Cell production system

Ribosomes

Ribosomes are small electron-dense particles measuring 20 x 30 nm.

- composed of a small (40S) and a large (60S) ***subunit***
- from 4 types of rRNAs and about 80 different proteins
- *two classes of ribosomes:*

1. of prokaryotes, chloroplasts and mitochondrias, and
2. of eukaryote

- are formed in the nucleolus, their proteins are synthesized in the cytoplasm
- strongly *basophilic* → react with basic dyes
- occur either as individual granules or in clusters = **polyribosomes** (held together by mRNA)
- proteins formed for the cell's own use are synthesized on unbound polyribosomes
- the association of rRNA and ribosome occurs in the *nucleus*, complete ribosomal subunits travel out of the nucleus through nuclear pores

Endoplasmic reticulum

- the site of synthesis of lipids and saccharides
- segregation of proteins from the cytoplasm and initial posttranslational modification (preparation for specific functions) occurs here
- in fully differentiated cells there are 2 types of endoplasmic reticulum:

1. ***rough ER***
2. ***smooth ER***

Rough endoplasmic reticulum (GER)

- also ***granular; rought***
- in cells specialized for *protein secretion* (pancreatic, fibroblasts, plasma cells)
- '*composed of*' **tubules** and parallel clustered flat *cisternae* formed by membranes sometimes associated with the outer envelope of the nucleus
- the presence of ribosomes and polyribosomes on the cytoplasmic surface of the reticulum membrane, which give it a granular appearance
- Ribosomes are responsible for the basophilic properties
- the main **task** is the segregation of proteins for export or transfer to other cytoplasmic components
  - initial glycosylation of glycoproteins containing nitrogenous oligosaccharides, synthesis of phospholipids, post-translational modification of newly formed polypeptides
  - proteins synthesized in the GER have different destinations, may remain in the cytoplasm or be segregated from it and participate in different cellular activities

Smooth endoplasmic reticulum (HER)

- also ***agranular; smooth***
- also forms the intracellular network
- without associated ribosomes
- cisternae are *tubular*; huge number of interconnected channels of various shapes and sizes
- membranes of HER arise from rough ER → often merge into each other
- **synthesis** of lipids, phospholipids, carbohydrates and steroid hormones
- **sarcoplasmic reticulum**: a specialized form of the HER that is involved in the process of muscle cell contraction (reservoir of calciums)
- often in steroid hormone synthesizing cells (ovary, testis, adrenal gland), and in hepatocytes (detoxification reaction)

Golgi complex (GK)

- determines post-translational modification of products synthesized by the cell, envelops them and labels them with the destination address
- of three distinct compartments bounded by a smooth membrane:

1. mildly curved sheathed cisternae,
2. a large number of small pouches and
3. several larger vacuoles located at one pole of the GC

- functional connection between the ER and the rest of the cell (difficult to determine its boundaries)

- ER → newly formed protein → GK cisternae (the nearest cisterna is called the production = convex = *cis region*), in the **trans region** (concave = matric) vesicles gather → condensing vacuoles (these structures bud from Golgi cisternae and split off as vesicles transporting proteins to various sites)
- plays an important role in glycosylation, sulfation, phosphorylation and selective proteolysis of proteins

Links

Literature used

- JUNQUIERA, L. Carlos – CARNEIRO, José – KELLEY, Robert O.. *Fundamentals of Histology.* 1. edition. Jinočany : H & H 1997, 1997. 502 pp. ISBN 80-85787-37-7.