ISSN:2249-5347
IJSID
International Journal of Science Innovations and Discoveries
An International peer Review Journal for Science

Nobel Prize in Medicines 1933

Thomas Hunt Morgan

The Nobel Prize in Physiology or Medicine 1933 was awarded to Thom as H. Morgan "for his discoveries concerning the role played by the chromosome in heredity"

As long as human beings have existed they will have observed children's resemblance to their parents, the resemblance or non-resemblance of brothers and sisters, and the appearance of characteristic qualities in certain families and races. They will also early have asked for an explanation of these circumstances, which has produced a kind of primitive theory of heredity chiefly on a speculative basis. This has been characteristic of the theories of heredity right up to our time, and as long as there existed no scientific analysis of the hereditary conditions, the mechanism of fertilization remained impenetrable mysticism.

Old Greek medicine and science took much interest in these questions. In Hippocrates, the father of the healing art, you can find a theory of heredity that probably can be traced back to primitive ideas. According to Hippocrates, inherited qualities, in some way or other, must have been transmitted to the new individual from different parts of the

organisms of the father and the mother. Similar ideas of the transmission of qualities from parents to children are to be found in other Greek scientists, and, modified, also in Aristotle, the greatest biologist of the olden times.

Later on, this so-called transmission theory has been dominating. The only theory of heredity that has perhaps rivalled it, is the so-called preformation theory, an old scholastic idea that can be followed back to Augustine, the father of the Church. This theory maintained that, by the creation of the first woman, all following generations were also preformed in this first mother of ours. In modified form the preformation theory dominated the biology of the eighteenth century. Nevertheless, the transmission theory survived. Its last great representative was Darwin. He also seems to have understood heredity as a transmission of the personal qualities of the parents to the offspring through a kind of extract from the different organs of the body.

This conception, however, that is thus deeply rooted in the biology of past times and that will still be adopted rather generally, is fundamentally false; it has been reserved to the genetic researches of our time to prove this.

Modern hereditary researches are of a recent date, they are not yet seventy years old. Their founder is the Augustine monk Gregor Mendel, Professor at Brünn, who published (1866) his experiments on hybridization among plants, fundamental for this whole science. In the same year, in Kentucky, the man was born, who became Mendel's heir and founder of the school in heredity researches that has been called higher Mendelism, the winner of this year's Nobel Prize in Physiology or Medicine, Thomas Hunt Morgan.

Mendel's observations are of revolutionizing importance. As a matter of fact they completely upset the older theories of heredity, although this was not at all appreciated by his contemporaries. Mendel's discoveries usually are stated in two heredity laws or better rules of heredity. The first of his rules, the cleaving rule, means that if two different hereditary dispositions or hereditary factors (genes) for a certain quality - for instance for size - are combined in one generation, they separate in the following generation. If, for instance, a constantly tall race is crossed with a constantly short race, the individuals of

next generation become altogether medium-sized, or, if the factor «tall» is dominant, exclusively tall. In the following generation, however, a cleaving takes place, so that once more the size of the individuals becomes variable according to certain numerical proportions, then of four descendants: one tall, two medium-sized, and one short.

The second of Mendel's rules, the rule of free combinations, means that, when new generations arise, the different hereditary factors can form new combinations independent of each other. If, for instance, a tall, red-flowered plant is crossed with a short, white-flowered one, the factors red and white can be inherited independent of the factors large and small. The second generation then, besides tall red-flowered and short white-flowered plants, produces short red-flowered and tall white-flowered ones.

Mendel's immortal merit is his exact registration of the special qualities and consequent following of their appearance from generation to generation. In this way he discovered the relatively simple, recurrent, numerical proportions, which give us the key to a true understanding of the course of heredity. The experimental genetics of our century then has proved that, taken as a whole, these Mendel rules are applicable to all many-celled organisms, to mosses and flowering plants, to insects, mollusks, crabs, amphibia, birds, and mammals.

Mendel's rules, however, met with the same fate as many other great discoveries that have been made before their time. Their significance was not understood, they fell into oblivion, and after pater Mendel had died in 1884, nobody mentioned them anymore. Darwin apparently knew nothing about his great contemporary; otherwise he could have made use of Mendel's works for his own researches, and the rediscovery of Mendel's work was made only about 1900.

By that time, however, the qualifications for the application and perfection of Mendel's theories were quite different from those of their first publication. The general biological attitude had changed, and, above all, the knowledge of the cell and the cell nucleus had made excellent progress. The mechanism of fertilization had been discovered by Hertwig in 1875, and in the eighteen-eighties Weismann had asserted the opinion that

the nuclei of the sex cells must be the bearers of the hereditary qualities. The indirect or mitotic cell division and the chromosomes - the strange, threadlike, colourable structures that then appear - had been discovered by Schneider in 1873 already. Only several decades later, however, was the meaning of the remarkable cleaving, wandering, and fusion of these chromosomes during the different phases of the cell division and the fertilization understood.

When, at last, Mendel's discoveries came to light, their significance was soon perceived. Behind Mendel's rules there must be some relatively simple, cellular mechanism for the exact distribution of the hereditary factors at the genesis of the new individual. This mechanism was found just in the proportion of chromosomes in the sex cells before and after the fertilization. The opinion that the chromosomes are the real bearers of heredity was first clearly pronounced by Sutton in 1903, and by Boveri in 1904. This opinion was enthusiastically received by the students of the cell. Only by this discovery organic life got the unity, the continuity that human thought demands and that is more real and more provable than the hypothetic common descent of Darwinism.

The further development of the chromosome theory during the first decade of this century may here be skipped. However, the soil was well prepared when, in 1910, the American zoologist Thomas Hunt Morgan began his researches in heredity. These soon led him to the great discoveries regarding the functions of the chromosomes as the bearers of heredity that have now been rewarded with the Nobel Prize for Medicine in 1933.

Morgan's greatness and the explanation of his astonishing success is partly to be found in the fact that, from the beginning, he has understood to join two important methods in hereditary research, the statistic-genetic method adopted by Mendel, and the microscopic method, and that he has always looked for an answer to the question: which microscopic processes in cells and chromosomes result in the phenomenons appearing at the crossings?

Another cause for Morgan's success is no doubt to be found in the ingenious choice of object for his experiments. From the beginning Morgan chose the so-called banana-

fly, Drosophila melanogaster, which has proved superior to all other genetic objects known so far. This animal can easily be kept alive in laboratories; it can well endure the experiments that must be made. It propagates all the year round without intervals. Thus a new generation can be had about every twelfth day or at least 30 generations a year. The female lays about 1,000 eggs, males and females can easily be distinguished from each other, and the number of chromosomes in this animal is only four. This fortunate choice made it possible to Morgan to overtake other prominent genetical scientists, who had begun earlier but employed plants or less suitable animals as experimental objects.

Finally, few have like Morgan had the power of assembling around them a staff of very prominent pupils and co-operators, who have carried out his ideas with enthusiasm. This explains to a large extent the extraordinarily rapid development of his theories. His pupils Sturtevant, Muller, Bridges, and many others stand beside him with honour and have a substantial share in his success. With perfect justice we speak about the Morgan school, and it is often difficult to distinguish what is Morgan's work and what is that of his associates. But nobody has doubted that Morgan is the ingenious leader.

As Mendelism can be summed up in Mendel's two rules, Morganism, at least to a certain extent, can be expressed in laws or rules. The Morgan school usually speaks of four rules, the combination rule, the rule of the limited number of the combination groups, the crossing-over rule, and the rule of the linear arrangement of the genes in the chromosomes. These rules complete the Mendel rules in an extraordinarily important way. They are all inextricably connected, and form together a close biological unity.

It is true that Morgan's combination rule, according to which certain hereditary dispositions are more or less firmly combined, limits to a large degree Mendel's second rule that, at the formation of new hereditary substances, the genes may be freely combined. It is completed by the rule of the limited number of the combination groups, which has turned out to be corresponding to the number of chromosomes. On the other hand, the combination rule is confined by the strange phenomenon that Morgan calls crossing-over or the exchange of genes, which he imagines as a real exchange of parts between the

chromosomes. This crossing-over theory has met with much resistance. During the last few years, however, it has got a firm support through direct microscopic observations. Also the theory of the linear arrangement of the hereditary factors seemed in the beginning a fantastic speculation, and the publication of Morgan's so-called genetic chromosome map, upon which the different hereditary factors are checked in the chromosomes like beads in a necklace, was greeted with justified scepticism. The fact was that Morgan had arrived at these sensational conclusions by statistical analysis of his Drosophila crossings and not by direct examination of the chromosomes, which, besides, is possible only in exceptional cases. But also on this point later researches have acknowledged him to be in the right, and nowadays also other genetic scientists admit that the theory of the localization of the hereditary factors within the chromosomes is not an abstract way of thinking but corresponds to a stereometric reality.

The results of the Morgan school are daring, even fantastic, they are of a greatness that puts most other biological discoveries into the shade. Who could dream some ten years ago that science would be able to penetrate the problems of heredity in that way, and find the mechanism that lies behind the crossing results of plants and animals; that it would be possible to localize in these chromosomes, which are so small that they must be measured by the millesimal millimetre, hundreds of hereditary factors, which we must imagine as corresponding to infinitesimal corpuscular elements. And this localization Morgan had found in a statistic way! A German scientist has appropriately compared this to the astronomical calculation of celestial bodies still unseen but later on found by the tube - but he adds: Morgan's predictions exceed this by far, because they mean something principally new, something that has not been observed before.

Morgan's researches chiefly occupy themselves with the family of Drosophila, and perhaps it may seem strange that his discoveries have been rewarded with the Nobel Prize for Medicine, which is to be bestowed on the man who «has done the greatest service to mankind» and «has made the most important discoveries in the field of physiology or medicine». To this may first be alleged that numerous later examinations of other

geneticobjects, of lower and higher plants and animals, have given evidence of the fact that, as a principle, Morgan's rules are applicable to all many-celled organisms.

Further, comparative biological research has for a long time shown a far-extending fundamental correspondence between man and other beings. We can therefore consider it as a matter of course that also such an elementary function of the cell as the transmission of hereditary dispositions is similar, that, in other words, Nature uses the same mechanism with man as with other beings to preserve species, and that Mendel's and Morgan's rules thus are applicable also to man.

Human hereditary researches have already made great use of Morgan's investigations. Without them modern human genetics and also human eugenics would be impractical - it may be that eugenics still chiefly remain a future goal. Mendel's and Morgan's discoveries are simply fundamental and decisive for the investigation and understanding of the hereditary diseases of man. And considering the present attitude of medicine and the dominating place of the constitutional researches, the role of the inner, hereditary factors as to health and disease appears in a still clearer light. For the general understanding of maladies, for prophylactic medicine, and for the treatment of diseases, hereditary research thus gains still greater importance.

Mr. Steinhardt. The Caroline Institute regrets very much that Professor Morgan is not able to be here today in person. I beg Your Excellency, as the official representative of the United States of America, to accept the Nobel Prize for Professor Morgan. May I also ask Your Excellency, in forwarding the prize to him, to convey with it the admiring congratulations of our Institute.

For more details please visit:

http://www.nobelprize.org/nobel_prizes/medicine/laureates/1933/press.html