

U3

DNA the Central Dogma

3.4: Genes, Central Dogma

- 3.5: Cell Division-Mitosis and Meiosis,
- 3.6: Chromosomal involvement, DNA level of involvement.

CENTRAL DOGMA

- *What is the central dogma of DNA?*
- The **central dogma of molecular biology** describes the two-step process, transcription and translation, by which the information in genes flows into proteins: **DNA** → RNA → protein. Transcription is the synthesis of an RNA copy of a segment of **DNA**.
- Transcription is the synthesis of an RNA copy of a segment of DNA. RNA is synthesized by the enzyme RNA polymerase.

The Central Dogma



DNA



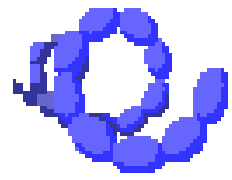
Transcription:
the synthesis of
an RNA copy of a
segment of DNA



RNA



Translation



Protein

Genes Are Located on Chromosomes

(1910 – 1920s)

- ❑ **Thomas Hunt Morgan discovers that genes are located on chromosomes.**
- ❑ Working on fruit flies, he concludes that certain traits are linked to gender and that those traits are probably carried on one of the sex chromosomes (X or Y).
- ❑ **He hypothesizes that other genes are also carried on specific chromosomes.**
- ❑ Using chromosome recombination, he and his students map the locations of genes on chromosomes.
- ❑ Morgan and his students write the seminal book ***“The Mechanism of Mendelian Heredity”***.

Genes Control Biochemical Events

George Beadle and Edward Tatum

(1930) discover through experiments on neurospora, a bread mold, that genes are responsible for the production of enzymes.

Their report is the genesis of the "**one gene-one enzyme**" concept.

DNA Is the Genetic Material (1928, 1944, 1952)

- ◇ Several scientists prove that DNA is the chemical basis of genetic information.
- ◇ Oswald Avery proves that DNA carries genetic information.
- ◇ Linus Pauling discovers that many proteins take the shape of a spiral, like a spring coil.
- ◇ Finally, biochemist Erwin Chargaff finds the arrangement of certain nitrogen bases in DNA always occurs in a 1-to-1 ratio, forming base pairs.

DNA Is a Double Helix (1953)

- ◇ James Watson and Francis Crick describe the DNA molecule.
- ◇ The scientists suggest that the DNA molecule is made of two chains of nucleotides, each in a helix, one going up and the other going down. Crick adds the idea that matching base pairs interlock in the middle of the double helix to keep the distance between the chains constant.
- ◇ They show that each strand of the DNA molecule is a template for the other, and that DNA can reproduce itself without changing its structure, except for occasional errors or mutations.

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Cracking the Genetic Code (1960s)

- Marshall Nirenberg leads the team that discovers the genetic code,
- They showed that a sequence of three nucleotide bases (**a codon**) determines each of the **20 amino acids**.
- **Along with identifying all of the approximately 20,000–25,000 genes in the human genome, the Human Genome Project also sought to address the ethical, legal, and social issues that were created by the onset of the project.**