EMWA Professional Development Programme

Cell signalling
in drug development and regulatory documents

Foundation, 3.5 hours

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Pre-workshop assignment

Objective

To refresh the basic concepts of cell structure and gene expression that are necessary to understand the workshop.

Content and instructions

1. Answer the following questions and email them by 9 November:
   - How much knowledge of cell signalling/molecular biology do you have?
   - Why did you choose this workshop/which questions are you most interested in seeing answered?
   - In case you already had the chance of watching the videos below, do you have any questions about the general concepts described in them?

2. **Background learning** (or knowledge refresher): watch the following videos (please remember we are interested in the general ideas and concepts). Please feel free to contact me in case you need more materials or if you experience any difficulties.

Biological molecules, 15 min: carbohydrates/lipids/proteins
https://www.youtube.com/watch?v=H8WJ2KENlK0&list=PL3EED4C1D684D3ADF&index=3

Eukaryotic cell structure, 12 min:
https://www.youtube.com/watch?v=cj8dDTHGJBY&list=PL3EED4C1D684D3ADF&index=4

DNA and replication, 15 min (don't focus on the details about the DNA replication mechanism):
https://www.youtube.com/watch?v=8kK2zwjRV0M

DNA, genes, proteins, 4 min:
https://www.youtube.com/watch?v=uHSx9zObyC0&frags=pl%2Cwn

The Central Dogma, transcription and translation overview, 2 min:
https://www.youtube.com/watch?v=6F3f3IpIMmc

From DNA to protein, 3 min:
https://www.youtube.com/watch?v=gG7uCskUOrA&frags=pl%2Cwn

3. Read and understand the relevant terms in the **glossary** (see below). Please have a copy during the workshop for reference.

4. (**OPTIONAL**) If you would like to know more about the central dogma of molecular biology, watch the videos and read the other materials in the *Central dogma (DNA to RNA to protein)* lesson from **KHAN Academy**, and try to answer the self-assessment:
https://www.khanacademy.org/science/biology/gene-expression-central-dogma

If you are interested in learning even more, KHAN Academy covers plenty of other topics with nicely explained videos and materials, for example:

DNA as the genetic material: https://www.khanacademy.org/science/biology/dna-as-the-genetic-material

Structure of a cell: https://www.khanacademy.org/science/biology/structure-of-a-cell

(For a list of all topics: https://www.khanacademy.org/science/biology?t=classes)

Crash course biology has also other interesting topics:

The Central Dogma, 14 min: https://www.youtube.com/watch?annotation_id=annotation_44093&feature=iv&src_vid=8kK2zwjRV0M&v=itsb2SqR-R0

(Full playlist: https://www.youtube.com/playlist?list=PL3EED4C1D684D3ADF)

Assessment criteria

To attain credit in this workshop, please send your answers to the questions to laiapedro@gmail.com by 9 November, watch the 6 videos listed above, and familiarise yourself with the terms in the glossary.

Time required

Approximately 1.5 hours (excluding the optional content).

Deadline or other information about bringing the assignment to the workshop

Send to laiapedro@gmail.com by 9 November.
Please note that receipt of the assignment will be acknowledged but reminders will not be sent.

Glossary

Eukaryotic cell	Eukaryotic cells contain a nucleus (membrane-defined compartment that isolates the genetic material from the rest of the cell) and organelles. Organisms that have eukaryotic cells include protozoa, fungi, plants and animals. Eukaryotic cells are larger and more complex than prokaryotic cells (prokaryotic cells don't have their genetic material separated from the rest of the cell by a membrane).
Eukaryotic Cell structure	
plasma membrane	Double layer of lipids and proteins that surrounds a cell and separates the cytoplasm from its environment. It is selectively permeable, which means that it only lets certain molecules enter and exit.
cytoplasm	Contents of the cell with the exception of the nucleus. Includes the cytosol (liquid found inside the cell) along with filaments, proteins, ions, macromolecular structures, and the organelles suspended in the cytosol.
organelle	Each of the different compartments within the cell that perform a specific function; they are usually isolated from the rest of the cytoplasm through intracellular membranes. Examples: mitochondria, endoplasmic reticulum, Golgi apparatus, lysosomes, ribosomes.
ribosomes	The organelle in charge of synthetizing proteins (organelle where messenger RNA is translated into proteins). Ribosomes are made of ribosomal RNA and associated proteins, and are found in large numbers in the cytoplasm of living cells.
nucleus	Organelle that protects the DNA and produces the necessary precursors for protein synthesis (mRNA).

Biological Molecules	
amino acids	Building blocks (monomers) to form proteins. There are 20 different amino acids in human cells, each one coded in the DNA by a different triplet of nucleotides (codon).
polypeptide	Chain of amino acids linked by peptide bonds.
protein	Biomolecule consisting of one or more long chains of amino acid residues (called polypeptides) folded into a specific three-dimensional structure. Proteins have a wide range of functions, including catalysing metabolic reactions (enzymes), replicating the DNA, and transporting molecules.
nucleotides	Building blocks (monomers) to form nucleic acids (DNA and RNA). Consist of a five carbon sugar (ribose in RNA and deoxyribose in DNA) linked to a nitrogenous base and a phosphate group. There are 4 types of nucleotides in DNA (Adenine, Thymine, Guanine, Cytosine) and 4 types of nucleotides in RNA (Adenine, Uracil, Guanine, Cytosine) depending on the nitrogenous base they have.
DNA	Deoxyribonucleic acid, double-stranded polymer of nucleotides. It is a self-replicating material present in the nucleus of eukaryotic cells as the main constituent of chromosomes. It is the carrier of genetic information. DNA molecules are read in groups of 3 (named “codons”); each codon translates into one specific amino acid.
RNA	Ribonucleic acid, single-stranded polymer of nucleotides. RNA differentiates itself from DNA in that its nucleotides have a ribose instead of a deoxyribose and in that it contains Uracil instead of Thymine.
mRNA	Messenger ribonucleic acid. Temporary copy of a DNA segment (gene) that serves as template for protein synthesis.
DNA to protein	
central dogma	Hypothesis that explains how the information in genes flows into proteins: DNA is transcribed into RNA in the nucleus, and RNA is translated into proteins in the ribosomes.
transcription	First step of gene expression: process in which a segment of DNA is copied into RNA; occurs in the nucleus.
translation	Process by which a protein is created based on an mRNA template, occurs in the ribosomes.