March 1st 2013 - Ch. 5

DNA, Gene Expression and Biotechnology

What is the code and how is it harnessed?

What is it?

* DNA is a nucleic acid, a macromolecule that stores information.
* It consists of individual units called nucleotides: a sugar, a phosphate group and a nitrogen containing base

TWO important features of DNA

1. DNA contain instructions on how to create a body and control its growth and development

2. Instructions are passed

DNA

3 things to know

* Structure
* How it works: DNA to proteins
* How it replicates: When? And Where?

STRUCTURE

* Double Helix Twisted
* Watson and Krik were the first to come up with the shape of DNA
* Roslyn Franklin had the DNA x-rays that Watson & Krik used to discover the shape.
* DNA consists of two polynucleotides twisted in a double helix
* The sequence of the nitrogenous bases in DNA carries genetic information

HOW IT WORKS

* DNA gives instructions for building every organism on earth
* Genome – complete set of DNA . It can be found in the nucleus of virtually every cell.
* Alleles – alternate versions of a gene that code for the same trait
* 95% of your DNA is non-coding DNA.

Take-home message

* Only a small fraction of the DNA in eukaryotic species codes for genes.
* The function of the rest is still a mystery. (Although we are now starting to understand some of the functions of so called “JUNK” DNA)

**3-15-13**

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 1. DNA to RNA

- Because Nucleus has DNA

- Your book calls this step transcription

The RNA is a single strand – compliment of the DNA strand with 1 change T to U

Three steps:

1. Unzip the DNA

2. Take the complement

Replace all of the T’s with U’s

* Very important – do this AFTER the complement

So now we have an RNA molecule with the DNA’s information on the RNA

RNA runs away

* Leaves the nucleus

Because it has to get to the protein factory

* Ribosome

The ribosome reads the RNA code

* 3 letters (codon) at a time!

RIBOSOME

Looking for a start instruction

* So it isn’t making proteins from “Junk”

Once it finds the start code

* Amino Acids coded for are connected

Process continues till “stop” code

DNA > RNA> PROTEINS

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* END OF DNA WORKING \*\*\*\*\*\*\*\*\*\*\*\*\*\*

DNA replication

WHEN , WHERE, HOW IS HAPPENS?

It happens during interphase – The cell splits and replicates

It happens in the nucleus

How does it happen:

1. DNA molecules unzips

2. Bases are read

3. Complementary bases are paired on each of the 2 strands

4. Both strands are proofread

5. Mistakes cut out and corrected

6. Process resumes

Mutations

* Bad reputation
* Tend to be disruptive
* Very, very rare

5.8 Causes and effects of mutation

- Alteration in the sequence of DNA

What causes mutations?

Mistakes in copying DNA

Exposure to radiation

**3-18-13**

2 DNA’s

Mitochondrial

* mDNA or mtDNA
* 100s of copies / cell
* Passed from mother
* Circular
* 15,000 base pairs
* Runs your powerplants

Nuclear

* nDNA
* 1 copy per cell
* ½ from each parent
* Long threads
* 3,000,000,000 base pairs
* Builds you makes you run

What are they good for?

Mitochondrial

* Determine mother
* Trace lineages
* Species ID

Nuclear

* Determine Individual
* Determine Father
* Evolutionary relatives
* Drug effectiveness
* Genetic Disease Screening

What is biotechnology

* Biotechnology is the use of technology to modify oranisms, cells, and their moelcules to achieve practical benfits.
* How?
* Adding, deleting or transplaing genes from one organism to another

Biotech advan1ces fall into three categories:

(1) Producing medicines to treat diseases

(2) Preventing or curing diseases

(3) Altering agricultural products

5.12 Curing diseases with biotechnology

Gene therapy and the correction of malfunctioning genes

Gene Therapy Difficulties

(1) Difficulty getting the working gene into the specific cells where it is needed.

(2) Difficulty getting the working gene into enough cells and at the right rate to have a physiological effect

(3) Preventing Diseases

Take home message 5.12

Gene therapy has had a poor record of success in curing human diseases.

This stems primarily from technical difficulties in transferring normal functioning Genes into the cells of a person with a genetic disease.

5.13

(2) Will a baby be born with a genetic disease?

- Cystic fibrosis

- Sickle-cell anemia

- Down syndrome

- others

(3) Is an individual likely to develop a genetic disease later in life?

- breast cancer

- prostate cancer

- skin cancer

Ethical Dilemmas

* Discrimination
* Health insurance
* How to proceed with the information

Bio-Tech allows us to identify:

* Whether a given set of parents is likely to procuce a baby with genetic disease