Perspective

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Approach the Middle of the Molecular Biology

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Description

In 1928, Fredrick Griffith, encountered a virulence property in pneumococcus bacteria, which was killing lab rats. According to Mendel, prevalent at that time, gene transfer could occur only from parent to daughter cells only. Griffith advanced another theory, stating that gene transfer occurring in member of same generation is known as Horizontal Gene Transfer (HGT). This phenomenon is now referred to as genetic transformation.

Griffith addressed the Streptococcus pneumonia bacteria, which had two different strains, one virulent and smooth and one a virulent and rough. The smooth strain had glistering appearance owing to the presence of a type of specific polysaccharide a polymer of glucose and glucuronic acid capsule. Due to this polysaccharide layer of bacteria, a host's immune system cannot recognize the bacteria and it kills the host. The other, a virulent, rough strain lacks this polysaccharide capsule and has a dull, rough appearance.

DNA Mutation

Confirmation that DNA is the genetic material which is cause of infection came from hershey and chase experiment. They used E.coli and bacteriophage for the experiment. This experiment is also known as blender experiment, as kitchen blender was used as a major piece of apparatus. Alfred Hershey and Martha Chase demonstrated that the DNA injected by a phage particle into a bacterium contains all information required to synthesize progeny phage particles. They used radioactivity to tag the bacteriophage's protein coat with radioactive sulphur and DNA with radioactive phosphorus, into two different test tubes respectively. After mixing bacteriophage and E.coli into the test tube, the incubation period starts in which phage transforms the genetic material in the E.coli cells. Then the mixture is blended or agitated, which separates the phage from E.coli cells. The whole mixture is centrifuged and the pellet which contains E.coli cells was checked and the supernatant was discarded. The E.coli cells showed radioactive phosphorus, which indicated that the transformed material was DNA not the protein coat.

The transformed DNA gets attached to the DNA of E.coli and radioactivity is only seen onto the bacteriophage's DNA. This mutated DNA can be passed to the next generation and the theory of Transduction came into existence. Transduction is a process in which the bacterial DNA carries the fragment of bacteriophages and passes it on the next generation. This is also a type of horizontal gene transfer.

Hereditary Characteristics

As we approach the middle of the 20's, molecular biology is entering a golden age defined by both vertical and horizontal technical development. Vertically, novel technologies are allowing for real-time monitoring of biological processes at the atomic level. Molecular biologists today have access to increasingly affordable sequencing data at increasingly higher depths, facilitating the development of novel genetic manipulation methods in new non-model organisms. Likewise, synthetic molecular biologists will drive the industrial production of small and macro molecules through the introduction of exogenous metabolic pathways in various prokaryotic and eukaryotic cell lines.

DNA coding for a protein of interest is now inside a cell, and the protein can now be expressed. A variety of systems, such as inducible promoters and specific cell-signaling factors, are available to help express the protein of interest at high levels. Large quantities of a protein can then be extracted from the bacterial or eukaryotic cell. The protein can be tested for enzymatic activity under a variety of situations, the protein may be crystallized so its tertiary structure can be studied, or, in the pharmaceutical industry, the activity of new drugs against the protein can be studied.

Polymerase Chain Reaction (PCR) is an extremely versatile technique for copying DNA. In brief, PCR allows a specific DNA sequence to be copied or modified in predetermined ways. The reaction is extremely powerful and under perfect conditions could amplify one DNA molecule to become 1.07 billion molecules in less than two hours. PCR has many applications, including the study of gene expression, the detection of pathogenic microorganisms, the detection of genetic mutations, and the introduction of mutations to DNA. The PCR technique can be used to introduce restriction enzyme sites to ends of DNA molecules, or to mutate particular bases of DNA, the latter is a method referred to as site-directed mutagenesis. PCR can also be used to determine whether a particular DNA fragment is found in a cDNA library. PCR has many variations, like reverse transcription PCR (RT-PCR) for amplification of RNA, and, more

recently, quantitative PCR which allow for quantitative measurement of DNA or RNA molecules.

While researchers practice techniques specific to molecular biology, it is common to combine these with methods from genetics and biochemistry. Much of molecular biology is quantitative, and recently a significant amount of work has been done using computer science techniques such as bioinformatics and computational biology. Molecular genetics, the study of gene structure and function, has been among the most prominent sub-fields of molecular biology since the early 2000s. Other branches of biology are informed by molecular biology, by either directly studying the interactions of molecules in their own right such as in cell biology and developmental biology, or indirectly, where molecular techniques are used to infer historical attributes of populations or species, as in fields in evolutionary biology such as population genetics and phylogenetics. There is also a long tradition of studying biomolecules "from the ground up", or molecularly, in biophysics.

Horizontally, sequencing data is becoming more affordable and utilized in many different scientific fields. This will drive the development of industries in developing nations and increase accessibility to individual researchers. Likewise, CRISPR/Cas gene editing experiments can now be conceived and implemented by individuals for under $10,000 in novel organisms, which will drive the development of industrial and medical applications.