful in other fields.

Recently, in 1901 to be exact, Koch has added another sensational link to the chain of his research on tuberculosis, when he presented his findings concerning the relation between human and bovine tuberculosis to the Congress on Tuberculosis in London. He found that human tuberculosis could not, as a rule, be inoculated into cattle, while they were very susceptible to bovine tuberculosis. So he found a very noteworthy difference between the tubercle bacilli of the two diseases. Experience at that time, concerning the transmission of tuberculosis from cattle to humans, gave Koch cause to consider bovine tuberculosis as being of only quite secondary importance in the development of human tuberculosis, whereas in this respect he strongly emphasized and stressed the spread of tuberculosis between humans.

Koch's view that a definite difference existed between the tubercloses from the two sources named, and his opinion that bovine tuberculosis was relatively harmless, met with strong opposition, whereby a diametrically opposed viewpoint was also strongly

affirmed. Accordingly Koch's pronouncement caused a long series of investigations. His observation on the low virulence of human tuberculosis in cattle can now be considered established. It has also been found that the difference goes further, when it was found that there are certain typical dissimilarities with respect to the way they grow, etc. between tubercle bacilli from these two sources. In this way it was possible to approach, even if not to give conclusively, the answer to the difficult question of the possibility or frequency of transmission of bovine tuberculosis to humans. The current position regarding this question permits it to be answered for the present to the extent that tubercle bacilli of the same sort as those in cattle have indeed been found in humans, and seen to be present more often than experience in 1901 gave reason to believe, and on this account the matter must be given continued attention; however, the number of cases in which such bacilli have been met with, together with other observations, especially the frequency of human tuberculosis in districts where bovine tuberculosis is either lacking or infection of humans from this quarter can by and large be ruled out, provide strong support for Koch's conception of the *dominant* importance of infection from one human to another in the spread of tuberculosis in humans.

For more details please visit:

http://www.nobelprize.org/nobel_prizes/medicine/laureates/1905/press.html