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Review Article

Why Were We 150 Years Late For Recognizing Mendel's Assumption Regarding The Gene? ------ The True Mendelian Dualistic Genetics Was Born

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Abstract: This review reveals that genetics is undergoing a revolution, from monism to dualism. The backdrop of the revolution was the discovery of Mendel's true gene assumption. According to this assumption: "If the tall variety contains something in its germ cells that makes the plants tall, and if the short variety contains something in its germ cells that makes the plants short" (The "something" is what was later called a "gene") the gene should be the facilitator of the trait (and the individual) rather than the producer. No product can be made solely by the facilitator. This means that the individual (and traits) should be produced by both elements, the facilitator (the gene) and its facilitating action's acceptor (in the fertilized egg). That is to say, Mendelian genetics is dualistic genetics. However, "modern genetics" is monistic genetics believing genes are the hereditary material able to give rise to the individual. Mendelian dualistic genetics was discovered by the Chinese scholar M. Zhou 150 years after Mendel's article was published. This paper is a review of this discovery. The important message is: After verification, the objective facts are consistent with Mendelian dualistic genetics, but they are not consistent with gene monism.

Keywords: genes; hereditary material; genetics; template; producer.

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INTRODUCTION:

1. Introduction

The search for the hereditary material in living organisms is very difficult. However, the cornerstone of genetics is the hereditary material; therefore, to establish genetics, first the hereditary material must be identified. The hereditary material is actually the producer of (new) individuals. For example, the hereditary material assumed by preformation, pangenesis and germ-plasm theories are "miniature," "gemmules" and "germ-plasm," respectively, and they are individual producers in these theories. Because "miniature," "gemmules" and "germ-plasm" are the only element of the hereditary material in these theories, these theories belong to monistic genetics. "Modern genetics" is also monistic genetics because it regards genes as the hereditary material. However, as the gene was proven to be DNA, and we found that it alone cannot produce the individual. Consequently, monistic genetics has failed to date. In 2018–2020, the Chinese scholar M. Zhou discovered that Mendel did not define genes as the hereditary material [1–4]. His gene assumption stated that the gene is only an element controlling the specifications of the individual (including traits), and the individual (including traits) is produced by the cooperation of genes and the producing-force element that performs production operations following the specifications set by the genes. Thus, Mendelian genetics is dualistic genetics. The reasons why Mendel's gene assumption has been ignored and misunderstood are complex. There is a monistic habit of thinking, and concepts such as the hereditary material and biological producing have not been clarified, but the most important reason is the lack of recognizing the two basic questions in genetics [1].

2. The hereditary material and its identification standards

The hereditary material refers to the material transferred from the parent to the offspring (in the fertilized egg) that is **responsible for biological hereditary characteristics**. However, this is not a definition; it just indicates from where the hereditary material originates and why it has such a name. The meaning of the hereditary material has not been clarified.

Inheritance is a well-known fact. It refers to parent–child traits being similar, or even the same, in living things. The fertilized egg is the only material source from the parent to the offspring. Thus, the materials responsible for heredity can only be in the fertilized egg; there is no other possibility.

Now we can define the hereditary material as the material given by the parent that can produce the individual. Thus, the hereditary material = the producer of the individual. This knowledge comes from the indisputable fact that eggs produce chickens, and it proves that the producer of the individual is in the egg. It is beyond doubt that the producer should be responsible for everything in the product. Similarly, if one's TV set is broken, who is responsible? The producer of the TV set. Who bears responsibility for an air crash caused by a defect in the aircraft itself? Of course, it is the aircraft producer. Thus, it is neither mysterious nor incomprehensible for the hereditary material to be responsible for hereditary characteristics. It is responsible because it is the producer of the individual, and, therefore, is responsible for everything about the individual, including its resemblance or even sameness, to its parent.

The hereditary material = the producer of the individual is the first gold standard to identify whether any material (such as DNA) is the hereditary material. For example, Whether DNA is the hereditary material depends first on whether DNA has the capacity to produce individuals.

In addition to this gold standard, there is a second gold standard, which states that the hereditary material should be able to replicate itself. This point is obvious in the reproduction of unicellular organism. When a bacterium reproduces (1cell→2cell), each of the new two cells can still reproduce into two. In other words, when a cell reproduces (1cell→2cell), the hereditary material in the cell not only produces a new individual but also replicates a new copy of itself leaving to the new individual.

The new individual also contains the hereditary material. Which means that the hereditary material must be self-replicating.

So far, we have proven that only a material that meets the above two gold standards at the same time can be the hereditary material.

3. What is (biological) producing

Here we do not want to study the definition of production. We just want to emphasize that to produce living things the producer must consume energy. Living things are composed of cells, and the constituent materials of cells, such as nucleic acids, proteins, lipids and sugars, are all complex organic macromolecules. In contrast, the raw materials used to make these macromolecules are small molecules. It requires consuming energy and doing work to synthesize small molecules into macromolecules. For nucleic acid, as an example, the raw material is nucleotides, and to synthesize mononucleotides into a nucleic acid, the synthesizer must consume energy and do work to establish 3', 5'-phosphodiester bonds. Similarly, proteins are made from amino acids, and the synthesis of amino acids into proteins also requires consuming energy to build peptide bonds. Thus, in the process of producing the individual a material that does not consume energy and does no work cannot be the producer of individuals.

4. Two basic questions in genetics

Because the hereditary material = the producer of the individual, the question that geneticists have been most concerned about is the following: "who produces the individual?" This is the first basic question of genetics, i.e., the "first question". To answer this question the preformation, pangenesis, and germ-plasm theory put forward their own ideas. "Miniature", "gemmules" and "germ-plasm" were their respective answers. The common point of these assumptions is that they are all monistic: the hereditary material is composed of a single element.

"Modern genetics" regards genes as the only element of the hereditary material and "germplasm: the hereditary material of the germ cells: genes [5]" is its classic consensus; thus, it is also monistic genetics. After reading Morgan's "The theory of the gene" for the first time in 1964 Chinese scholar M. Zhou felt that the gene was not conceptually the same as "miniature", " gemmules " and "germ-plasm", but he could not clearly articulate the reason. It took more than 50 years, in 2018, for Mr. Zhou to discover that the question raised by Mendel's experiments was not the "first question" but another question. In one of Mendel's experiments, for example: "he crossed a tall variety of edible pea to a short variety. The offspring, or hybrids, F_1, were all tall. These were allowed to self-fertilize. Their offspring were tall and short in the ratio of three tall to one short"[6]. This experiment raised a question that had not been mentioned by his predecessors: "Why are there always two types of offspring from the cross between tall and short varieties (pea): one is the tall plants with the same specification as the tall variety, and the other is the short plants with the same specification as the short variety? Even F_1 is already all tall plants, but after F_1 self-fertilization, the short plants appear again in the offspring"? Such questions are completely different from "who produces the individual?", and how can such assumptions as "miniature", "gemmules" and "germ-plasm" be its answers? As a result, Zhou published the paper "Do you realize two basic questions in genetics?", which puts forward the concept of the second basic question of genetics [1].

The "second question" usually arises in sexually reproducing species (or cross between two varieties). Because there are two parents (father and mother), for the producer (germplasm), a new question arises: which specification pattern (that of father or mother) would appear in the produced offspring? In daily life, the "second question" leads people to ask questions such as "Why is Tom's oldest son tall like Tom, while the

younger son is short like Tom's wife? " "Why is Tom's son's (or daughter's) nose similar to Tom's nose, but the ears are similar to those of Tom's wife? " or "Why do the noses of the Habsburg family seem to be produced from only one template? ". Thus, the second question leads people to imagine whether fathers and mothers respectively have own set of hereditary elements for a specific version, in the form of a mold, template or design drawing.

In short, the "first question" is a matter of germplasm; whereas the "second question" is a matter of pattern, or we can adopt the term "template", which is widely used today. Thus, it is a matter of template.
The realization of the "second question" opened the door to understanding Mendelian thought.

5. Mendel's experiment and his gene assumption

Mendel designed an ingenious experiment. From the analysis of the experimental results, he determined the hereditary laws of a hereditary element (the gene). Consequently, the location of the gene was determined (existing in pairs in the zygote, and separating into two types of gametes when inherited). This laid the foundation for locating the gene on the chromosome and, finally, confirming that the gene is DNA. These achievements in the first half of the last century are well known, and therefore there is no need to describe them here.

However, "What kind of hereditary element was found by Mendel?" is a more important question. Consequently, we need to focus on Mendel's assumption regarding the gene. Mendel assumed the following: "if the tall variety contains in its germ cells something that makes the plants tall, and if the short variety carries something in its germ cells that makes the plants short"[6]. The "something" is what was later called a "gene". This assumption is obviously the answer to the question "Why are there always two types of offspring from the cross between tall and short varieties (pea): one is the tall plants with the same specification as the tall variety, and the other is the short plants with the same specification as the short variety"? Thus, the gene assumption is an attempt to solve the "second question", in which the gene should be the template rather than germplasm.

This is indeed the case. This assumption clearly tells us that the gene is the facilitator that makes the individual (plants) tall (or short), the gene is the element that frames and controls the specifications of the plant (individual).

No product can be made solely by the facilitator. In other words, genes alone cannot produce an individual or a trait. Whether tall or short plants, their producers are always fertilized eggs. Being a facilitator logically implies the existence of its facilitating action's acceptor; without an acceptor, there would be no facilitator. This means that the individual (traits included) should be produced by both elements, the facilitator and its acceptor, in the egg. Because the facilitator (genes) is the specification element of the individual (trait), its acceptor should be the producing-force element (remember that no matter that does not consume energy and does no work is not a producer of individuals) that follows the specifications set by the genes to perform producing task. Namely, a trait is produced by the producing-force element following the specifications set by a gene (or a few genes), and an individual is produced by the producing-force element following the specifications by a set of genes (genome). This is Mendel's dualistic genetics (1-4).

6. The gene is confirmed to be composed of DNA, and DNA is confirmed as template

Mendel's dualism can be elevated to a true science only when it is confirmed by objective facts. Therefore, now we should go to the real world to confirm the material truth of genes and confirm that it is indeed the individual (trait) specification element. At the same time, we should also find out the producing- force element and its material character.

In 1944, O.T. Avery *et al.* confirmed that genes are made of DNA and stated: "deoxyribonucleic acid (DNA) is capable of stimulating unencapsulated R variants of *Pneumococcus* Type II to produce a capsular polysaccharide" [7]. This occurred 79 years after Mendel's gene assumption. However, the meaning is exactly the same. DNA also is the facilitator (or stimulator) makes *Pneumococci* capsuled. It same is one element controlling the specification of a trait (capsule of *Pneumococci*); To produce capsule there still needs another element, producing-force element, in *Pneumococcus* body to perform produce operations following the specification set by the DNA. Obviously, each *Pneumococcus* is produced by the receptor of DNA's facilitating action within the bacteria following the genomic frame (or template), but with the new facilitator, capsule-DNA, bacteria can also produce capsules. The genes assumed 79 years ago closely match the DNA identified 79 years later.

From the first day that genes were confirmed as DNA, Mendel's gene assumption was strongly confirmed by experimental facts.

What Avery's team found was a devastating blow to "modern genetics": It directly proves that the trait, such as capsule, is not produced by the gene (DNA). This proves that DNA does not meet the first gold standard of the hereditary material.

After genes were confirmed as DNA, molecular biology has made rapid progress. It must be mentioned, of course, that DNA has been proven to be a template. In all the biological producing activities, DNA only participates in two production activities: producing

DNA and producing RNA. The role of DNA in these two activities is to serve as a template for framing product (DNA or RNA) specifications. In all producing activities, DNA does not consume energy, does no work and does not establish 3 ', 5' - phosphodiester bonds or other synthetic bonds. In short, DNA does not show any producing ability in the biological producing process. These facts not only prove that DNA has no producing power and cannot form the hereditary material, but also prove that genes are the template-like element just as assumed by Mendel. The DNA surface is only the template for RNA. RNA controls the synthesis of proteins [8-13], and eventually, proteins control the synthesis of other organic substances such as lipids and carbohydrates. Therefore, DNA actually controls all the biological materials (varieties) of the individual, and also controls all the traits' specifications; therefore, it is really the template of the individual. This fully confirms the correctness of Mendel's dualistic genetics; genes are one of the two elements that constitute the hereditary material, and they are the elements that frame and control individual specifications.

7. The egg's transcriptase system is another element of the hereditary material --- the producing-force element

After identifying DNA as the template, it was easier to identify the producing-force element. The producer of the individual is in the fertilized egg, and the genome (DNA) within the fertilized egg is the template of the individual. Therefore, the substance that performs the producing operation on the template is the producing-force element. It was discovered that the egg transcriptase was the only thing following the limits of DNA to perform producing tasks in the fertilized egg. Therefore, the producing-force element is the egg transcriptase. No other options exist. The egg transcriptase consumes energy to do work to establish 3', 5'-phosphodiester bonds and synthesize RNA products. In fact, the initiation of DNA transcription by the egg transcriptase is also the true initiation of the life of a fertilized egg. Without egg transcriptase (for example, by artificially removing it from an egg), the egg would lose its life. It is no longer a living cell, let alone an individual (e.g., a pea or a fruit fly). This directly proves that egg transcriptase, like DNA, is a necessary element of life. Additionally, the transcription initiated by egg transcriptase is not a one-time event, but a continuous process. It is like an automated production line for cars. After the production line is started, a series of controlled automatic causal continuous production steps are initiated. Egg transcription also initiates a procedural continuously causal automated producing process. This also requires a series of transcription factors that control the temporal, spatial region and transcription order. Therefore, to be precise, the producing-force element is a series, which is led by egg transcriptase and contains a set of transcription factors prestored in the egg, So, it should be called the transcriptase system [2].

8. Identification of the hereditary material

We have found out the hereditary material of Mendel's dualistic genetics. It is composed of two elements: the DNA (genome) and egg transcriptase system. The two elements as a whole constitute the hereditary material, so we use “Transc× DNA” to represent the union of these two elements, which is the hereditary material.

The hereditary material is not what anyone could claim. Only the material that meets the two gold standards for the hereditary material is the true hereditary material. Therefore, we will verify whether Transc× DNA meets the gold standards.

8.1 Transc ×DNA is able to give rise to the individual [2]

Any individual, whether animal or plant, is the product of a normal, preprogrammed, causally continuous and autonomously producing process caused by the transcription of egg’s DNA (genome) by the transcriptase system of the egg (unicellular organism included). Without such a transcription, no new individuals (new living things) could come into being. These all are undeniable objective facts.

Not only the new individual results from egg transcription, but also the individual in any phase of life results from this producing process (the individual in A, B..... Z phase is the result of the process progressing to the A, B..... Z phase, and the individual in N phase is the result of the process progressing to the N phase).

It cannot be denied that an individual's life is a continuous process. In this process, the individual existing in each second is the automatic result of the individual existing in the previous second. This process begins with egg transcription and ends with the individual's death.

An embryo is the result of this process progressing to the embryonic stage, a juvenile individual is the result of this process progressing to the juvenile stage and an elderly individual is the result of this process progressing to the declining stage. Death is the result of the termination of this process owing to internal or external causes. Thus, the initiation of the egg transcription is actually the initiation of each individual's life. The production process caused by egg transcription is the life process of an organism; when this process ends, life ends.

Thus, Transc × DNA is able to produce the individual, thereby meeting the first gold standard for identifying the hereditary material.

8.2 Transcriptase×DNA can replicate itself

The second gold standard for identifying the hereditary material is self-replication. Thus, we must

prove that Transc × DNA can produce Transc × DNA by itself.

We chose a clonal cell line as the research material to avoid the (unnecessary) interference of the genome (DNA) separation and recombination during sexual reproduction.

In the clonal cell lines of any organism (e.g., *Mycoplasma mycoides*), the following occurs:
1 cell→2 cells→2^2 cells→2^3·····→2^n cells
Because Transc × DNA is present in each cell, the following is also true:
1 (Transc × DNA) →2 (Transc × DNA) →2^2 (Transc × DNA) →2^3·····→2^n (Transc × DNA)

Each generation of the above series of cells has undergone a reproduction process of 1 (Transc × DNA) → 2 (Transc × DNA). As mentioned in the previous section, this process is initiated by the cell's Transc × DNA and ends when the two cells divide after reproduction. The producing process initiated by Transc × DNA not only produces a new individual, but also produces a new Transc × DNA for the new individual. This proves that Transc × DNA is a self-replicating material.

Therefore, Transc×DNA also meets the second gold standard for identification of the hereditary material.

The confirmation of Mendel's dualistic genetics also meant the collapse of "modern genetics." The process of proof in this section also exposes the failure of genes (DNA) to act as the hereditary material. DNA is unable to produce individuals, and its replication relies on DNA replicase to achieve passive replication. Neither of the two gold standards for identifying the hereditary material were met.

9. Closing words

Mendel created scientific genetics. However, the real Mendelian genetics is dualistic genetics rather than the "modern genetics" of gene monism. It is a rare case in the history of science that it has taken more than 150 years from the publication of the article to the article being truly understood. For Mendel, it was a tragedy not to be recognized by the world before his death and even more tragic to be misunderstood after being recognized.

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