Introduction to Cell Biology
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Mendilian and Non-Mendilian Genetics Part 1

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Gregor Mendel, he discovered using maths and stats in a subset of experiments he was doing with the pea plant. Some kind of mathematical relationship between the phenotypes he was observing, as he crossed pea's hybridization, as they call it at that time, from generation to generation. And he could reproduce his observations for several traits, several changes in the way the pea pods, the seeds themselves looked; and that was pretty much what he wrote in his 1865 paper.

And this is something which I spent time on, and again many of you have been are aware of this from your school days, that there is the principle of dominance; there is segregation and there is independent assortment. All traits are monogenic that they are affected only by one locus. And each trait is controlled by a different set of factors.

And I have basically spun all of this in the light of what we know in modern biology and modern genetics. You hopefully have a very clear picture of the fact that in a diploid organism, there are a pair of chromosomes called homologous chromosomes. You know that the gene is effectively in the same physical location in both these chromosomes; in a diploid organisms, because they

are a pair of chromosomes that is a pair of alleles. And more often than not, both of these alleles are what we called as wild type alleles. They are exactly the same, they produce the same protein; so, effectively we have redundancy within our genomes.

And I also told you that even though the discovery after many decades of work was published in 1865; it was only around 1900 that there was a sort of a rediscovery of Mendel's work; and many people reproduced or tried to reproduce these experiments. They succeeded in many of the cases; in many of the other organisms, they failed. So, some traits worked, some traits did not. The traits which followed his laws; today, we call them; we call that set of genetics as Mendelian genetics.

And the traits which do not follow his laws and I will come to this are basically again, it is genetics; but, it does not follow Mendelian genetics simply because, many of the rules which are listed over here are not followed by those genes or by those alleles during the process of heredity, which is transferring of information from generation to generation.

Now, around the same time, the Charles Darwin, who many of you are aware of, also published his book; and he also had worked for many many decades in trying to collate information. And he basically collated, analyzed and put all his thoughts in the form of a theory, which we know is the theory of evolution.

And he said that phenotypic variation exists amongst individuals, and the variation is heritable; so heredity came into the picture. And those individuals with heritable traits better suited to the environment will survive, which many of you reproduced in colloquial language as survival of the fittest.

Now, Darwin had no clue about Mendel's work because Mendel's work was in German. Mendel was a monk in a very small monastery and Darwin was obviously became fairly famous in UK circles. He was linked to most famous scientists, but obviously, he had no idea about what Mendel was doing.

Now, we basically had the theory of evolution, which by 1900 had been discussed, agreed upon, not agreed upon; there was a lot of debate going on. And by the year 1900, we had a sudden

revelation that there existed literature for the past 35 years, which seemed to indicate the laws governing heredity.

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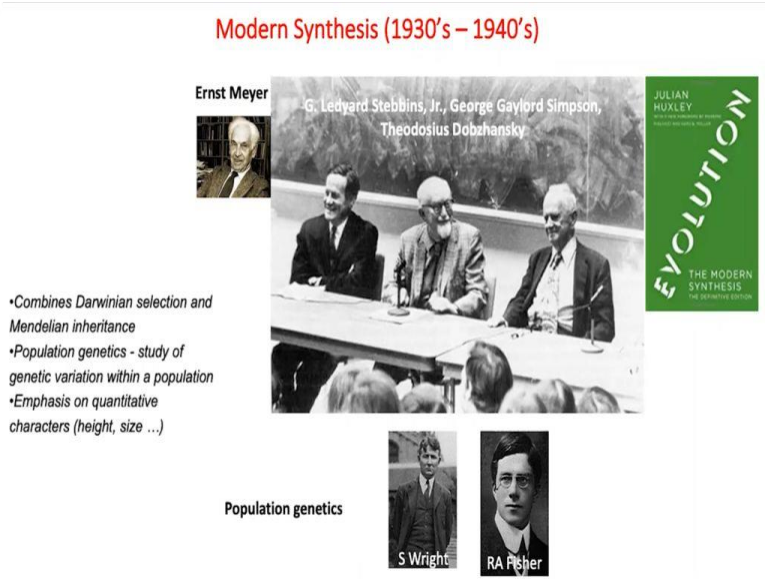

And using these two using these two ideas over the next 20 or 30 years, many researchers basically put together all these ideas into a single theory, which is called as the modern synthesis. And by around between the 1930s and 1940s because of influence of a lot of researchers and they are all listed here. This is a very big chapter in the development of the field of genetics, Ernst Meyer, Ledyard Stebbins, Gaylord Simpson, Dobzhansky. All of these, along with Julian Huxley, who wrote this very famous book, which is shown in green on the right hand side, talked about the modern synthesis.

And the modern synthesis, I am being simplistic over here; but very broadly, it brought together Darwin Darwinian theories of evolution. It brought together all the research done from the 1900s related to Mendelian inheritance. It also brought in ideas of population genetics from right, and it also brought in a lot of ideas from Fischer related to statistics. And all of this was put together with a quantitative application into sort of a hybrid theory called the modern synthesis.

Now, you learn about the modern synthesis, because it is been effectively dominating all biology, including your textbooks for so many years; pretty much 60 to 80 years at this point. And it is a so-called equivalent of the sort of grand universal theory of how life is going to go about; and I will not spend too much time on this.

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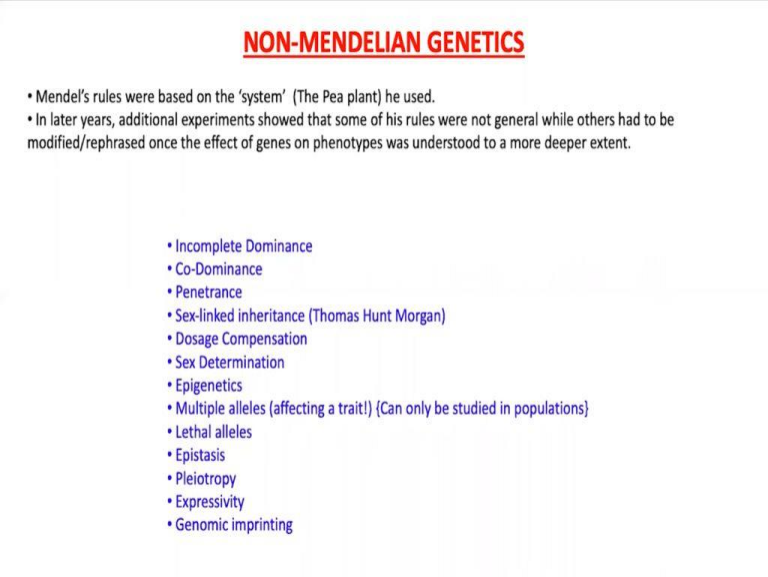

One of the things which has come about since Mendelian times and it started as early, it started before 1900; but after 1900, when Mendel's theory started to become an established in scientific circles. It was very obvious that when you do genetic experiments, when you do crosses or you do hybridization experiments, and you look at how information is transferred from generation to generation.

Yes, there were very clear examples, where Mendelian laws of segregation, independent assortment, dominance were followed. But, they it also turned out that there were many more examples where this was not really followed. And we broadly defined this entire area of genetics as Non-Mendelian genetics with a simple definition that they do not follow Mendelian patterns of patterns of inheritance.