

CONNECTIVE TISSUE – CELL ADHESION – CYTOSKELETON

Connective tissue

Introduction

- functions of the connective tissue (structural role and functional importance/ regulatory role of cell adhesion – effects on metabolism, cell migration, cell differentiation and cell proliferation)
- main types of the connective tissue
- cell types occurring in the connective tissue

Fibers

Collagen

- functions, general properties
- repeating unit of amino acids, importance of this in the formation of the molecular structure, characteristic amino acids
- molecular structure of the collagen fiber
- steps of biosynthesis (in detail: hydroxylation, glycosylation, formation of triple helix, importance and cleavage of register peptides), maturation of collagen (oxidation)
- main collagen classes, characteristics and distributions of the important types (fibrillar: I, II, III; network forming: IV; anchoring fibril: VII; non-collagen proteins with collagen domain: eg. acetylcholinesterase)
- ❖ disorders of biosynthesis: mutations of collagen genes (I: osteogenesis imperfecta, II: chondrodysplasias, III: Ehlers-Danlos /IV/, IV: Alport syndrome, VII: epidermolysis bullosa); vitamin C defect (scurvy)
- degradation (breakdown enzymes), cases/conditions of fast collagen turnover and
- ❖ scarring-fibrosis (cases)

Elastin

- function, distribution, properties
- characteristic amino acids, molecular structure
- biosynthesis (in detail: Lys oxidation, desmosine, isodesmosine)

Fibrillin

- function, distribution, main feature
- ❖ Marfan syndrome

Extracellular matrix (ECM)

Proteoglycans

- general properties
- 6 main types of glycosaminoglycans (repeating disaccharide units, main characteristics, tissue/cell distribution)
- functions of hyaluronic acid, heparin and heparan sulfate
- 3 main classes of proteoglycans, main types, characteristics, localization (large, aggregating PGs: aggrecan, perlecan; small, Leu-rich PGs: biglycan, decorin; cell surface PGs: syndecan, appican)
- molecular structure of aggrecan, properties
- ❖ Alzheimer disease
- main steps of proteoglycan biosynthesis, degradation of GAG

- ❖ mucopolysaccharidoses (Hurler, Hunter)
- inorganic and organic components of bone; degradation/remodelling of bone (role of osteoclasts and osteoblasts)
- ❖ osteoporosis
- components and types of cartilage
- ❖ FGF-receptor3 defect: dwarfism (achondroplasia)

Adhesion glycoproteins

- roles, general characteristics, classification according to function
- „pathway forming“: fibronectin, tenascin (mol. structure, binding domains, functions)
- basement membrane components: laminin, entactin (mol. structure, binding domains)
- structure and components of the basement membrane
- acting in hemostasis: thrombospondin, vWf (mol. structure, binding domains, functions)
- acting in mineralization and remodelling of the bone: osteonectin, -pontin

Cell adhesion

- importance of cell-matrix and cell-cell adhesion, possible effects on cell function (eg. anchorage-dependent cell proliferation, contact inhibition)
- formation of focal adhesional complex, „adhesosome“ as a signalling complex
- main classes of adhesion receptors
- integrins: general characteristics, classification (β 1- β 4), distribution, functions
- ❖ gene defects of integrins (β 2: leukocyte adhesion defect (LAD), β 3: Glanzmann disease)
- selectins: general characteristics, types (L, P, E), distribution, function
- IgCAM superfamily: main characteristics, types (ICAM-1,-2, NCAM), distribution, functions
- cadherins: main characteristics, functions, types (E; N, P, R, M)
- ❖ E-cadherin as a negative carcinoma marker
- role of adhesion receptors in extravasation of neutrophil granulocytes (selectins, β 2, β 1 integrins, ICAM-1,2; see: chemotaxis)

Cytoskeleton

- general characteristics, roles; cytoskeletal classes, properties, functions
- actin-cytoskeleton (microfilaments): aktin types, polymerization; importance and functions of actin-binding proteins
- motor protein of microfilaments: myosin II (importance in cell migration)
- ❖ hereditary spherocytosis (spektrin defect)
- ❖ progressive muscular dystrophies (defect of dystrophin: Duchenne disease, laminin defect)
- ***intermediate filaments***: general characteristics, main types and distributions
- ❖ importance in cell typing (tumour diagnostics)
- ***mikrotubules***: molecular structure, formation and dynamics
- mikrotubular motor proteins (kinesin, dynein) and their function
- ❖ MT toxins (colchicine, Vinca alkaloids, taxol)