# Molecular cascade and upstream downstream processing

Science, Biology

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One of the amazing features of life is the way each organism’s anatomical and biochemical detail is en d by deoxyribonucleic acids (DNA), which is a polymer of nucleotides. As organisms become more complex, the number of nucleotides that code for their characters becomes greater in number as well. Thus, for humans, there are 46 chromosomes that contain 3 billion nucleotide base pairs. In contrast, a much simpler Caenorhabditis elegans (nematode roundworm) has 6 chromosomes and 100 million nucleotide base pairs, which is completely sequenced in 2003 (Waksman Student Scholars). All of these details are efficiently packaged through a chemically stable double helix, which coil around themselves to this great number of molecules in a small part of the cell, called nucleus. The structure of DNA was elucidated by James Watson and Francis Crick in 1953 (Campbell and Reece, 2002). How the information in DNA is utilized is summarized in the central dogma of molecular biology. It starts with DNA replication, in which the chromosomes accurately make copy of themselves to prepare for cell division, whose steps are clearly visible even through a light. The genetic material is structured such that 1) only 1 replicate is made per cell division, and 2) the chromosome is attached to its copy at the centromere. Upon cell division, particularly metaphase, microtubules from centrioles at two ends of a dividing cell attach to the centromeres of the replicated chromosomes that are arranged at the middle of the cell. At anaphase, these microtubules shorten so that the chromosomes and their respective copies reach either ends of the cell as they form furrows to divide the cell into two. When the progeny cells are for fertilization, DNA replication is skipped. For this reason,

the chromosomes that reach the ends of the dividing cell are the homologues. In addition, the chances of two fertilizing cells being the same are slim to nothing (Campbell and Reece, 2002). Proteins are the molecules to which the features of an organism depend on. Its structure is thus a telling factor of its function. For example, what structure a keratin molecule assume vary its hardness. Those that make-up the hair of mammals have a structure of helix, and is thus less stable than that which makes up the claws of reptiles, which has a pleated sheet configuration. The plasma membrane of neural axons is covered with myelin that prevents the channeling of ions in and out of the cell, thus making signal transmission faster. Gated ion channels have amino acid sequences to allow the structure to open and close through the transient interactions of certain amino acids (Campbell and Reece, 2002). To use the data in the DNA to make proteins, the second and third steps of the central dogma ensue. In transcription, DNA is used as a template to make a more functional ribonucleic acid (RNA), which may then used as a guide to make a chain of polypeptides. Whether or not the proteins are bound to be floating on the cytosol or attached to the membrane depends on whether the ribosome making the polypeptide is attached to the endoplasmic reticulum (ER), a membrane organelle attached to the Golgi apparatus that makes the vesicles that merge with the plasma membrane, or not. Attachment is facilitated by a signal peptide at the end of the polypeptide, which attaches to a receptor in the ER. Thus, the absence of this signal peptide will prevent attachment and allow the ribosome to remain floating in the cytosol (Campbell and Reece, 2002). References: Campbell, N. A. and Reece, J. B. (2002). Biology. 6th ed. Pearson: San Francisco. Waksman

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