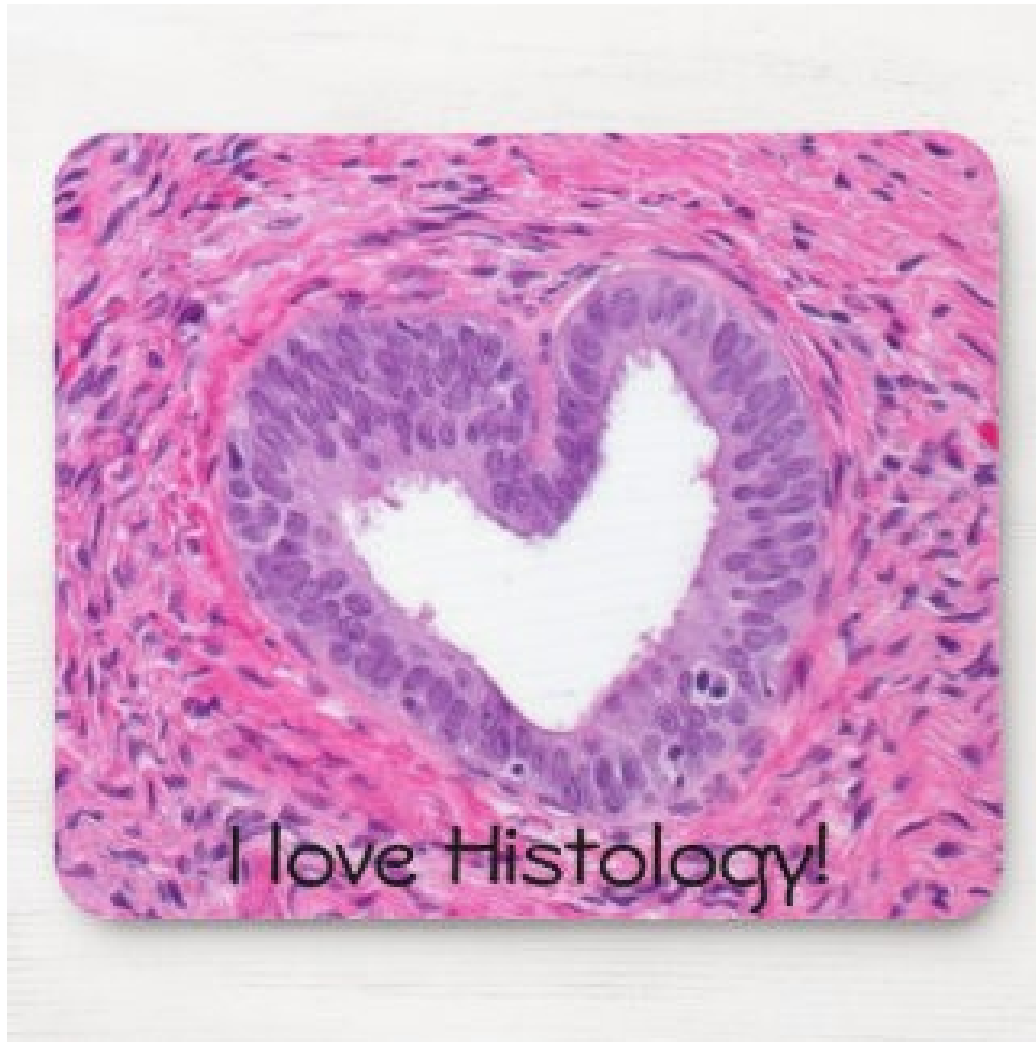


HISTOLOGIE



Buňka

Základní morfologická a funkční jednotka organismu schopná životních projevů: ???

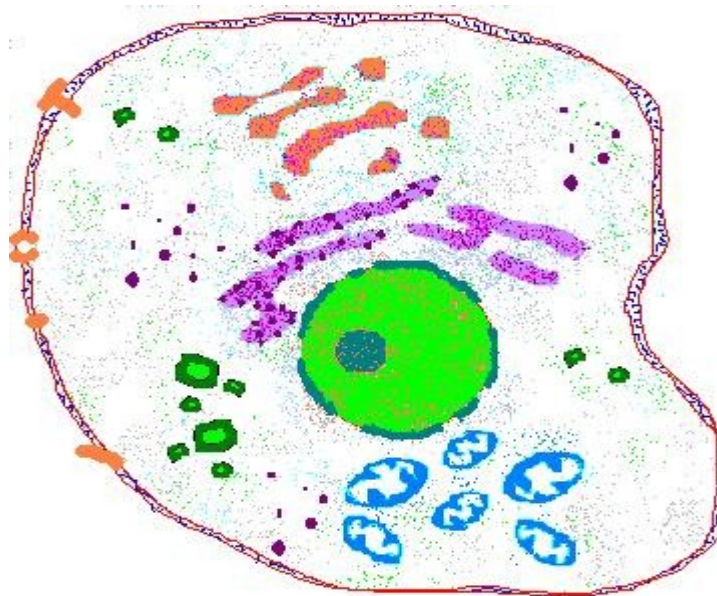
metabolismus

růst

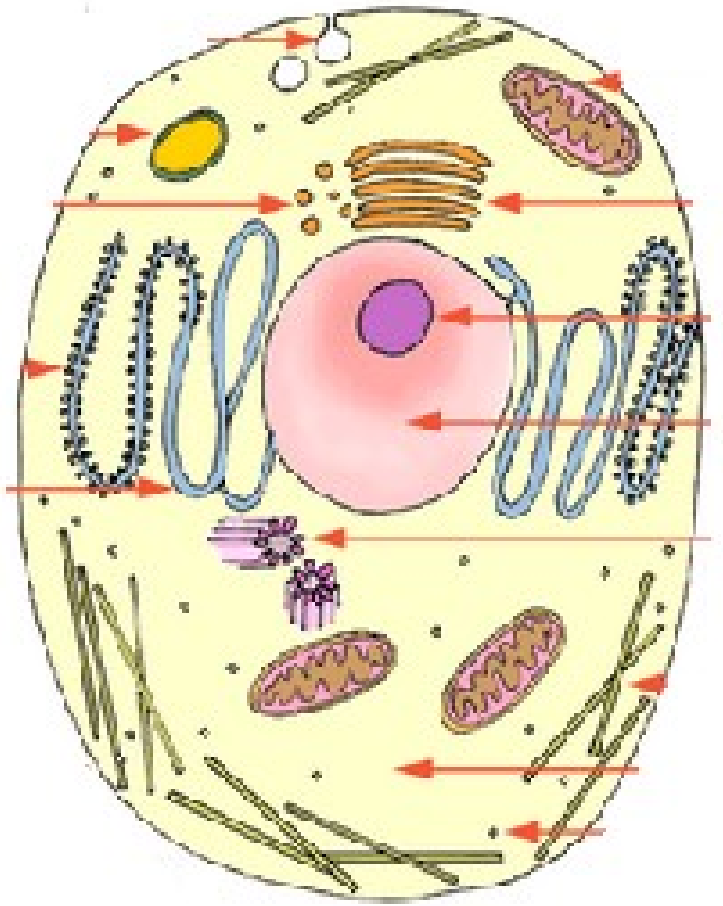
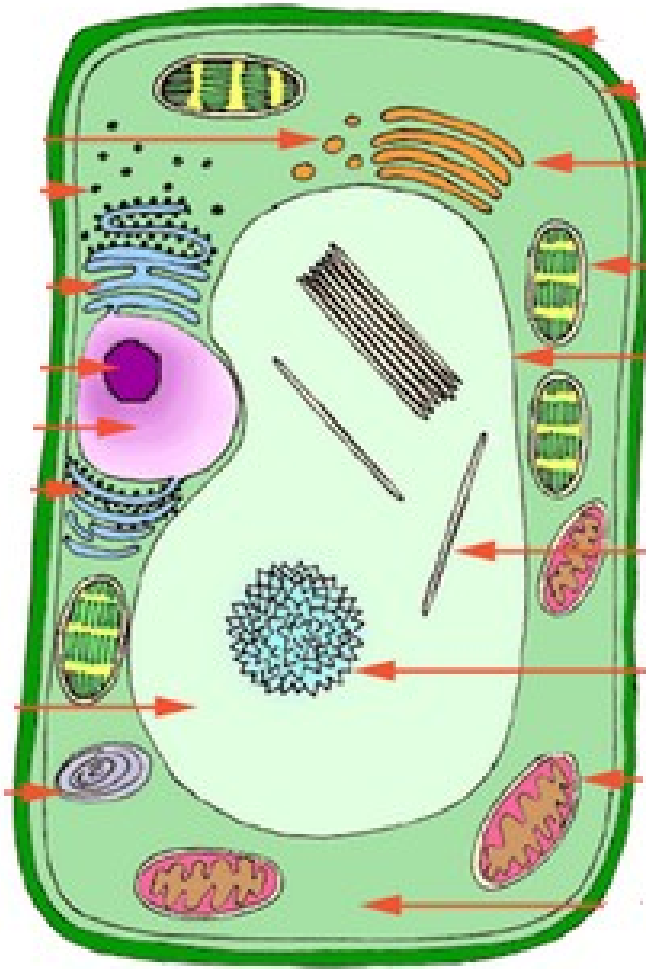
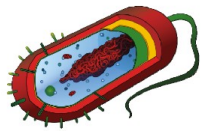
dráždivost

rozmnožování

pohyb



Velikost ?



Zkuste seřadit následující struktury podle velikosti - řešení

ribozom 20 nm

Adenovirus 80 nm

Streptokok 0,6 μm

jádro buňky 5 μm

erytrocyt 7,4 μm

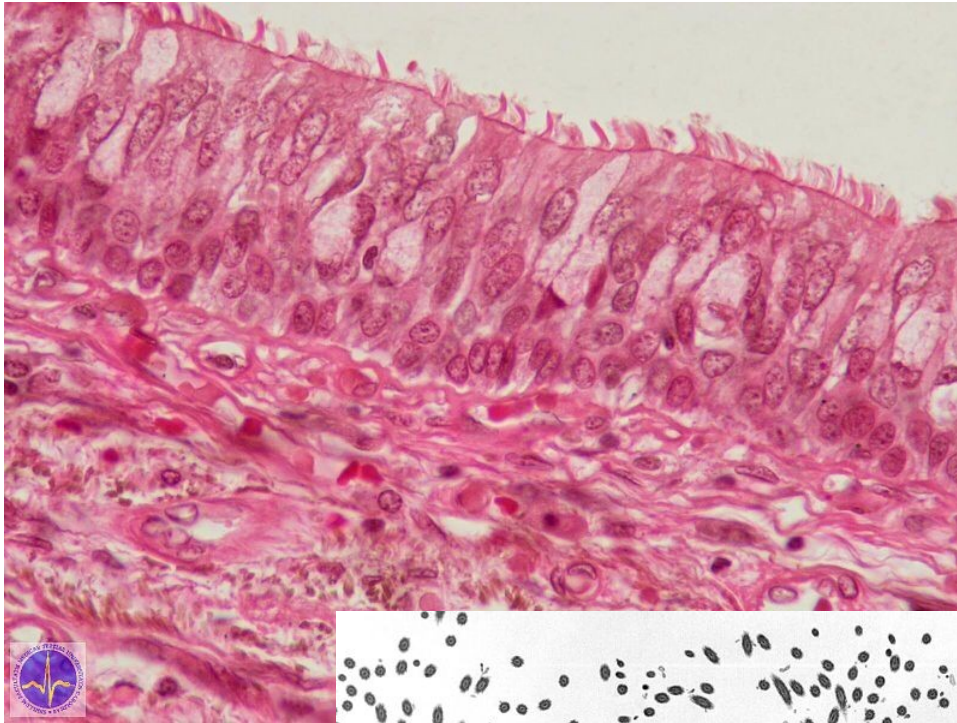
hepatocyt 30 μm

vlas (průměr) 80 μm

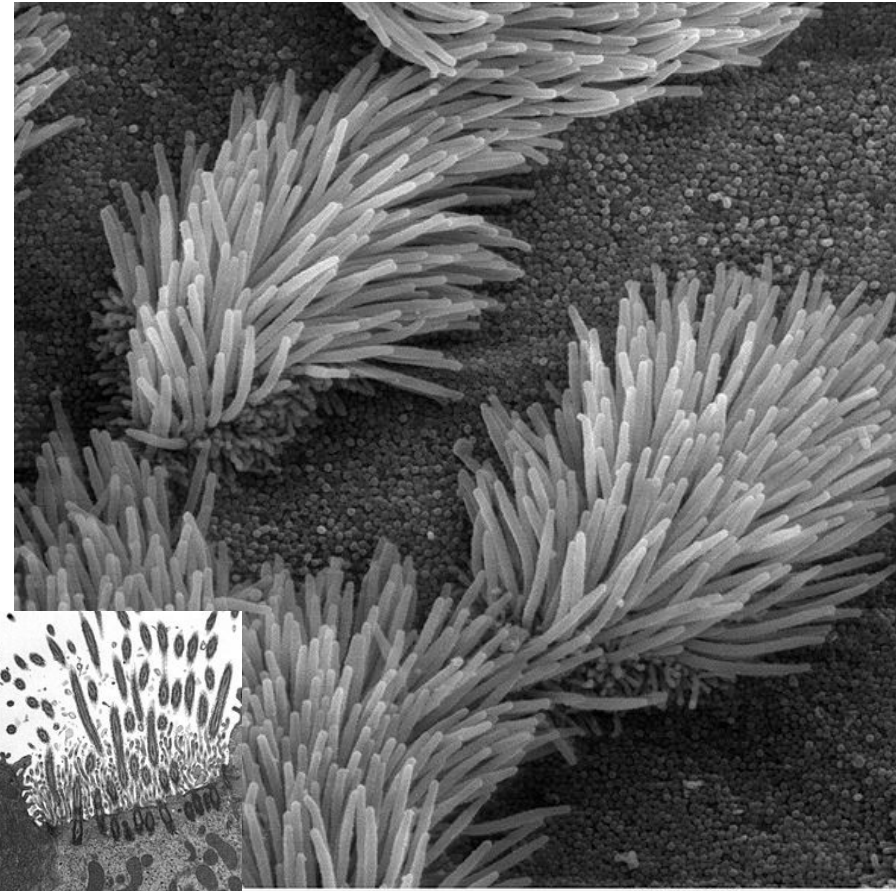
oocyt 120 μm

střevní klk 1 mm

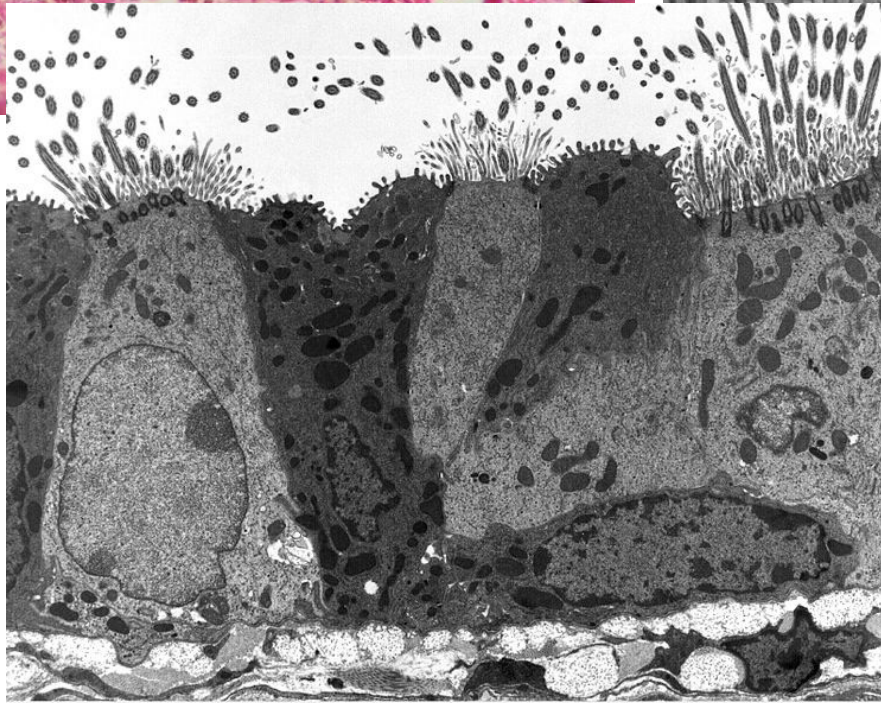
Mikroskopie



SM



SEM



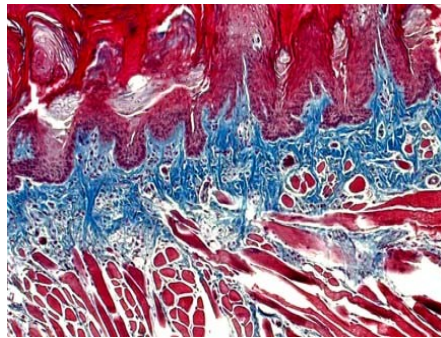
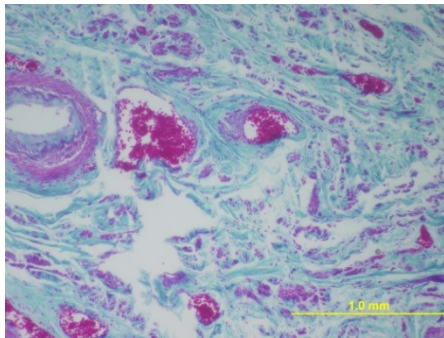
TEM

Trachea – víceřadý epitel s řasinkami

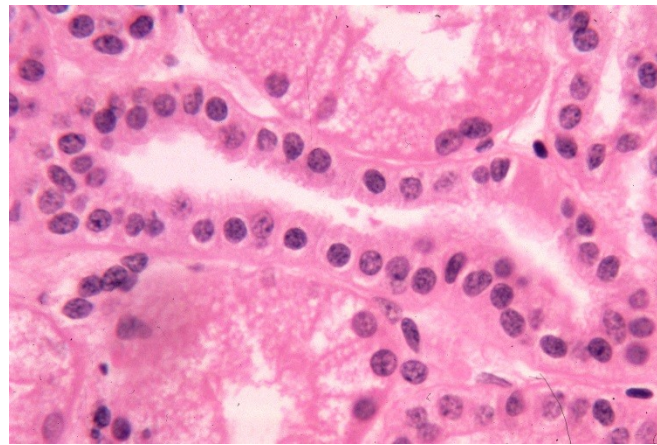
Barvicí metody:

přehledné – HE, AZAN

demonstrují všechny složky tkání

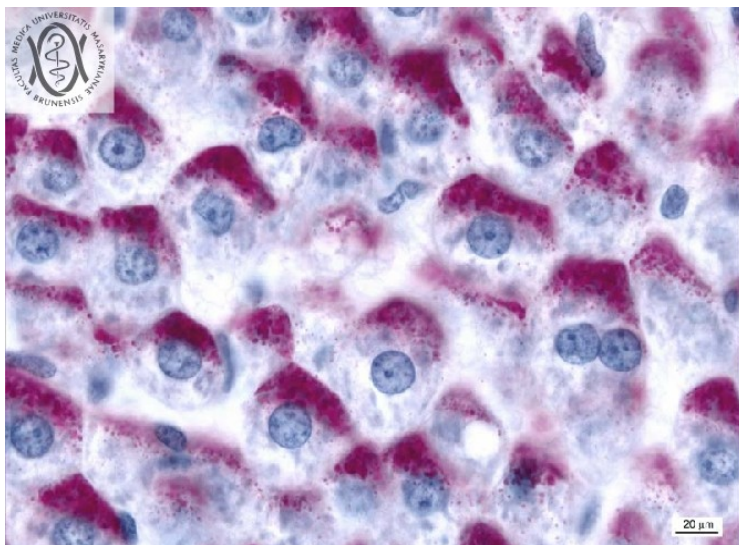


HE – nejpoužívanější barvení

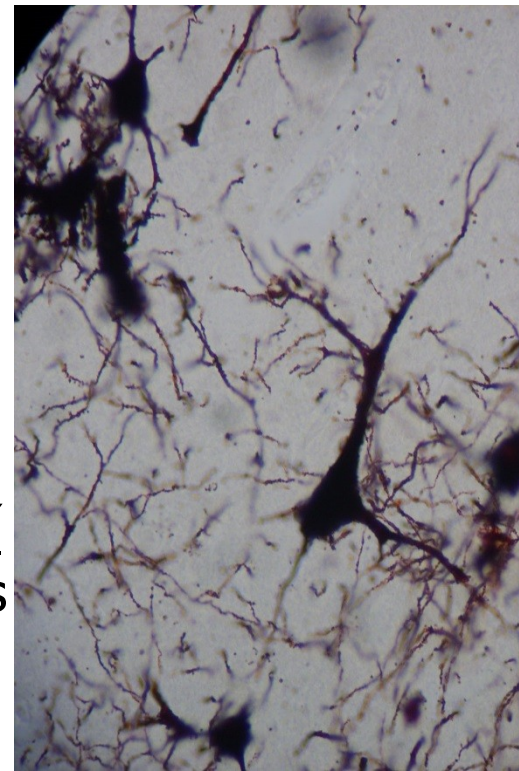


speciální

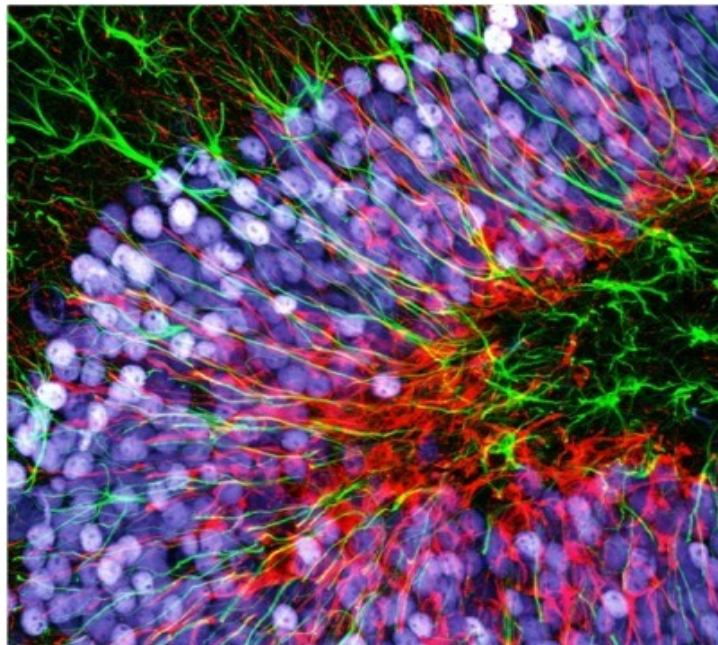
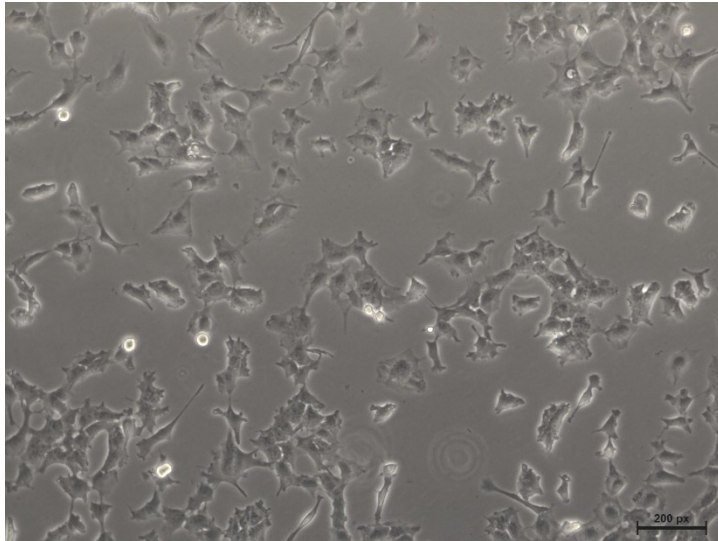
zdůrazňují určité buněčné nebo tkáňové složky



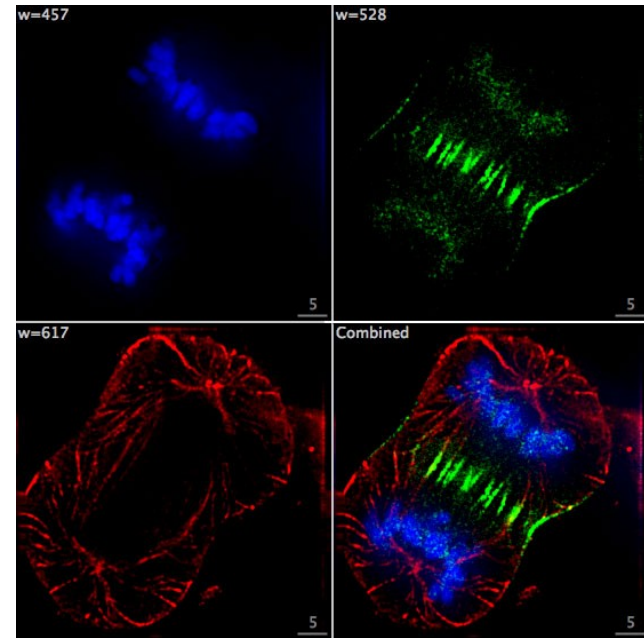
impregnační
soli Ag, Au nebo Os



Mikroskop s fázovým kontrastem

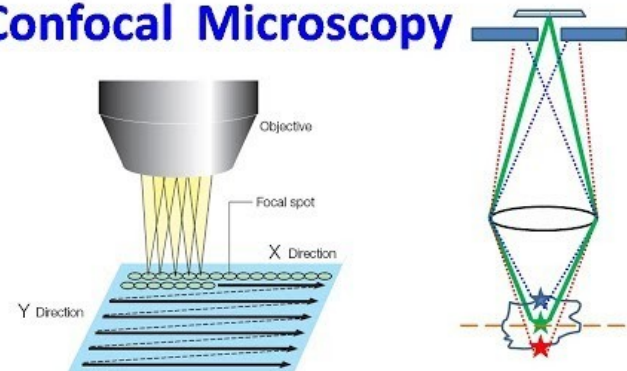


Fluorescenční mikroskop



[CC BY-SA 4.0](https://creativecommons.org/licenses/by-sa/4.0/)

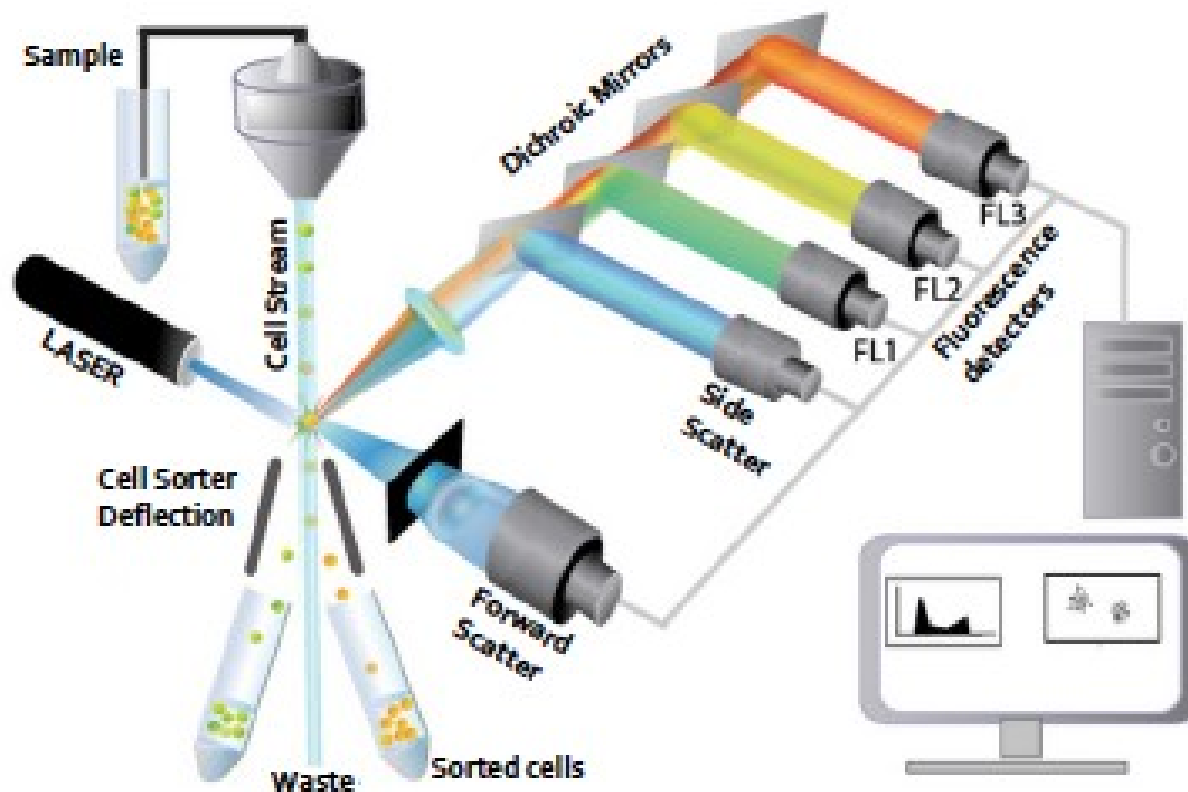
Confocal Microscopy



Průtoková cytometrie

Analýza fenotypu jednotlivých buněk – možné využití i pro jejich třídění

Hematologická laboratoř – DBOK



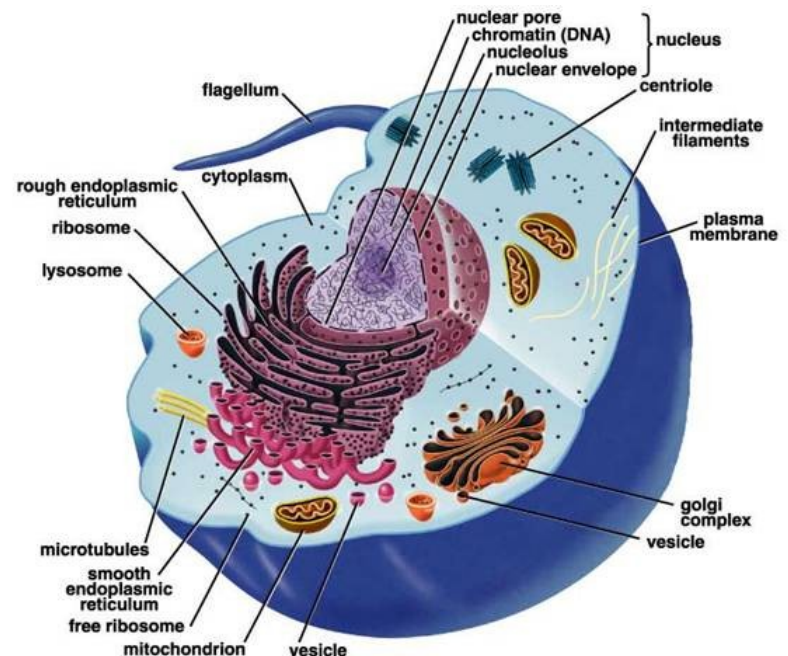
Organizace v buňce - kompartmentalizace

Izolace specifických prostředí
Selektivní přenos látek, energie a informací

jádro

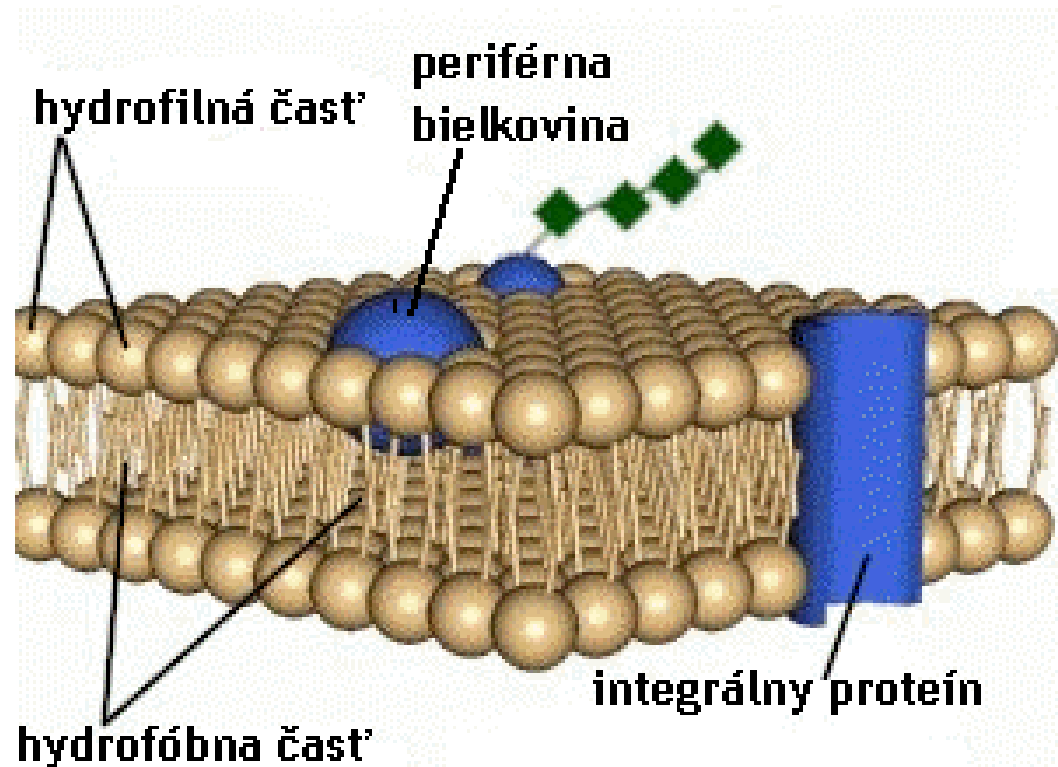
cytoplazma

cytosol včetně cytoskeletu
organely
inkluze



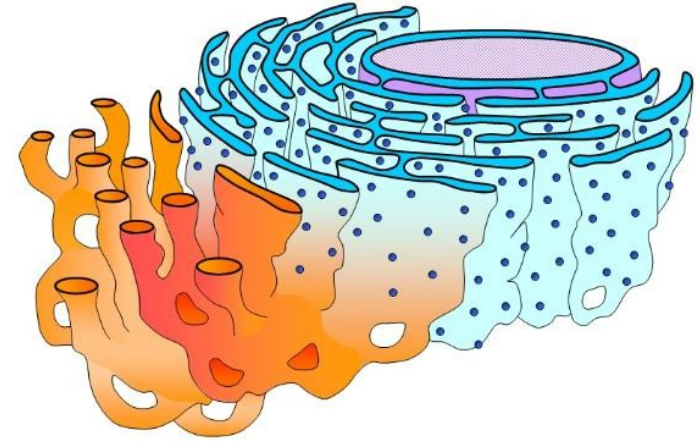
Stavba biomembrány

- semipermeabilní a fluidní
- tloušťka 7 – 10 nm
- dvě vrstvy fosfolipidů
- povrchové a prostupující proteiny



Membránové struktury v buňce

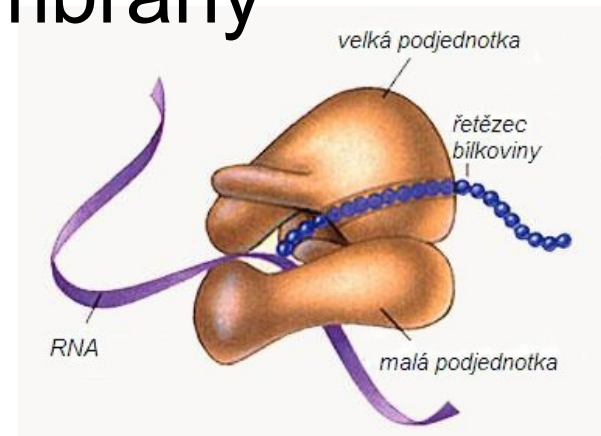
- Cytoplazmatická membrána
- Jaderný obal
- Endoplazmatické retikulum
- Golgiho aparát
- Mitochondrie
- lysozomy, endozomy, peroxizomy



http://cronodon.com/BioTech/Cell_structure.html

Struktury bez membrány

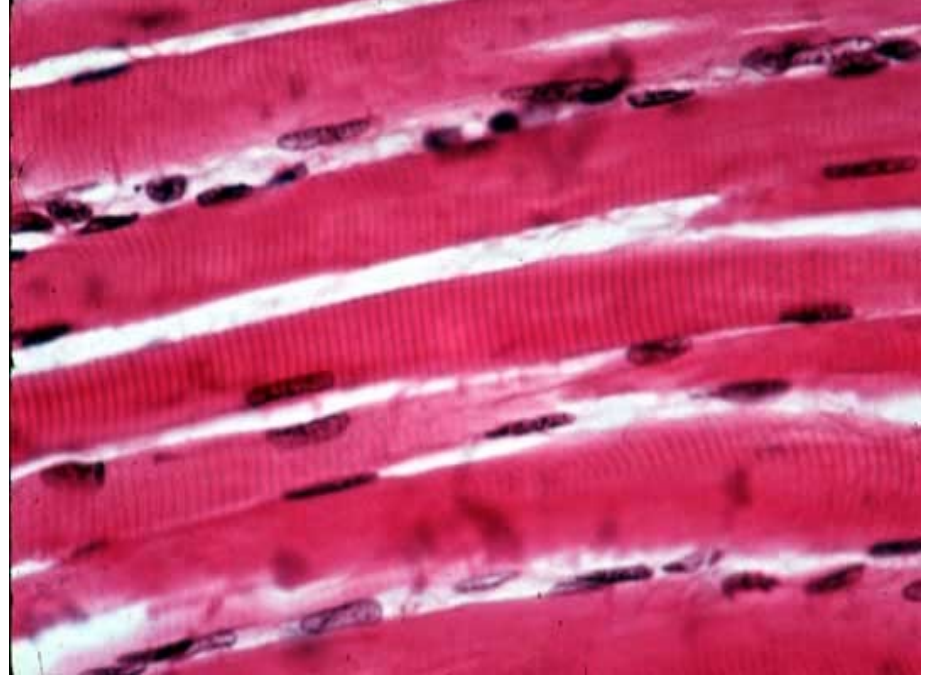
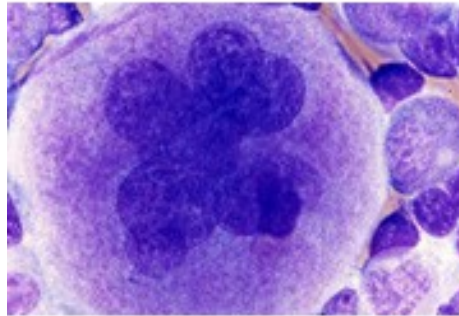
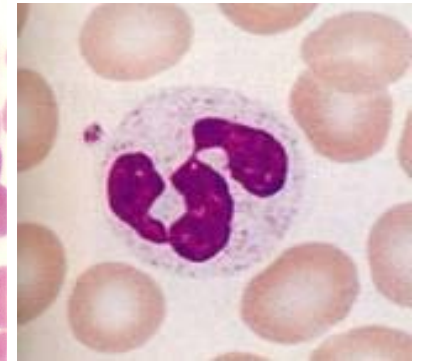
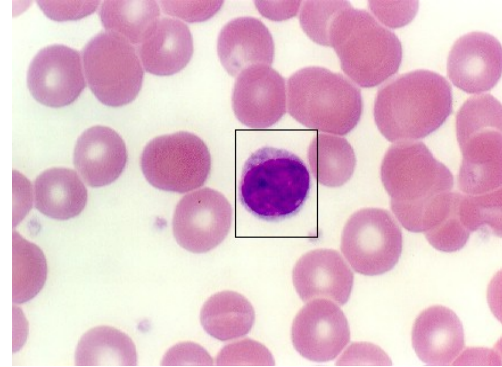
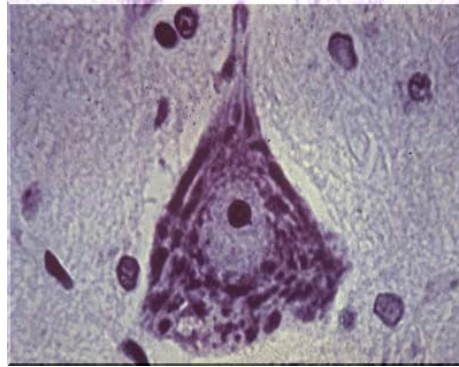
- Ribozomy
- Cytoskelet
 - Centriol
- Inkluze



<http://www.sszdra-karvina.cz/bunka/bi/02pro/obr/ribozom.jpg>

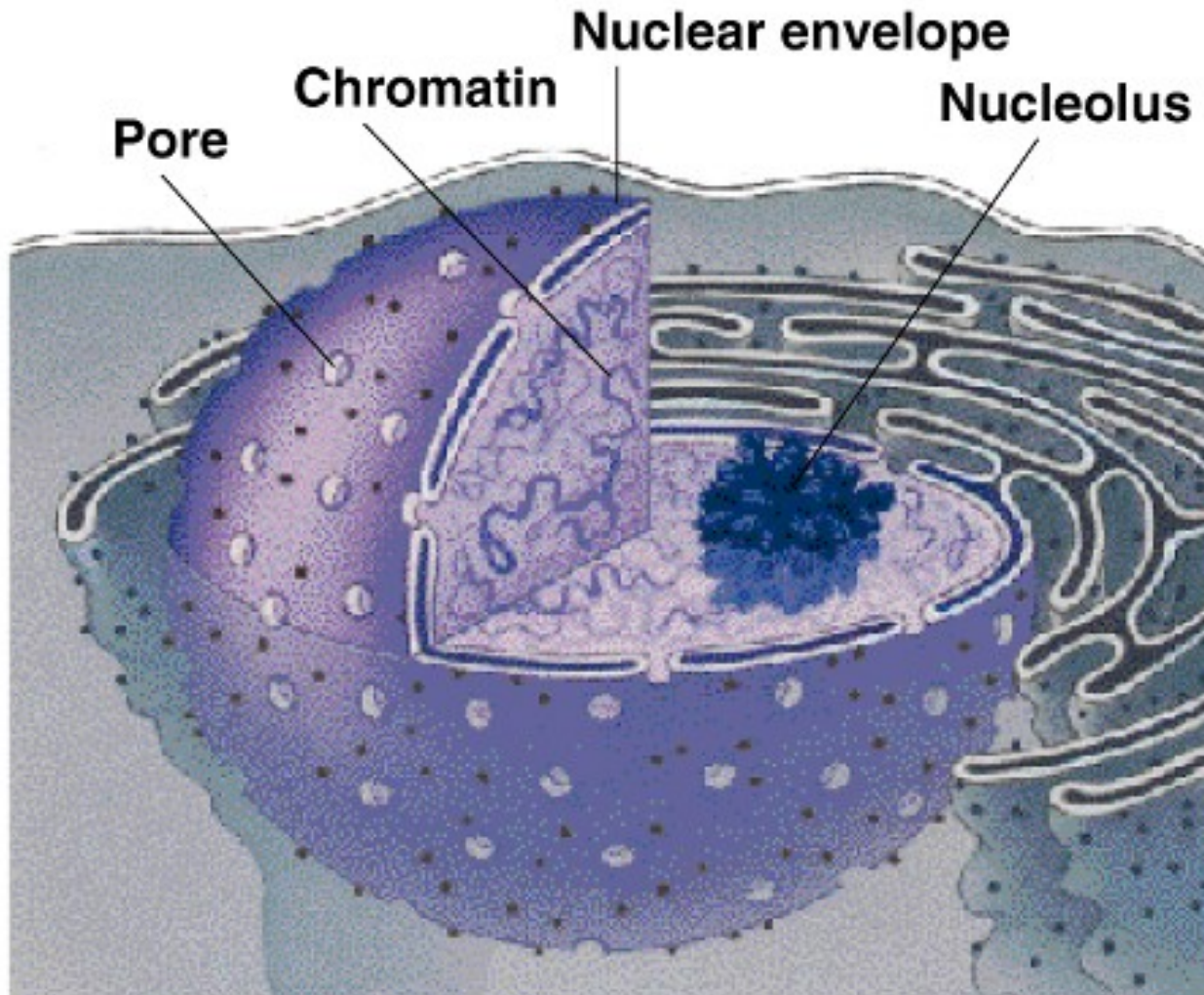
Jádro (nucleus)

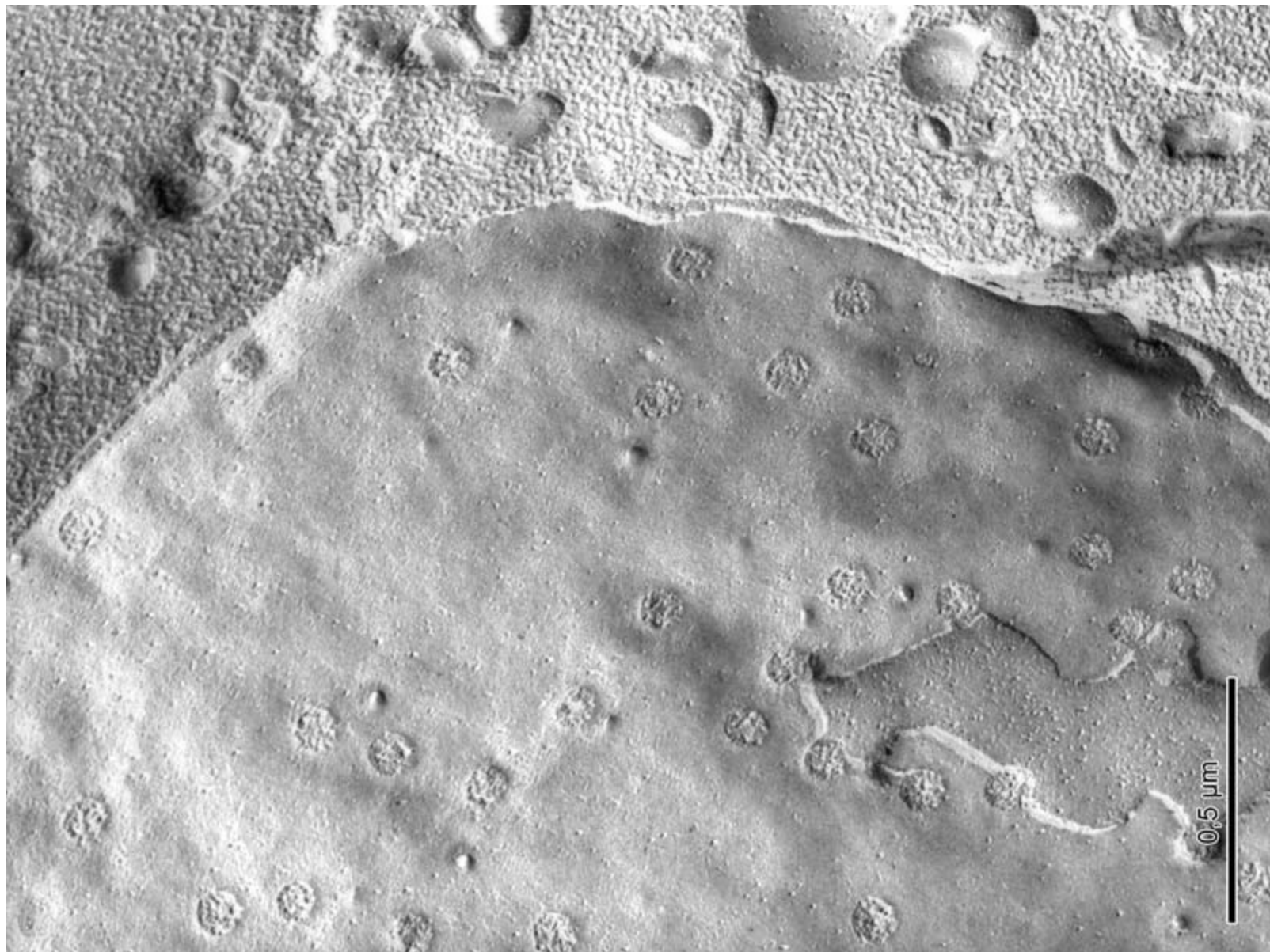
- Počet
- Velikost
- Tvar
- Stavba
- Funkce



Jaderný obal

dvojitá biomembrána s
póry
perisinusoidální
prostor

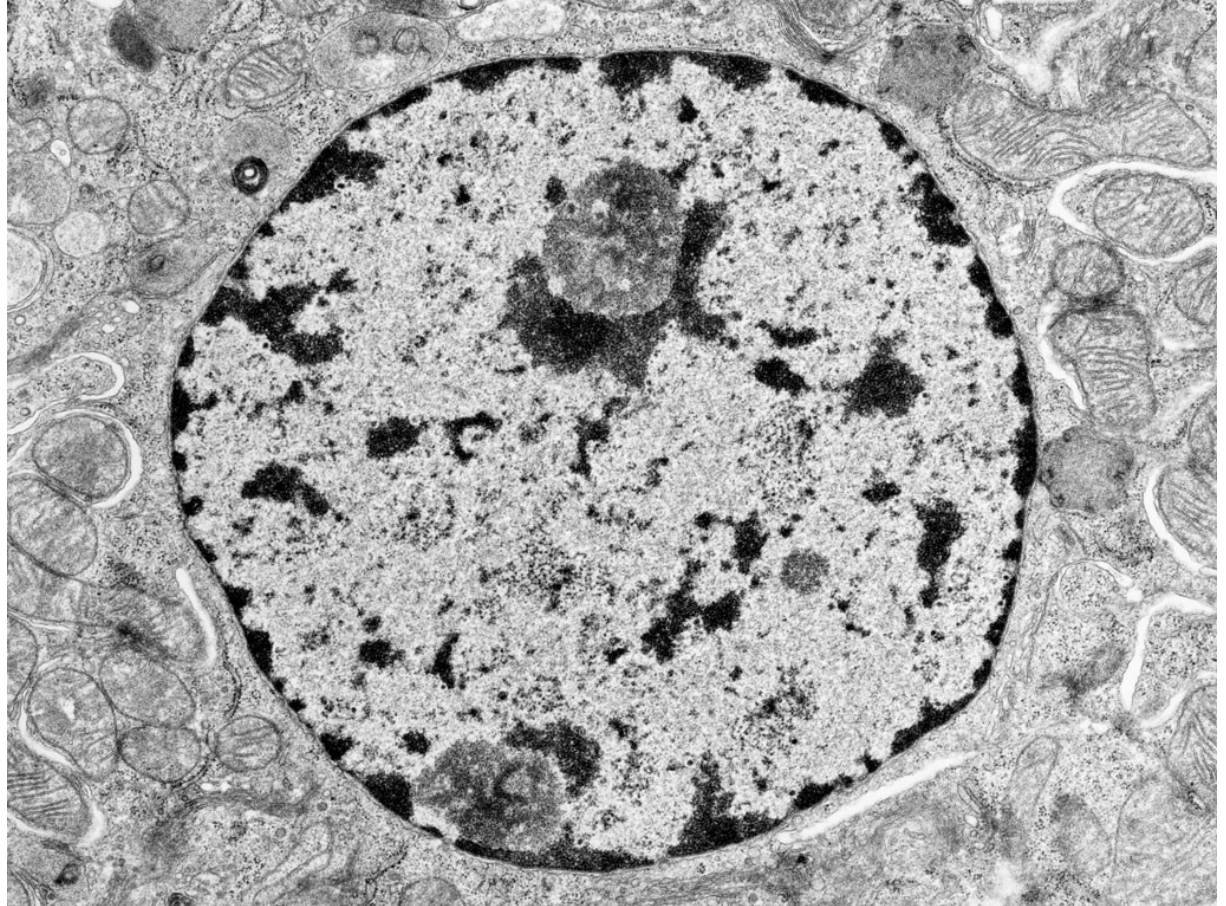




Chromatin (interfáze)

- **Heterochromatin**
- **Euchromatin**

Euchromatin -
spiralizace do
průměru 30 nm
(svinuté nukleosomy)



Chromatin (M-fáze)

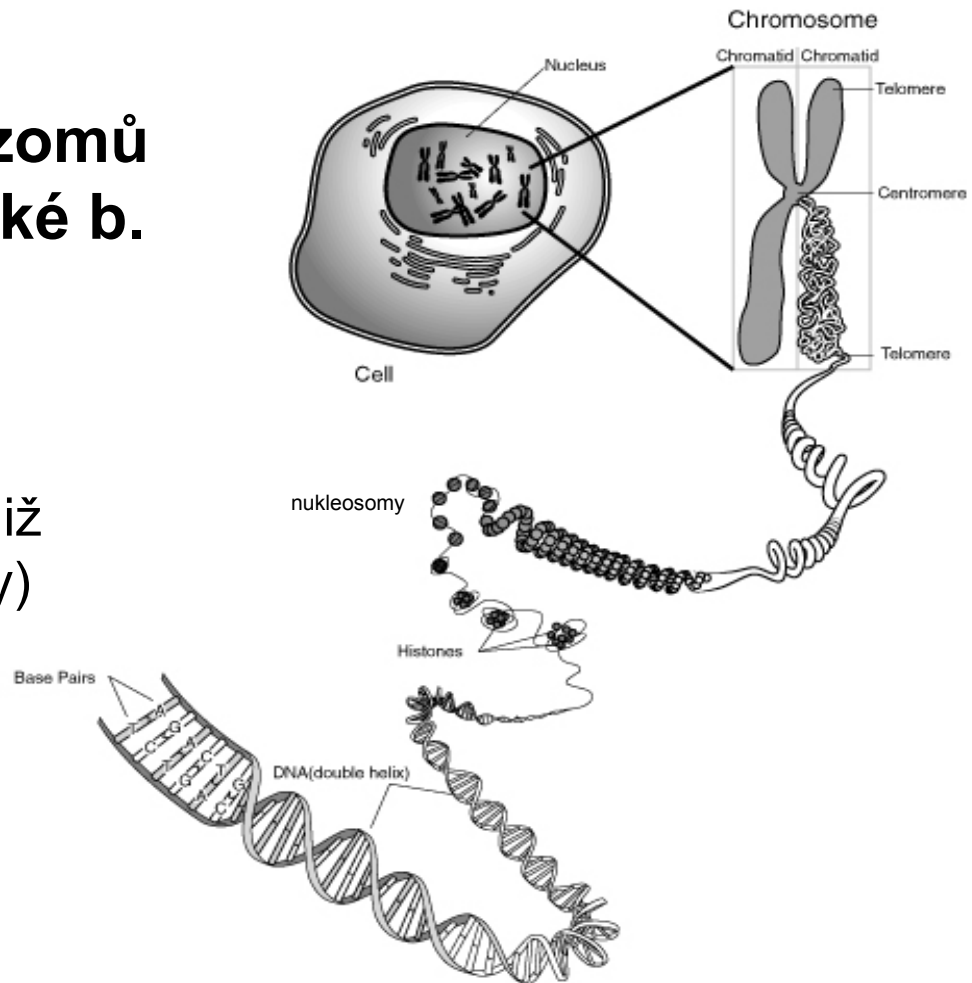
viditelná kondenzovaná vlákna DNA (chromozomy) během mitózy

**Diploidní sada chromozomů
= 2x23 v každé somatické b.**

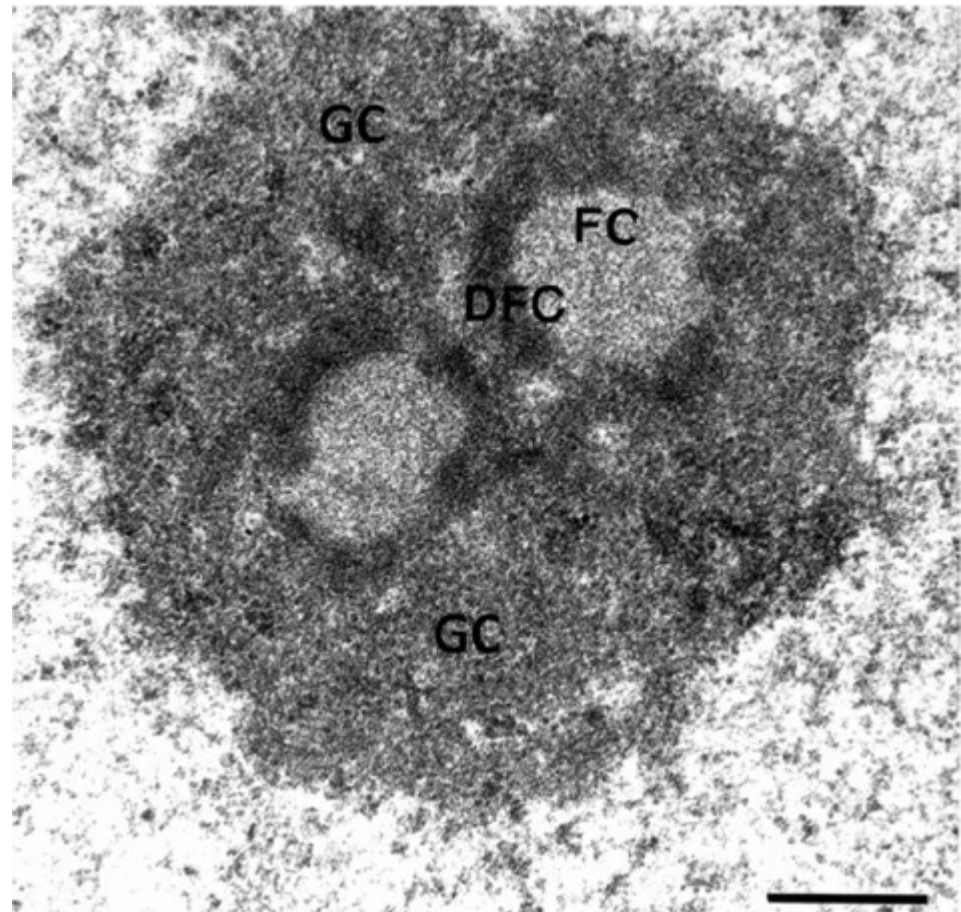
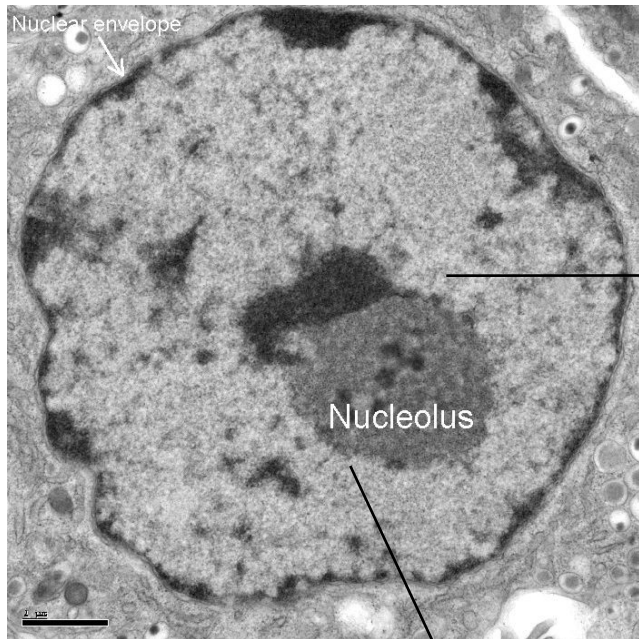
♀ 44 + XX

♂ 44 + XY

V mitotickém chromosomu je již replikovaná DNA (2 chromaidy)

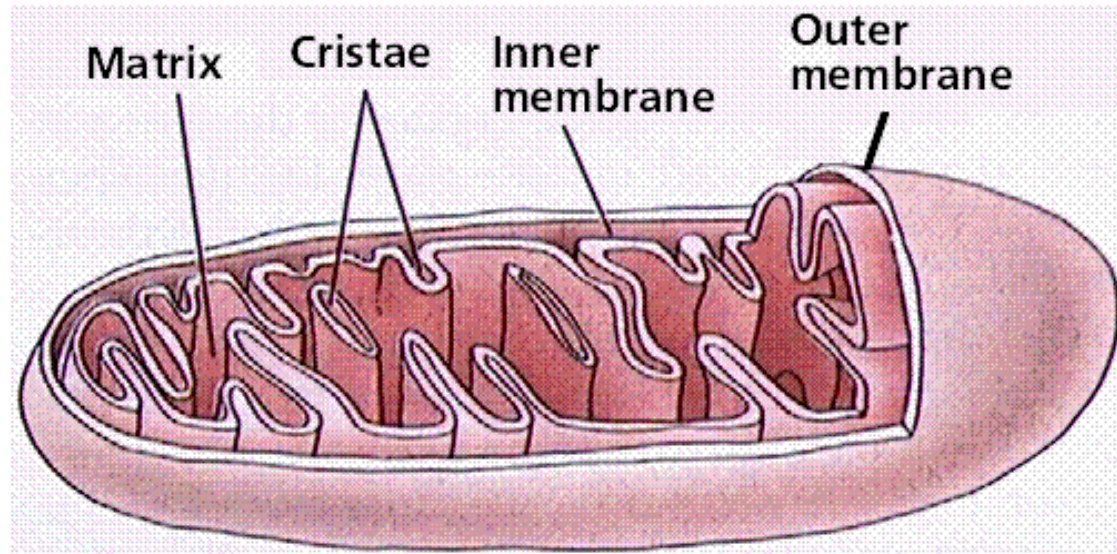


Jadérko (nucleolus)



Mitochondrie

- Semiautonomní organela
- Velikost
- Stavba
- Počet



<http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookCELL2.html>

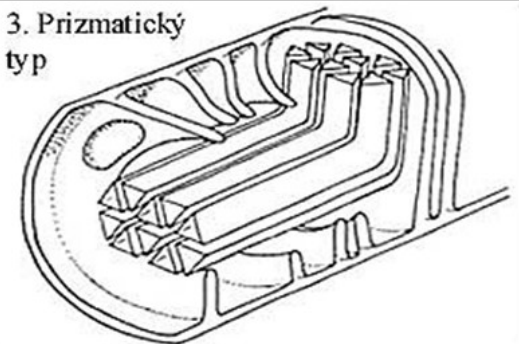
1. Kristový typ



2. Tubulární typ

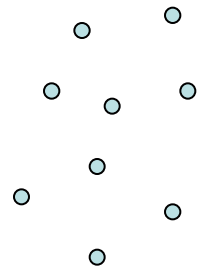


3. Prizmatický typ

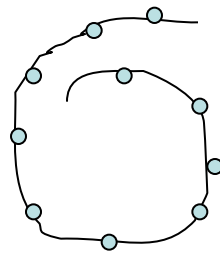


Ribosomy

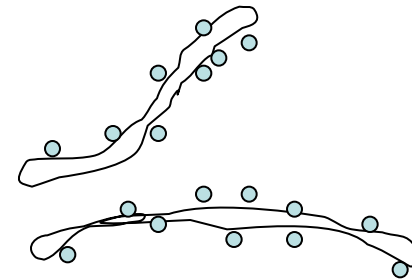
- Složení
- Velikost



volné
ribosomy

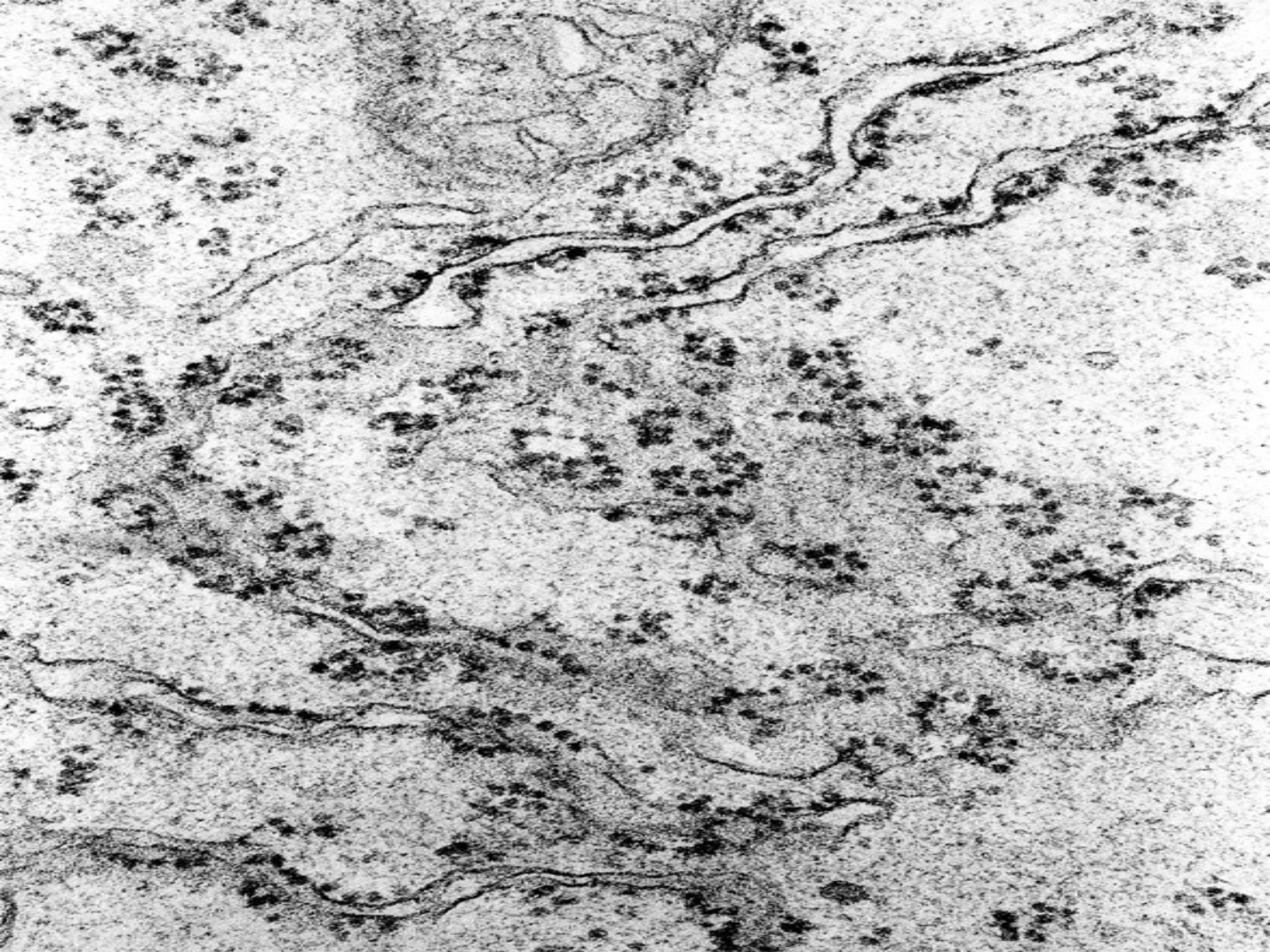


polyribosomy



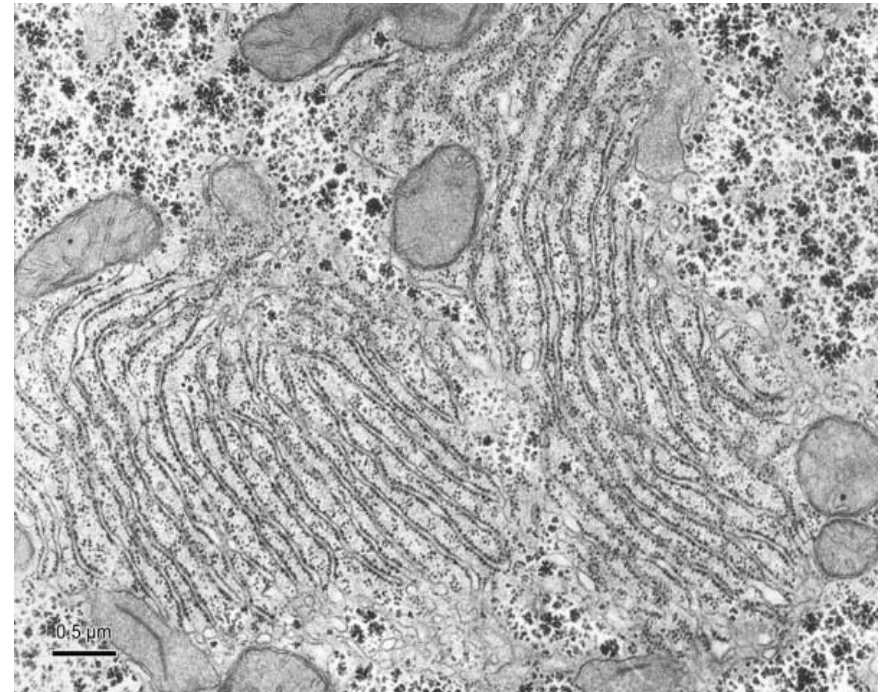
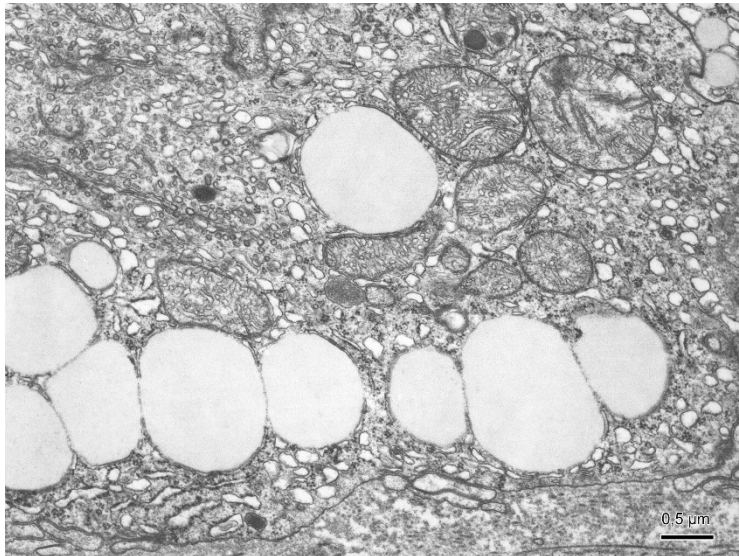
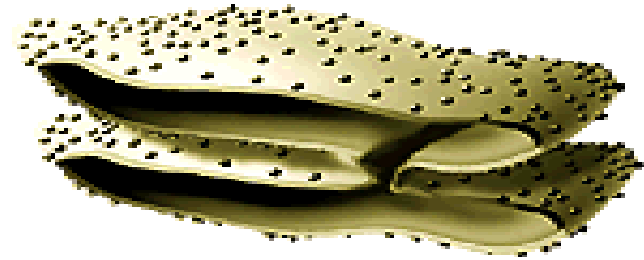
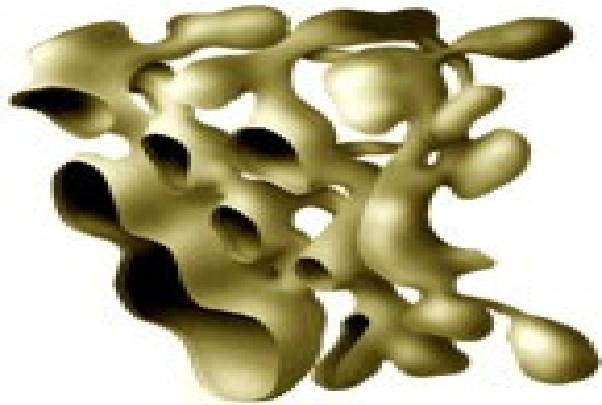
ribosomy na
endoplazmatickém
retikulu

Proteosyntéza „pro buňku“ a „na export“ (*např. žlázné bb.*)



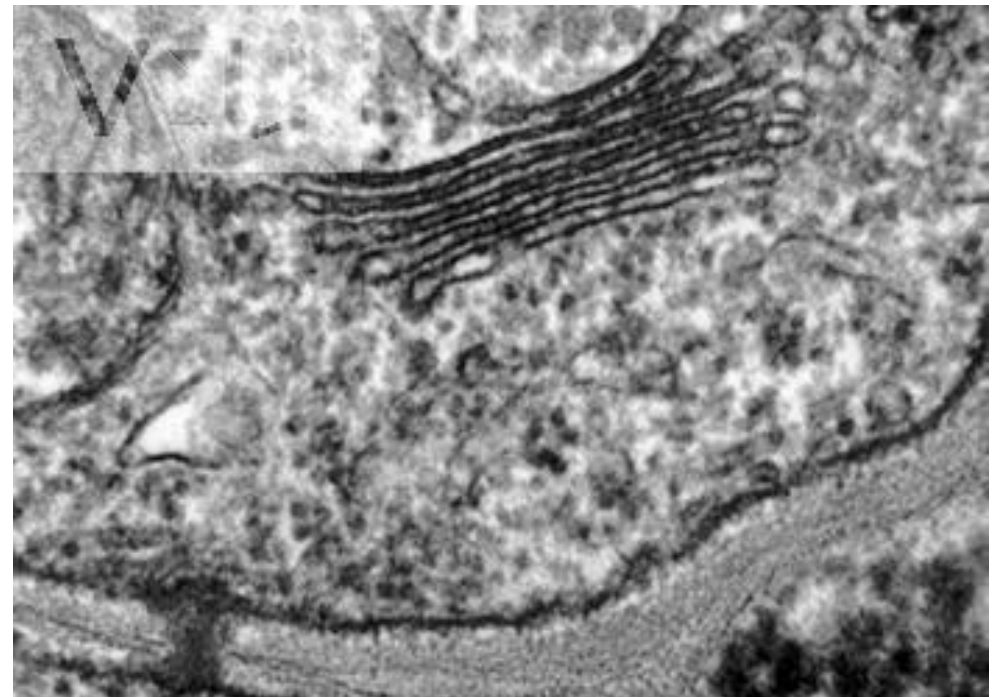
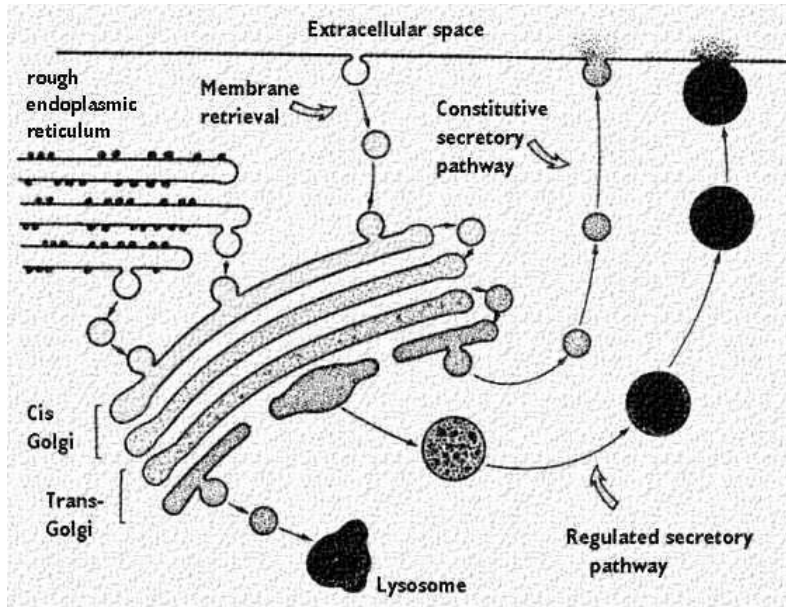
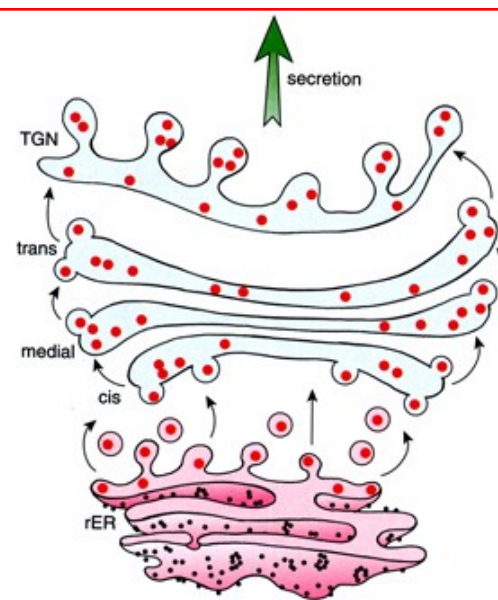
Endoplazmatické retikulum

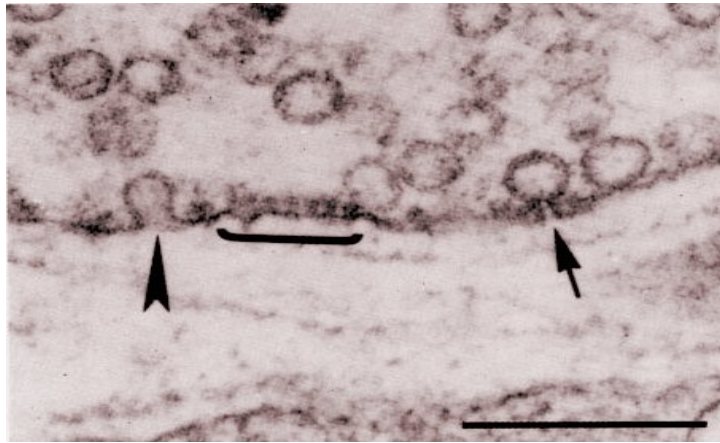
- Zrnité (granulární) ER – GER
- Hladké (agranulární) ER – AER



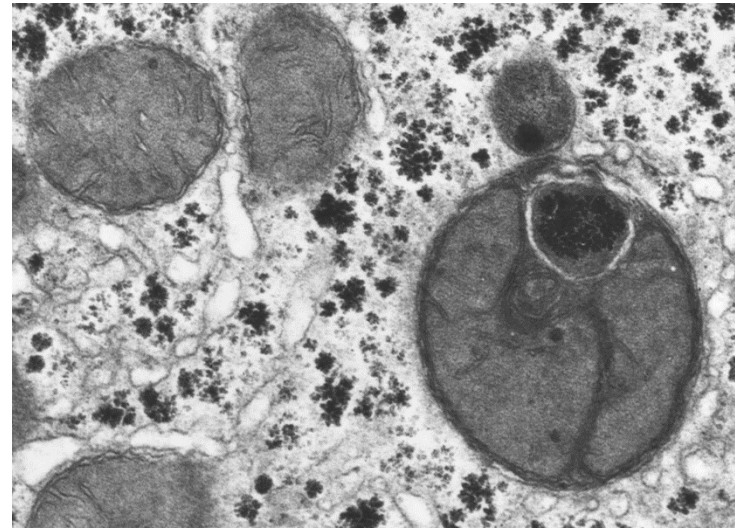
Golgiho aparát

- Struktura
- Funkce

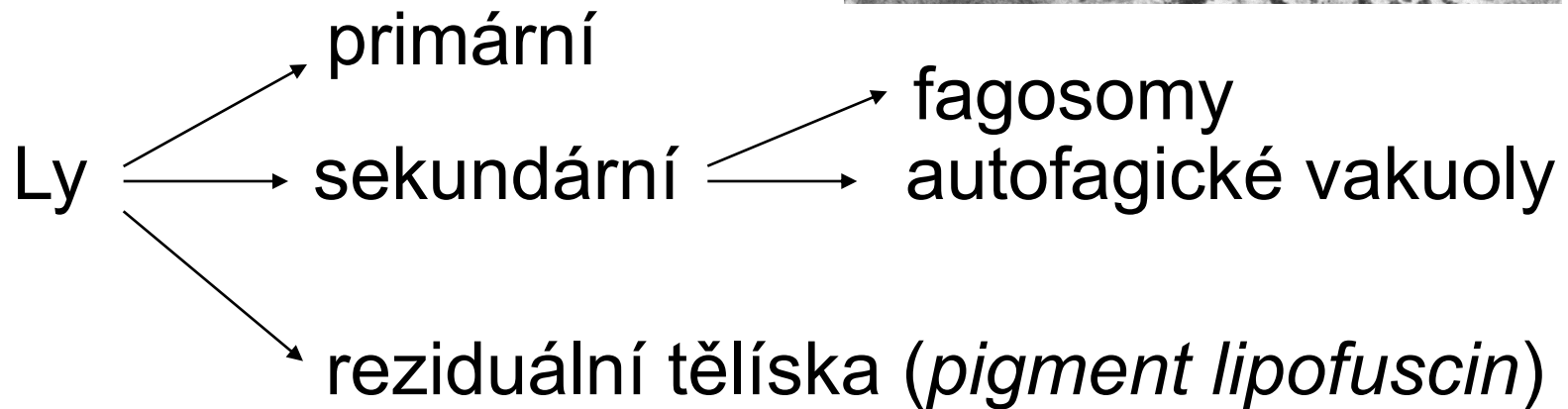




Endosomy

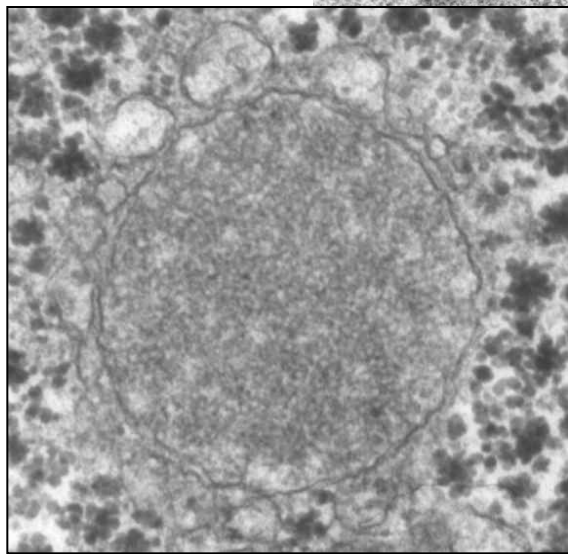
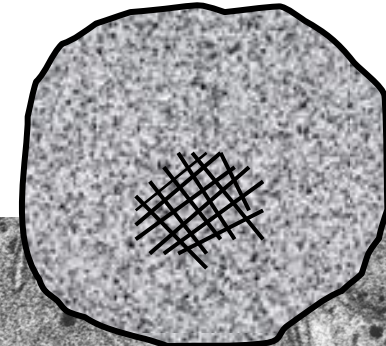
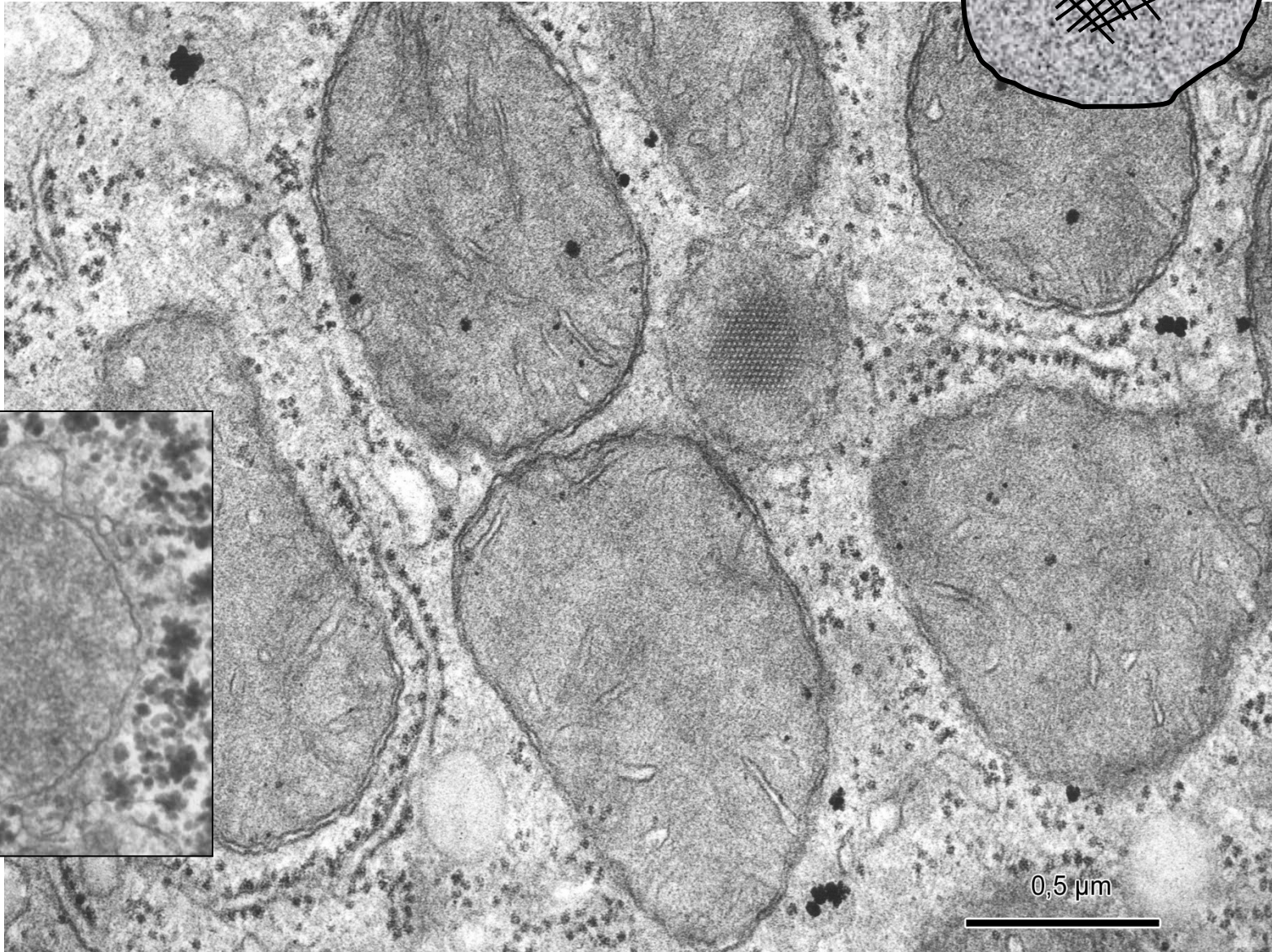


Lyzosomy



Peroxisomy (mikrotělíška)

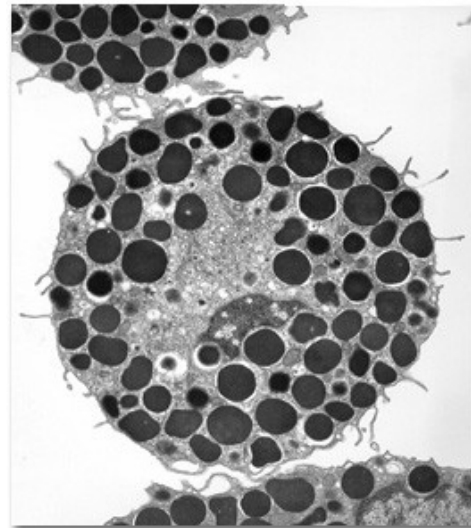
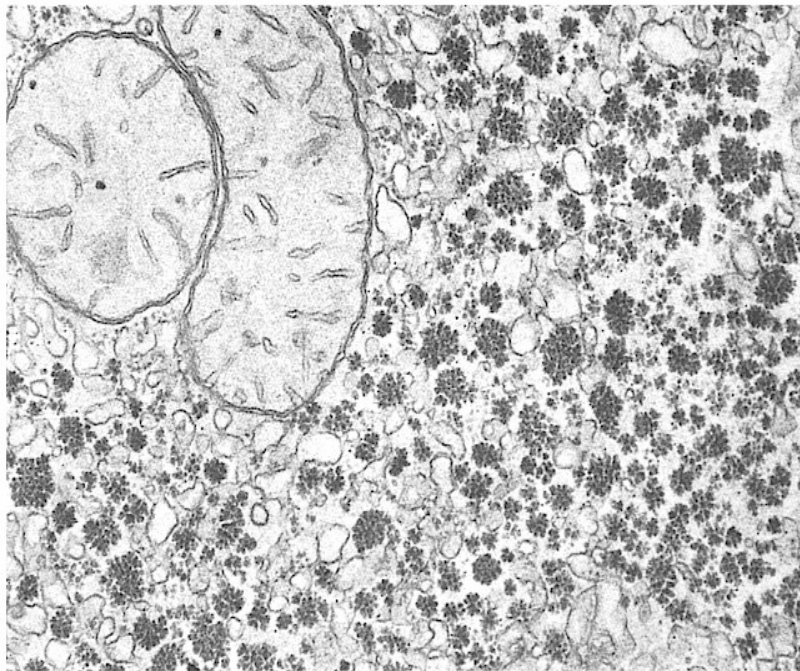
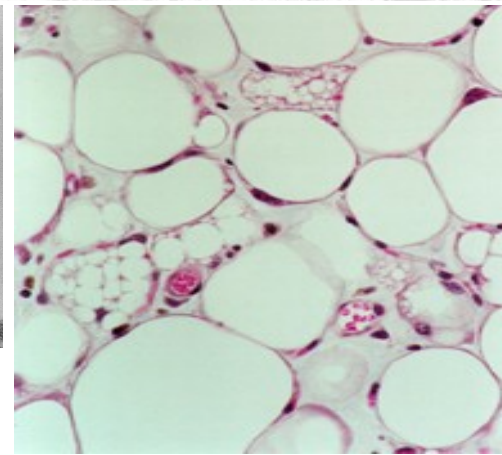
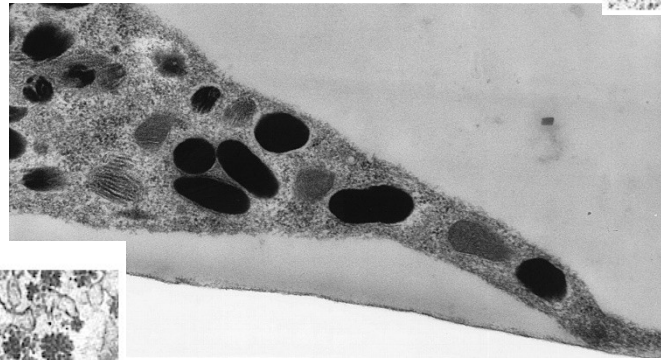
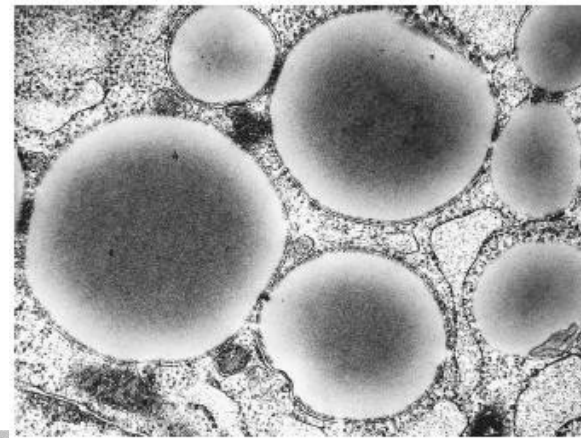
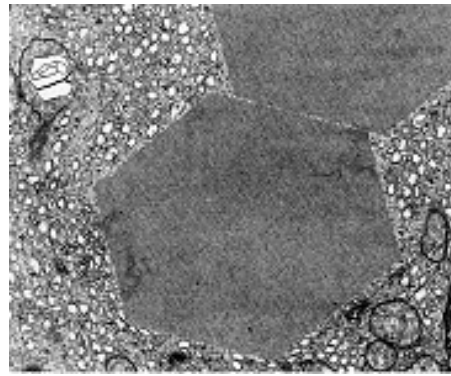
- Stavba
- Výskyt
- Funkce



0,5 μm

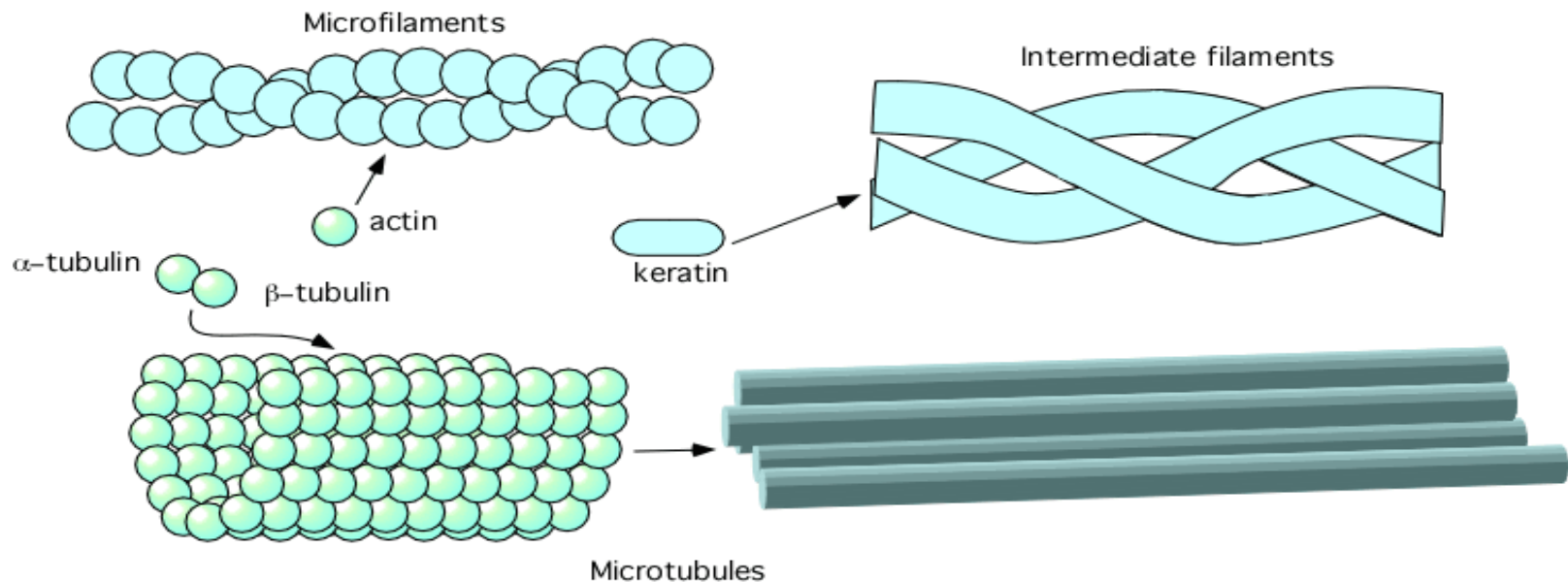
Inkluze

- Sekreční granula
- Zásobní látky
- Krystaly (proteiny)
- Pigmenty
endogenní
exogenní

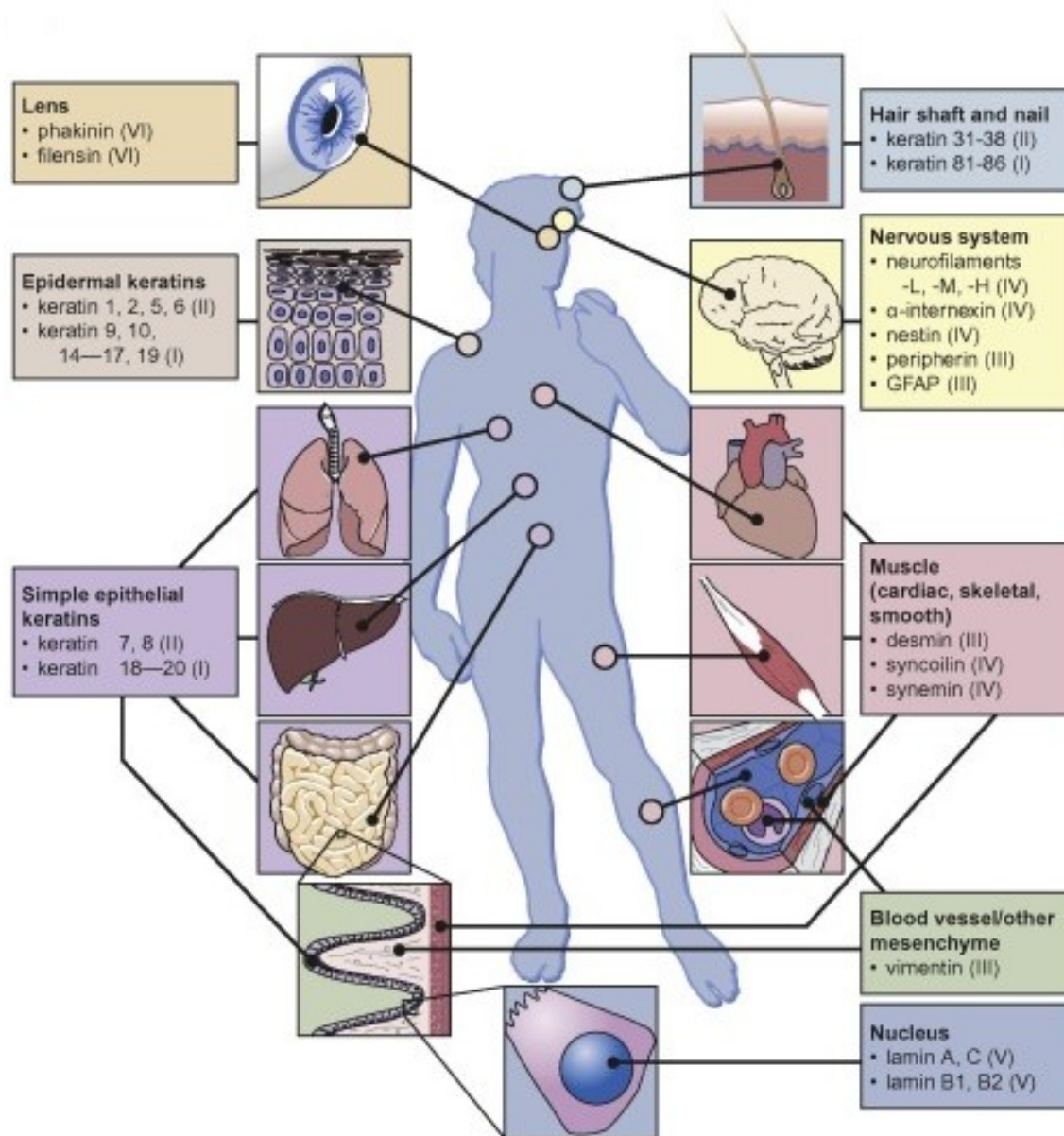


Cytosol (základní cytoplazma) obsahuje cytoskelet

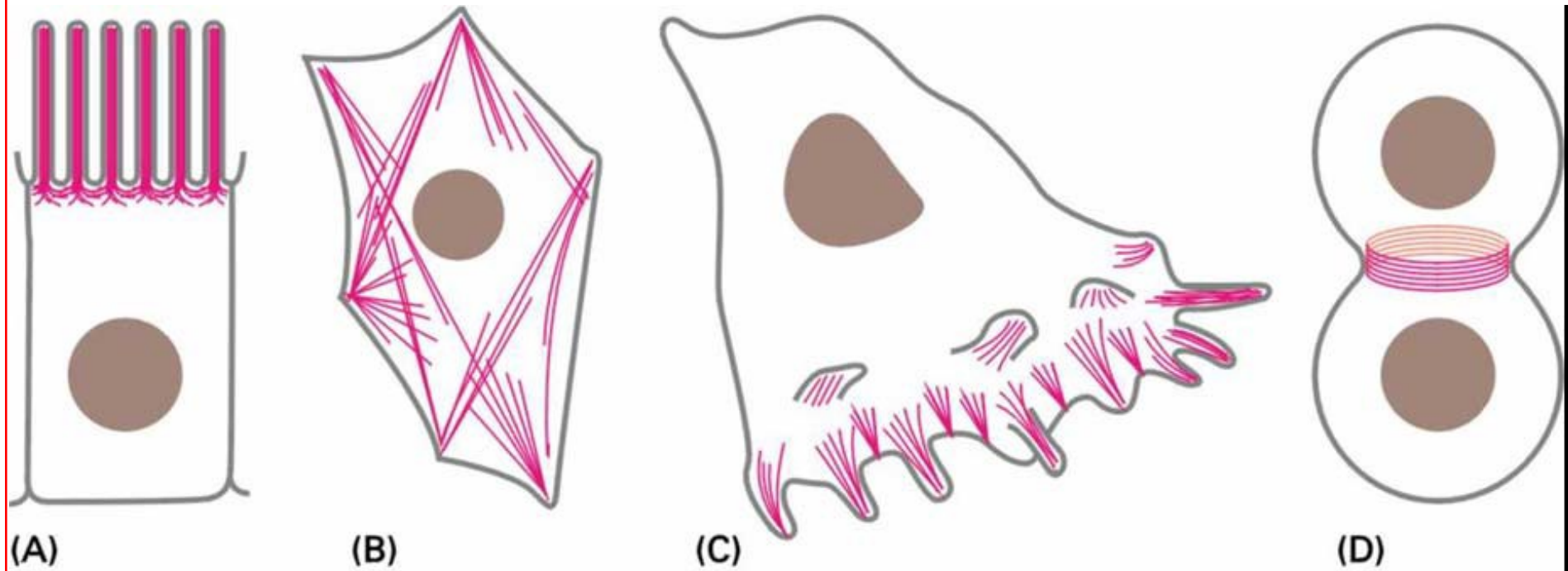
- Mikrotubuly (válce o Ø 22 nm) - α + β tubulin
- Mikrofilamenta (vlákna o Ø 5-7 nm) - aktin
- Intermediární filamenta (vlákna o Ø 8-11 nm) – tkáňově specifická



Detekce intermediárních filament - nástroj pro diagnostiku nádorů



Typy aktinových struktur v živočišných buňkách



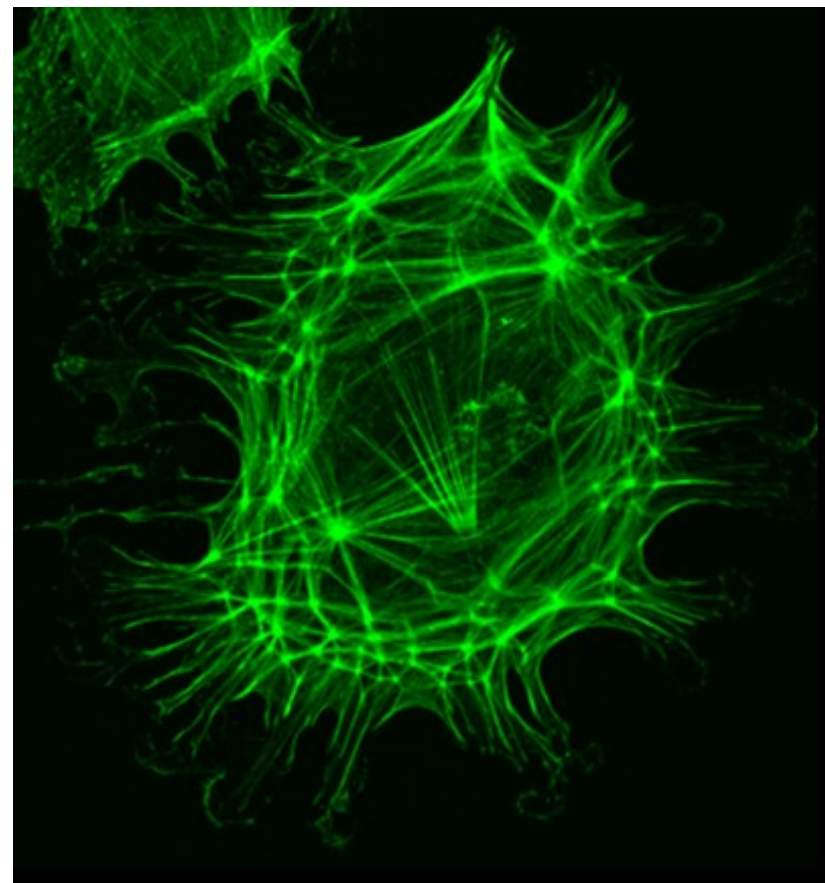
mikroklky

buněčný skelet

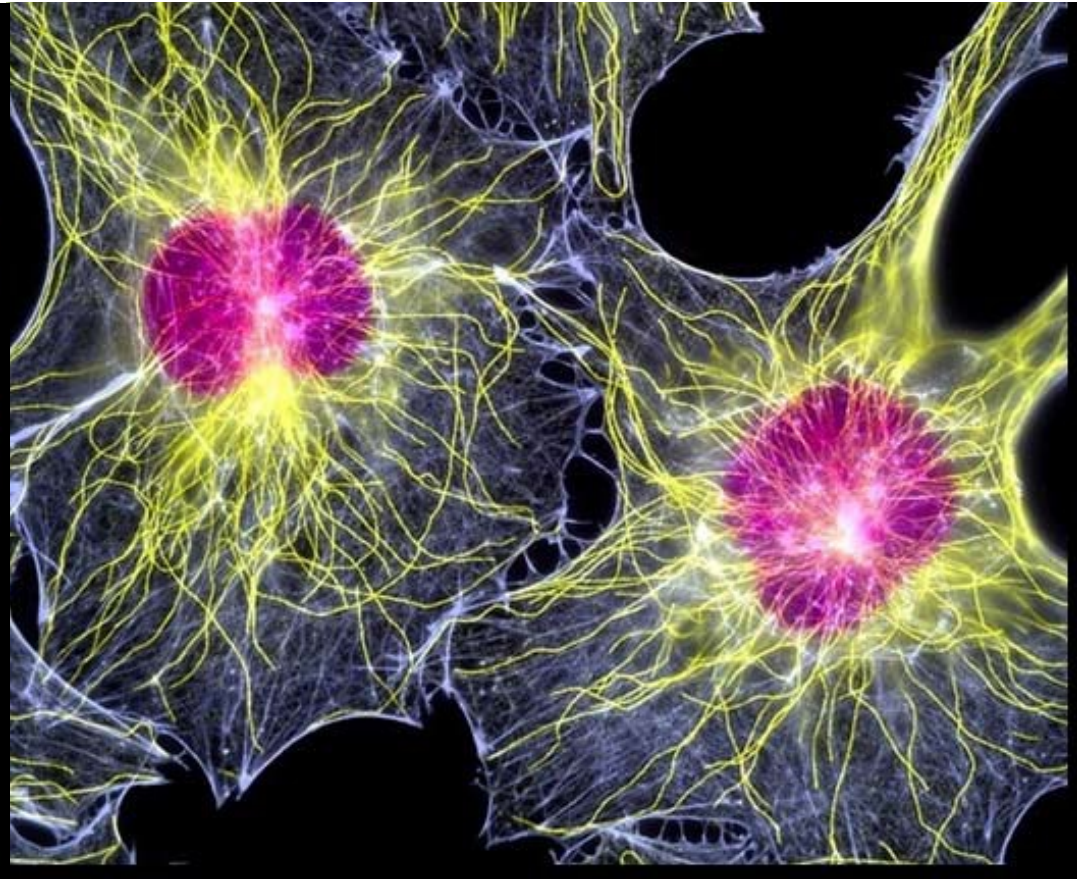
filopodia, lamelipodia

kontraktilní prstenec

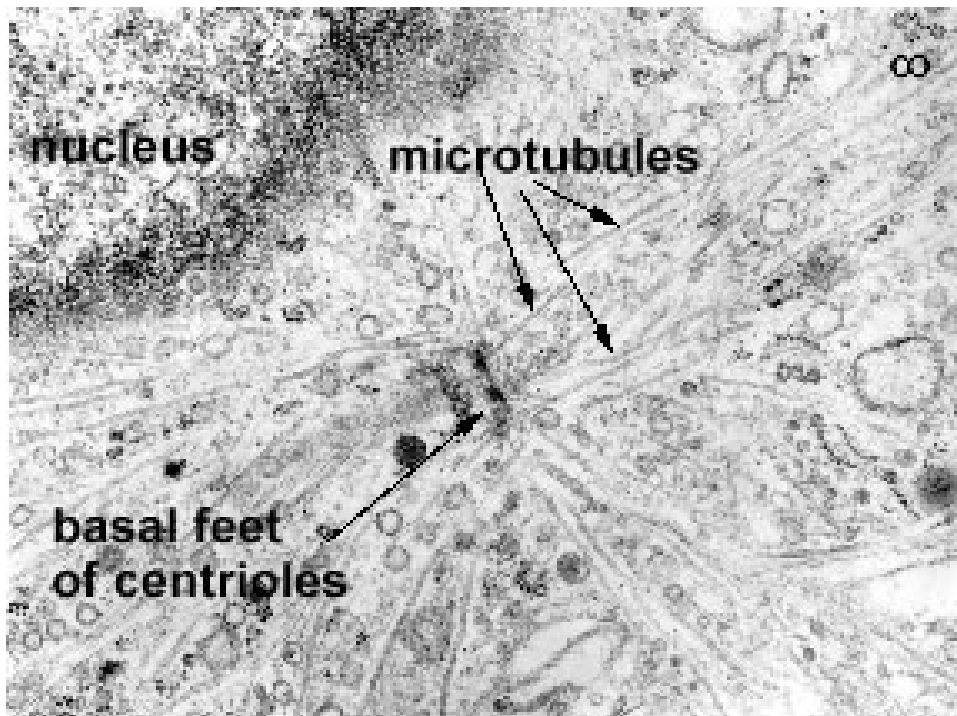
Cytoskelet – imunocytochemický preparát



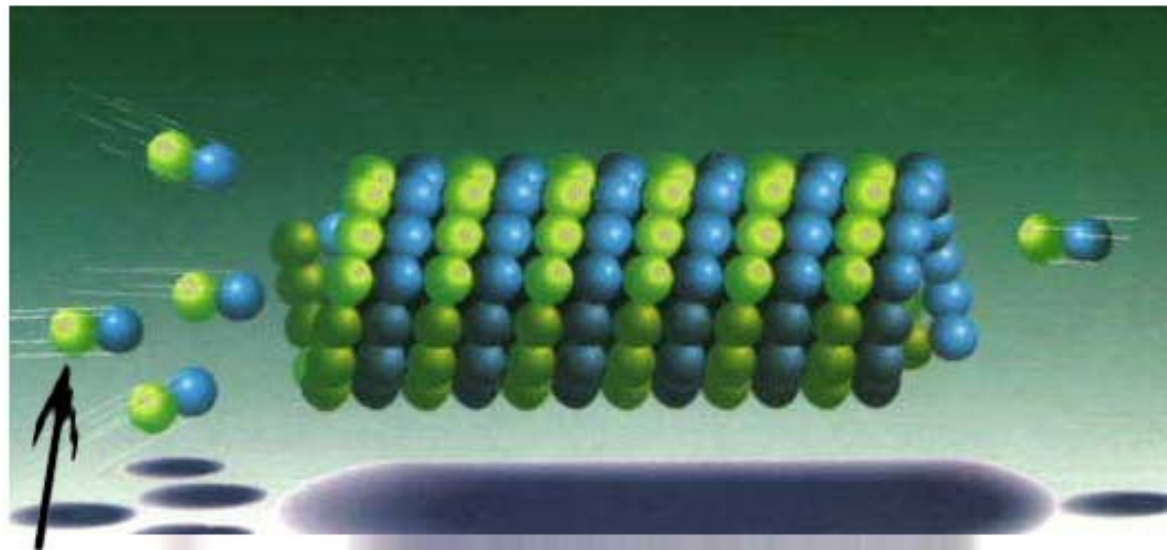
F-aktin



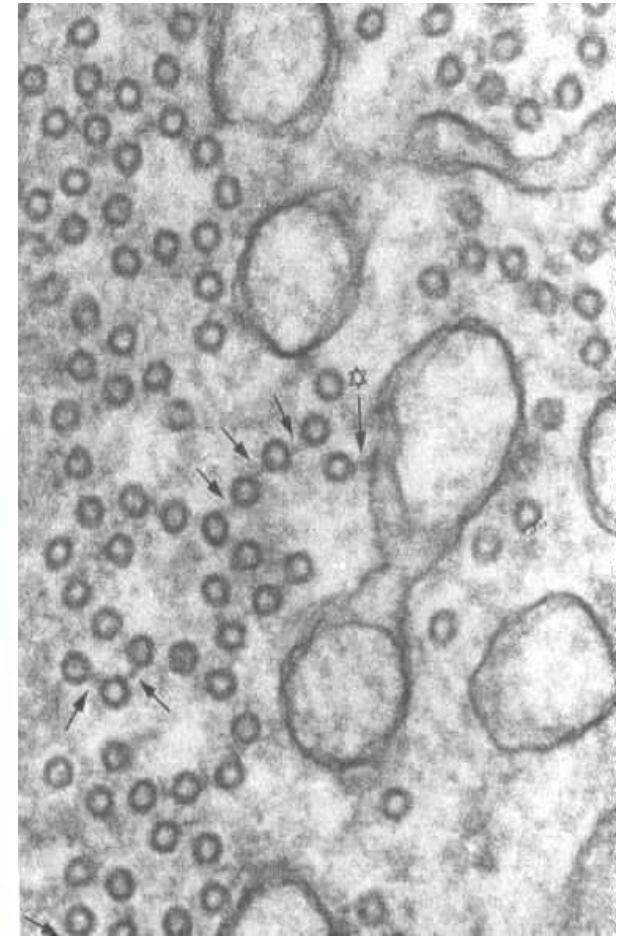
α -tubulin / **F-aktin** / **DNA**



Model ultrastruktury mikrotubulů

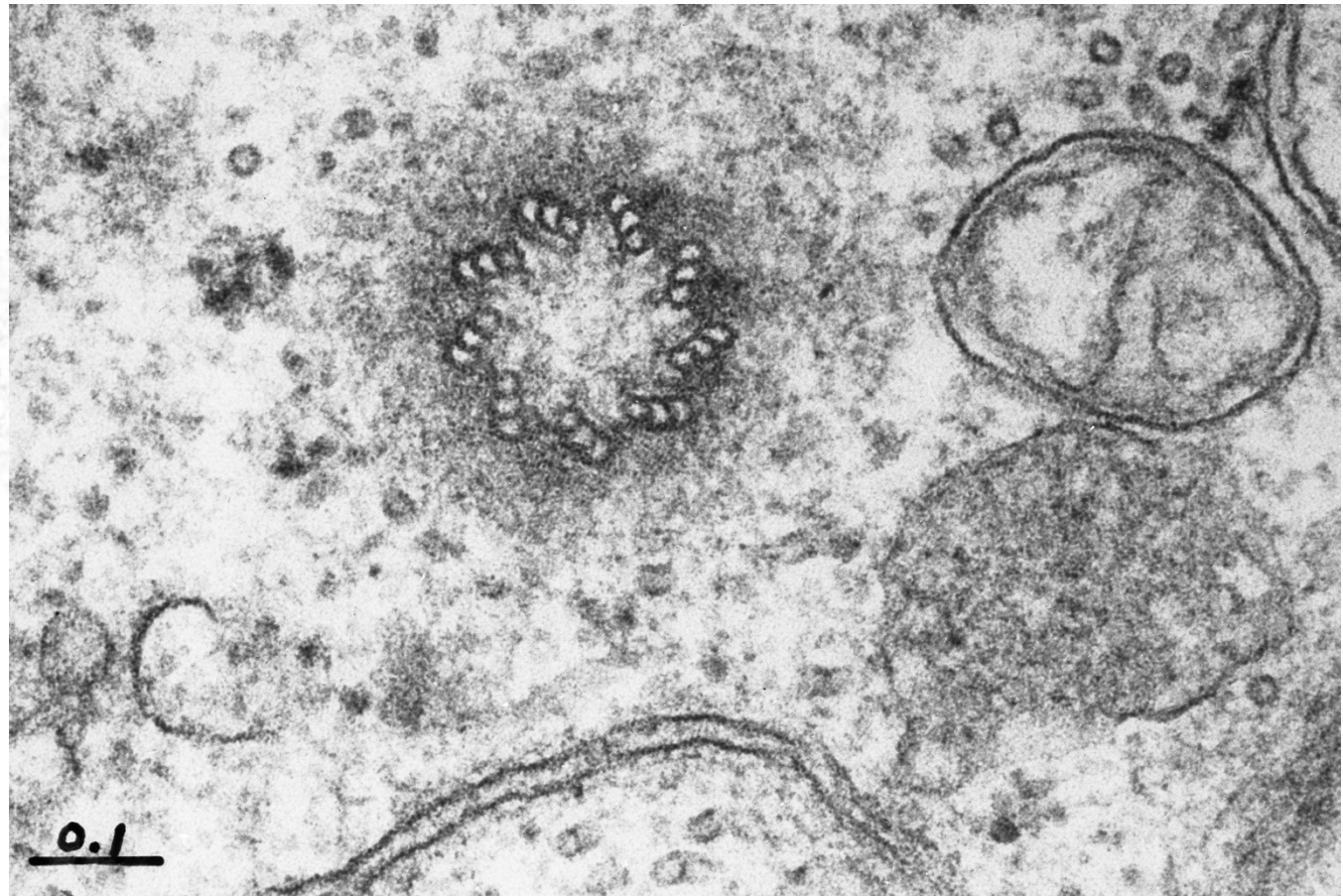
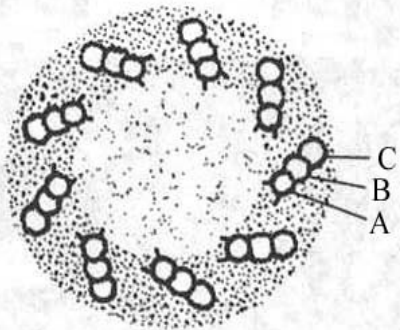
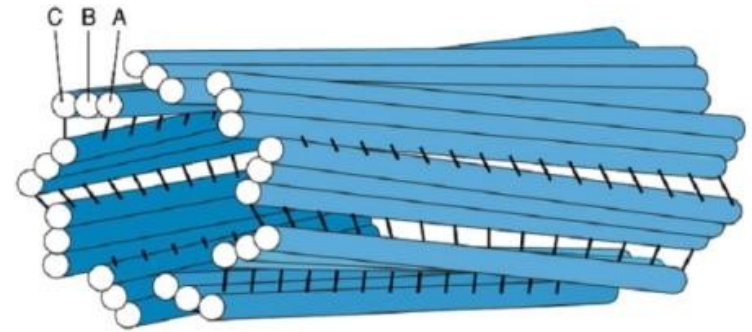


Mikrotubuly

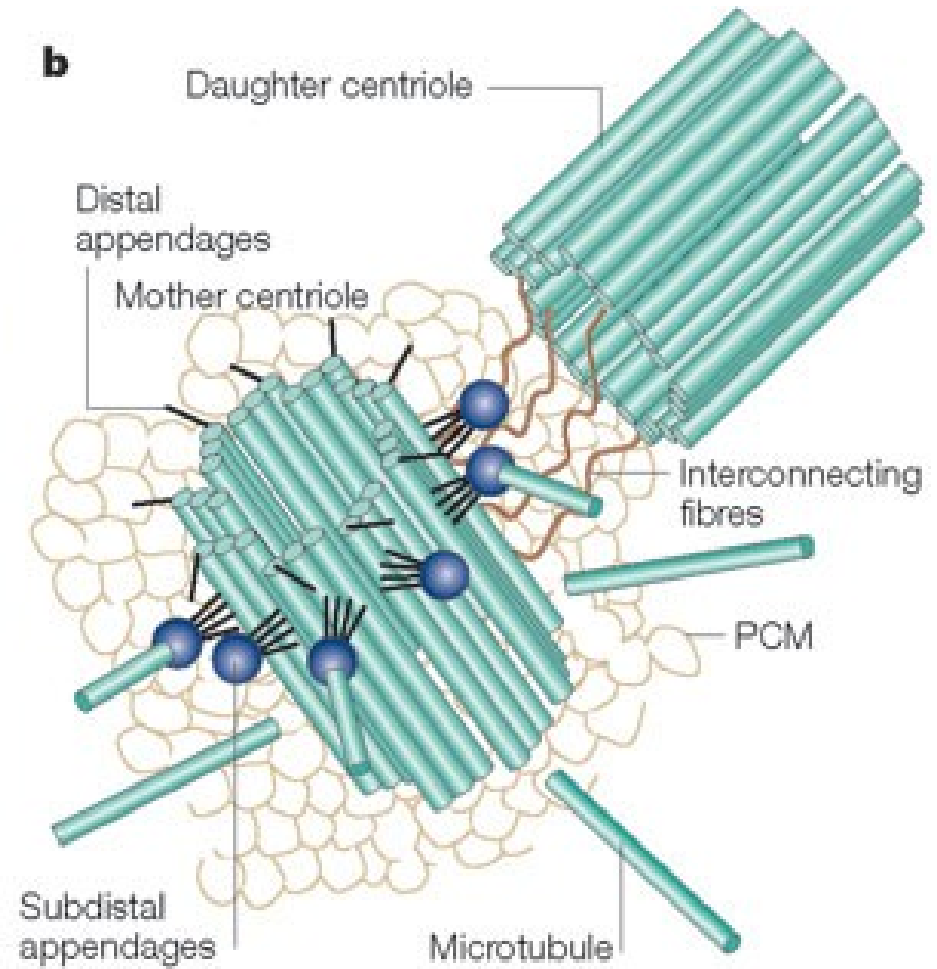


Centrioly

- Organizátory pro stavbu dělicího vřeténka
- Replikací vznikají bazální tělíska řasinek

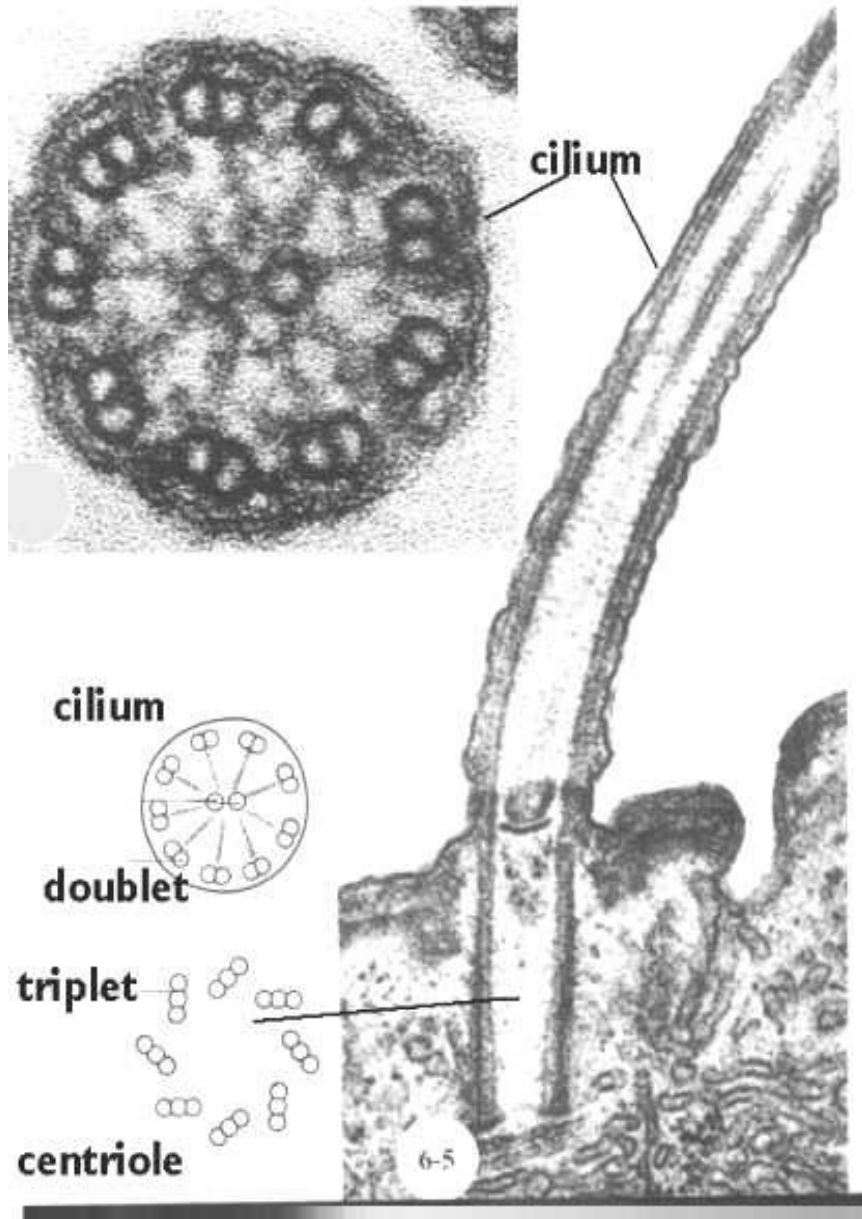


Stavba centrozomu



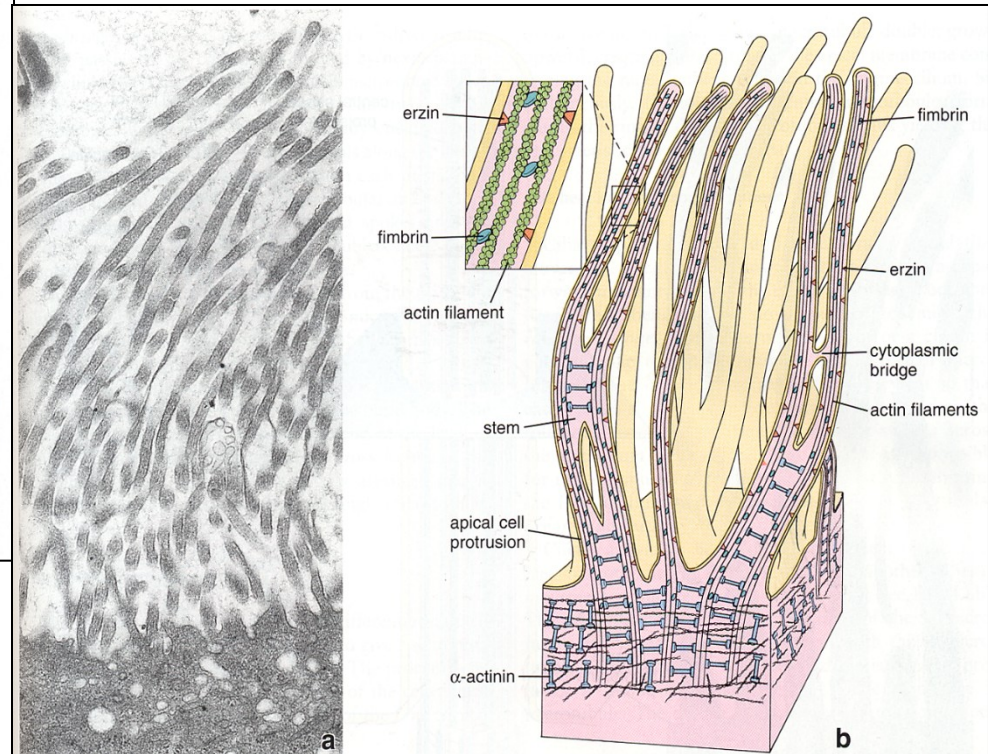
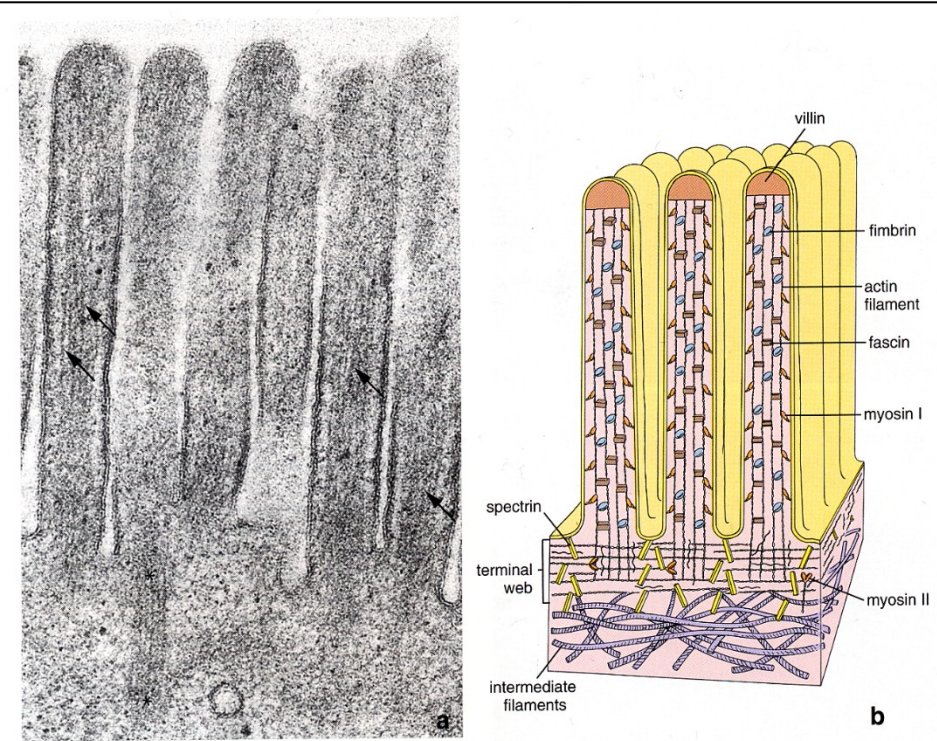
Úprava buněčných povrchů

řasinky, bičíky



Mikroklky, stereocilie

(výběžky vyztužené aktinovými filamenty)

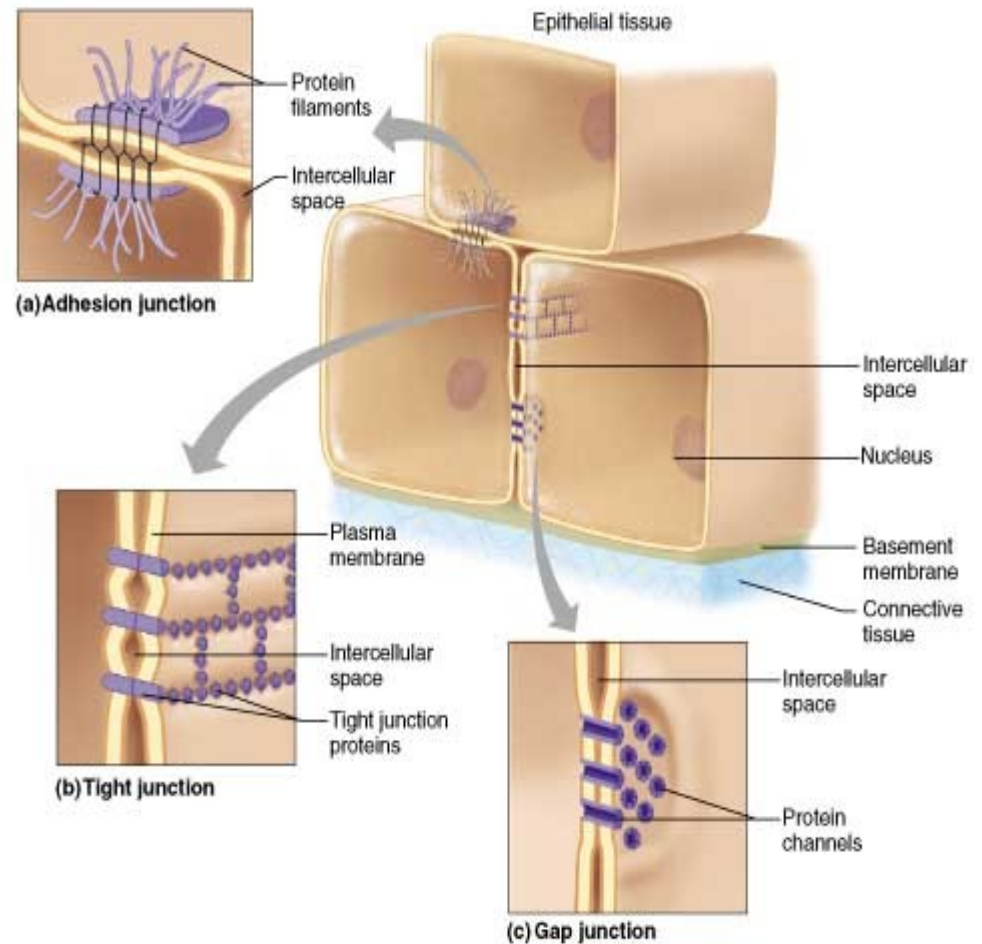


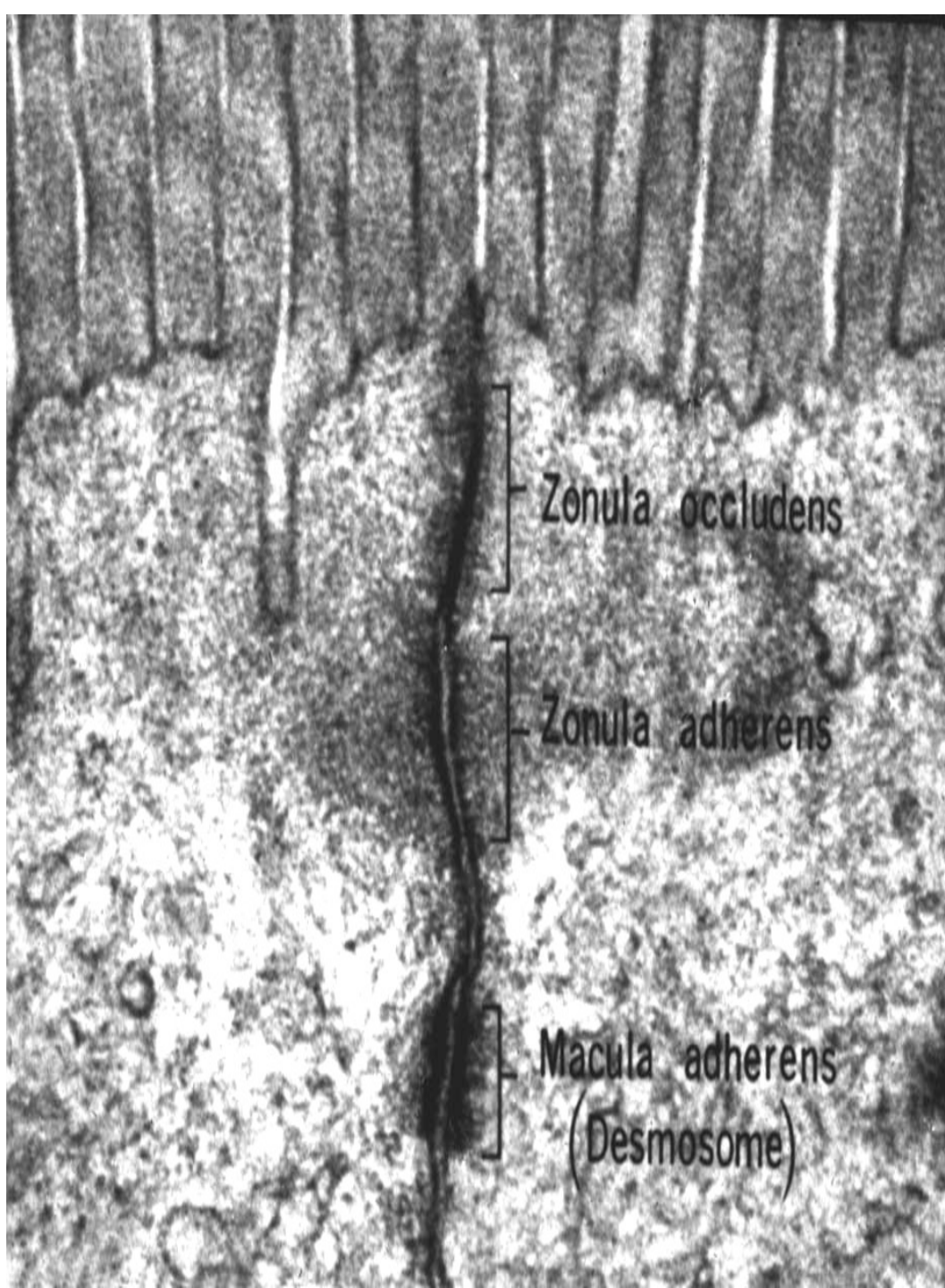
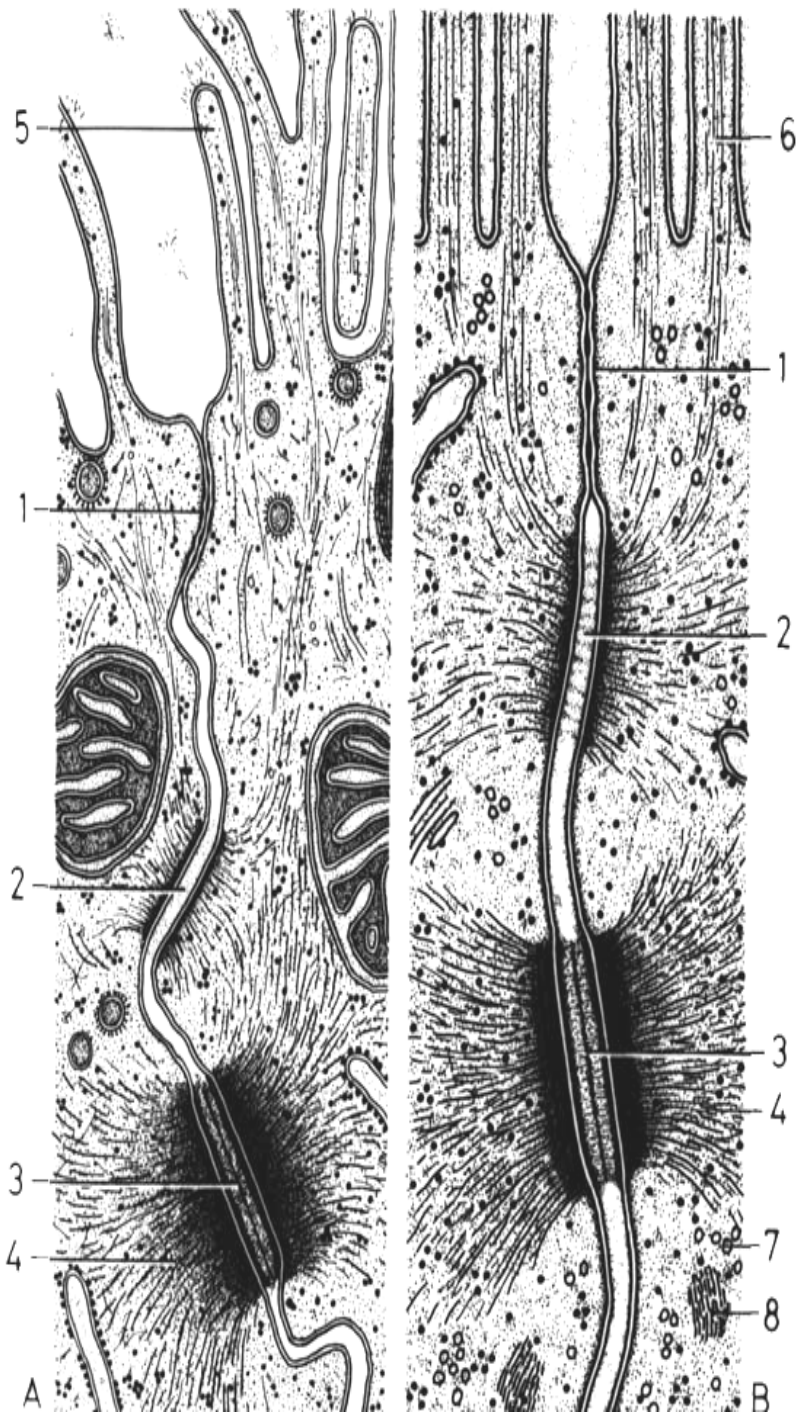
Intercelulární spoje

-Těsná (okluzní)
zonula occludens

- Adhezní:
zonula adherens (15-20 nm),
dezmosom (25-45 nm)

- Komunikační:
nexus (2 nm)

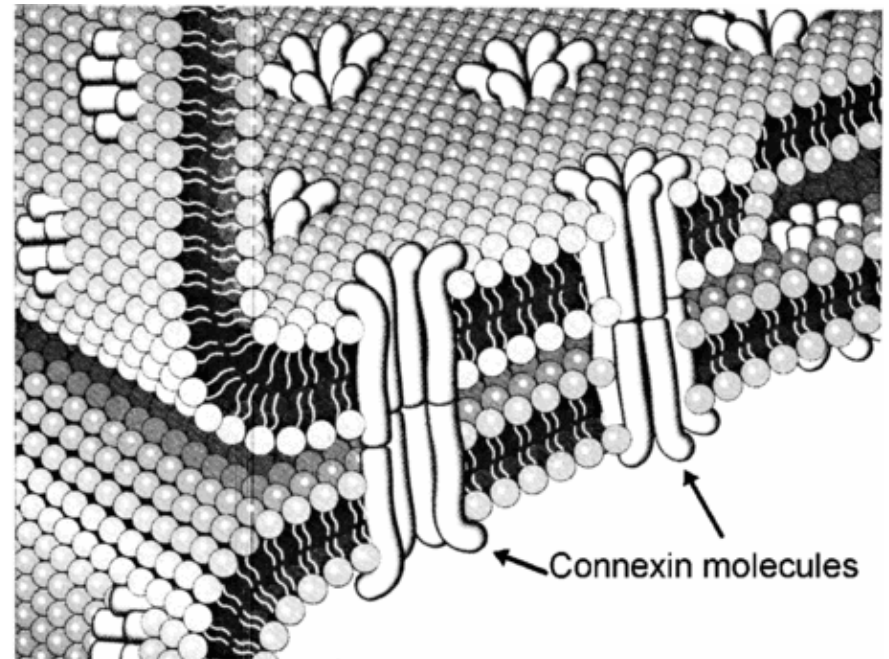
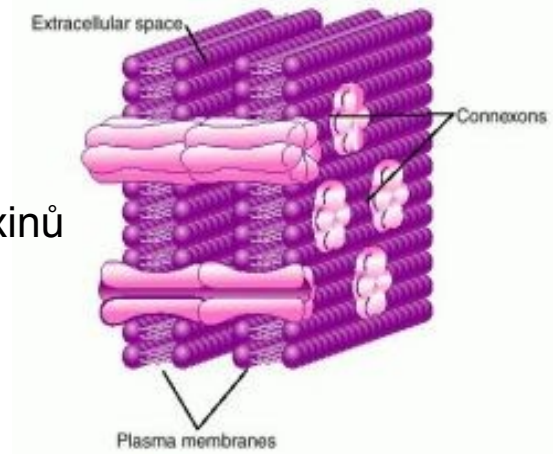




Nexus

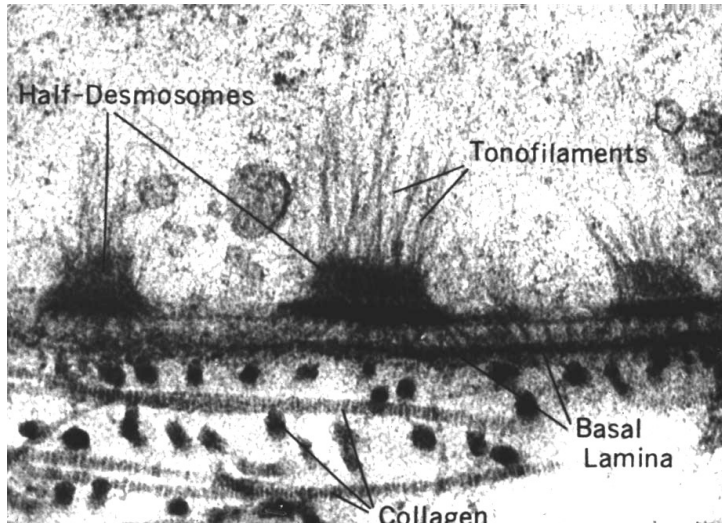


konexon = 6 konexinů

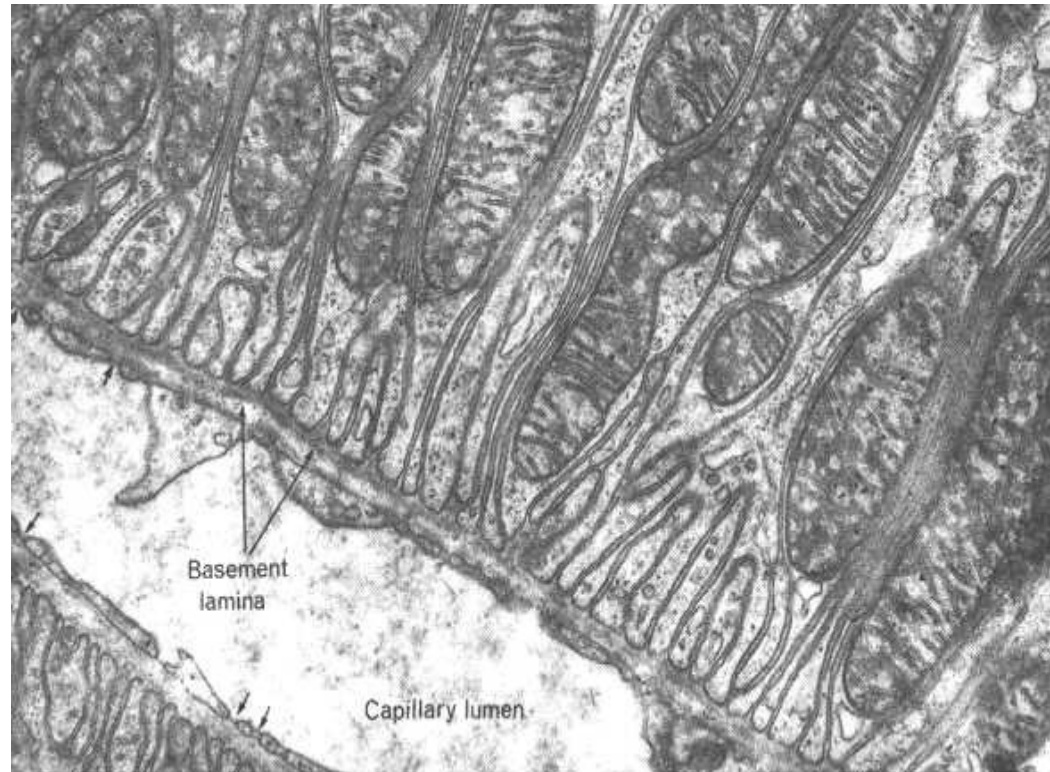


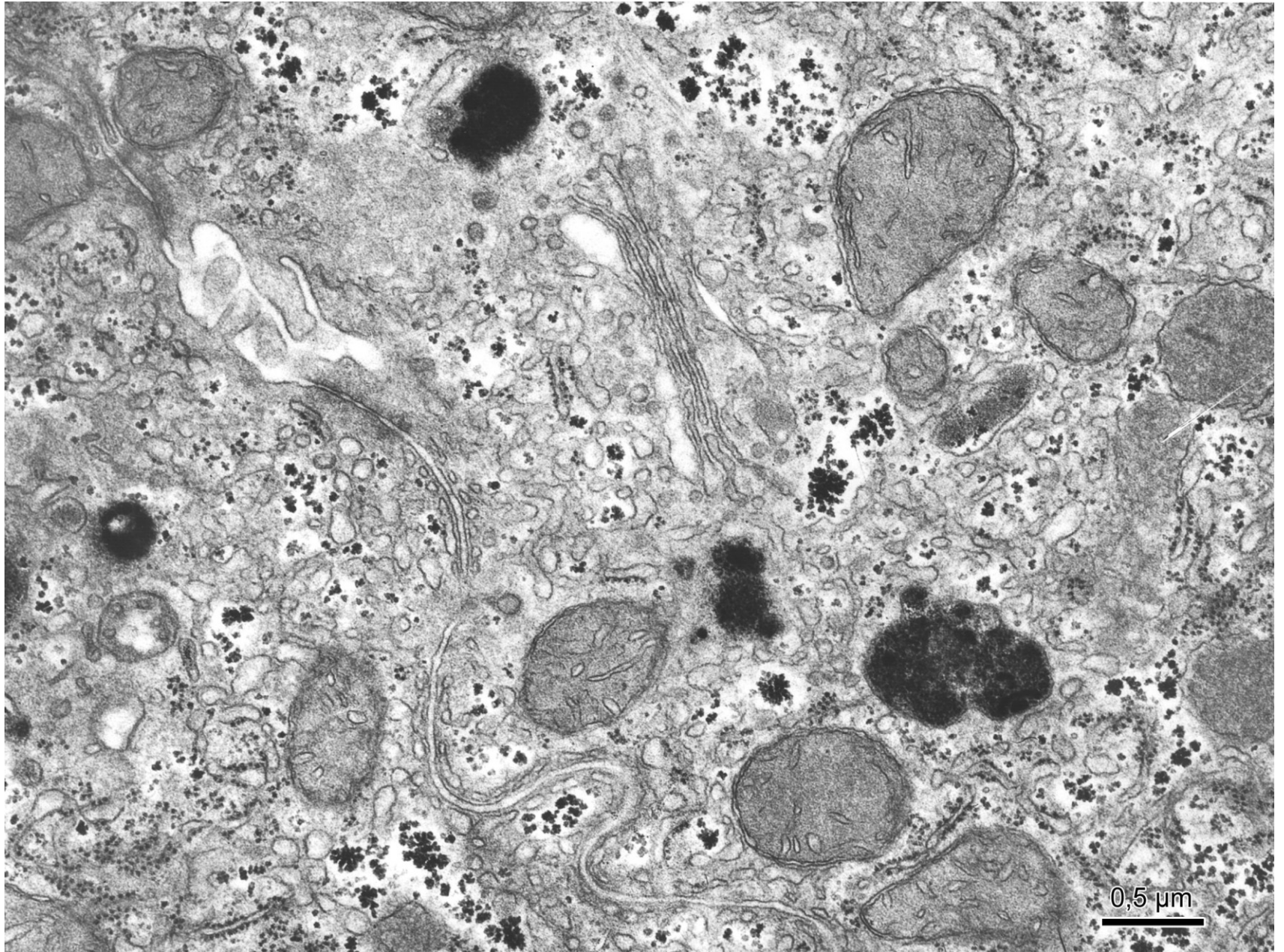
Bazální povrch buněk

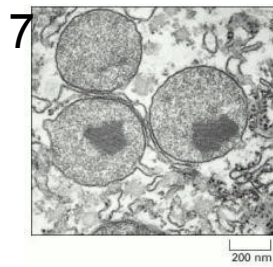
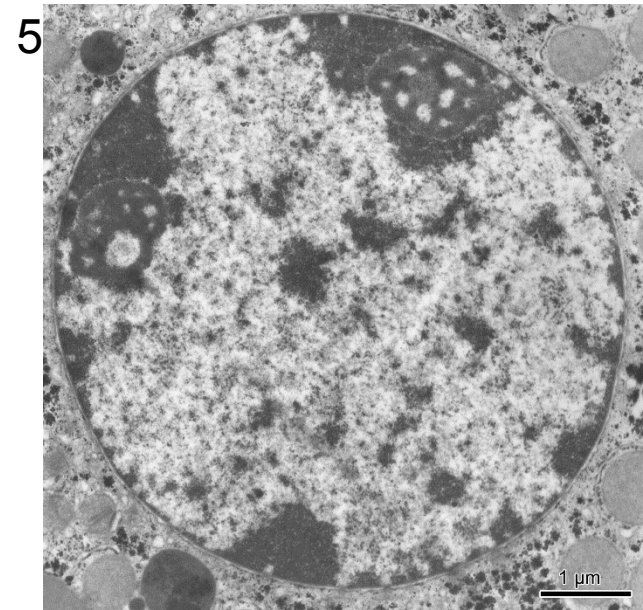
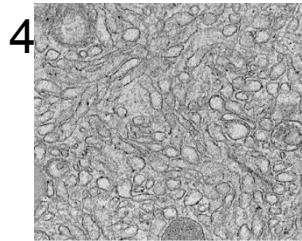
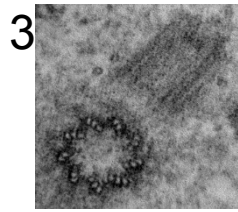
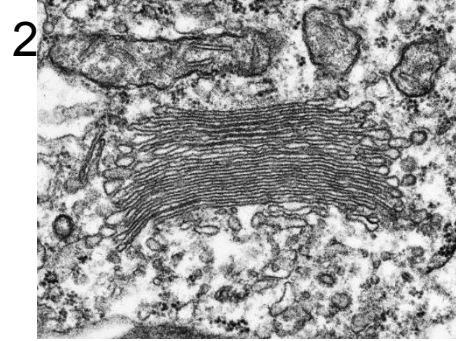
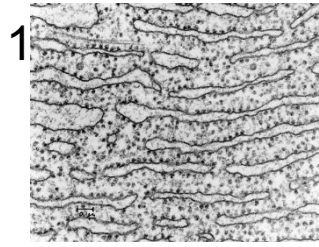
hemidesmosomy

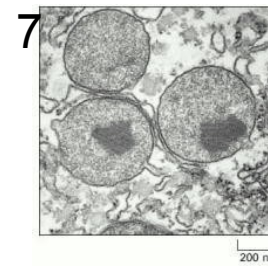
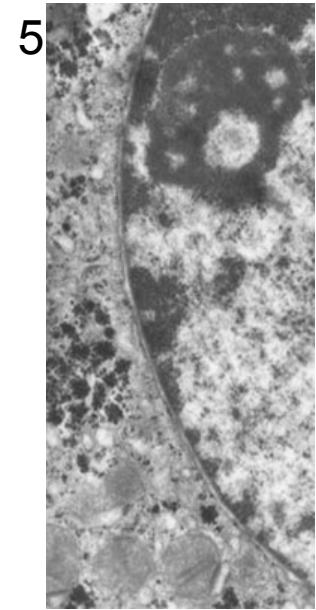
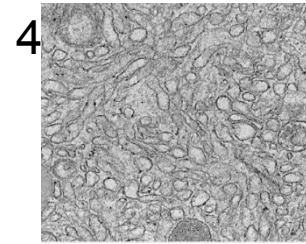
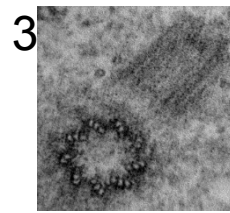
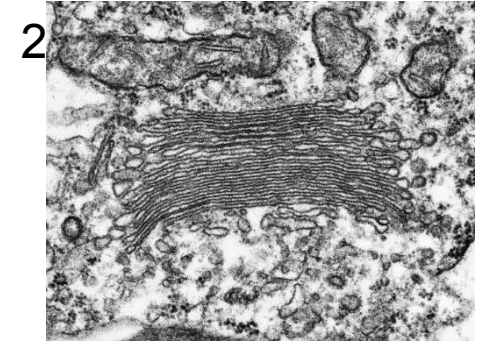
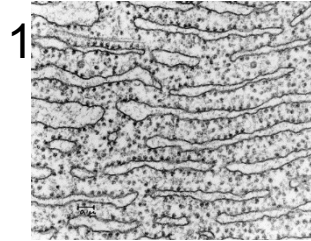
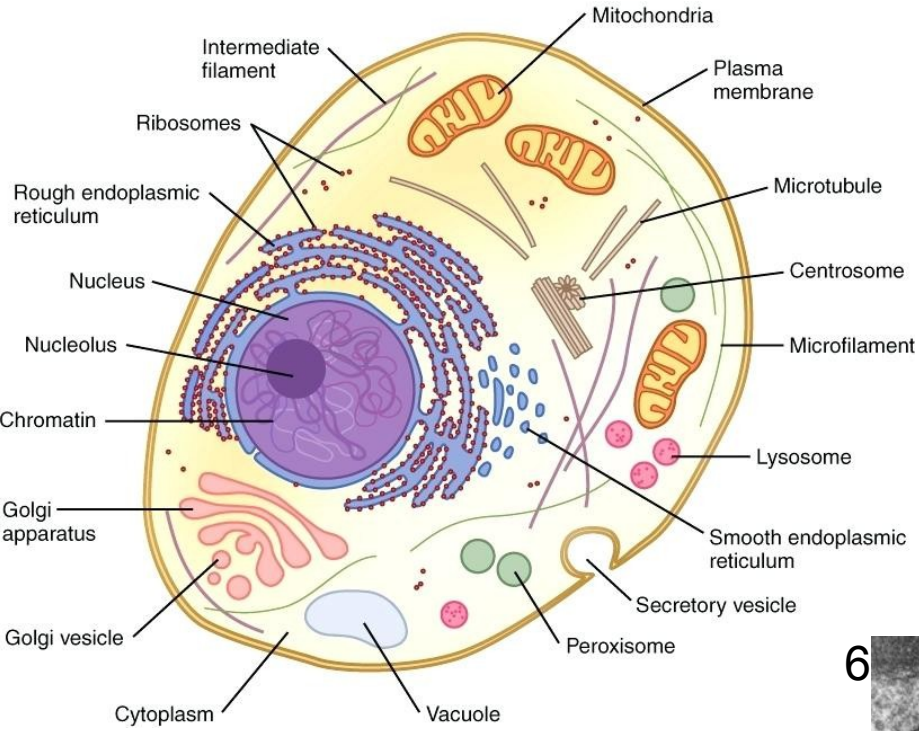


bazální labyrint

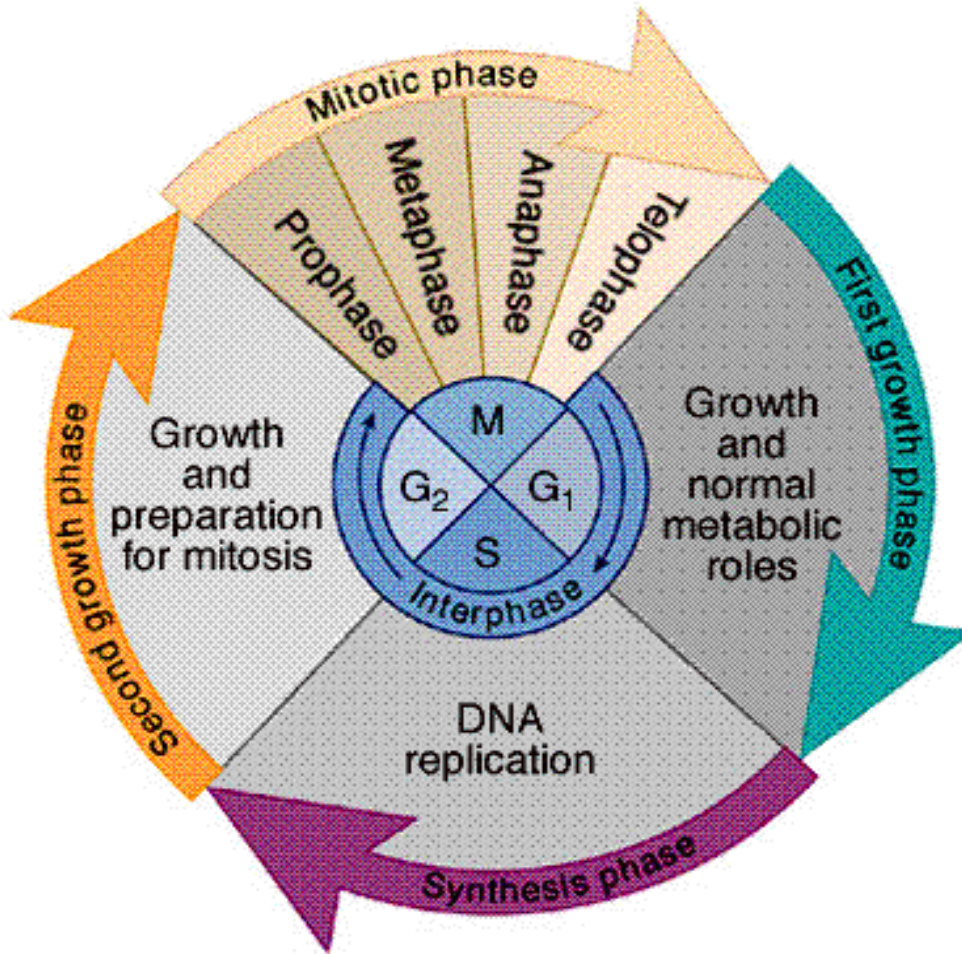






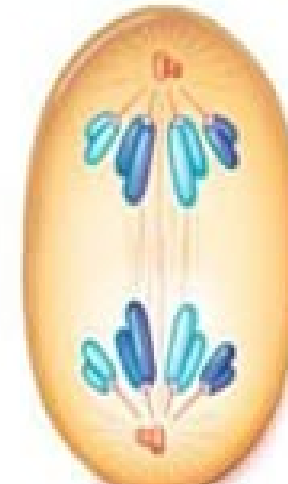
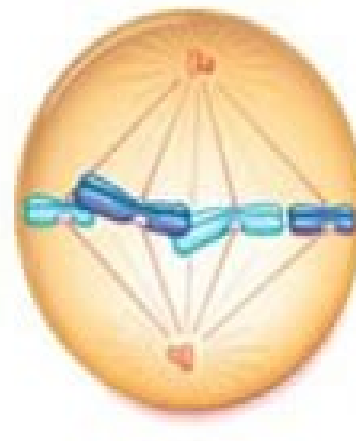
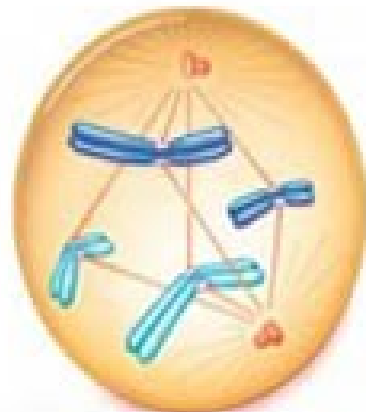
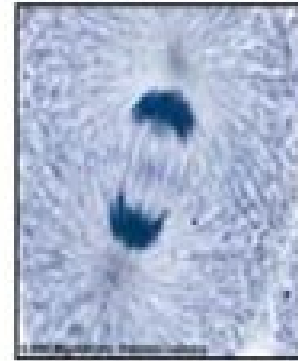
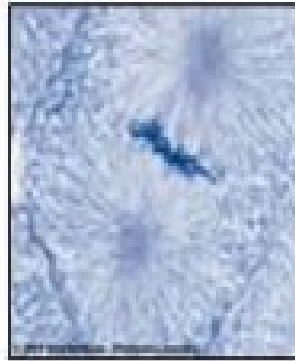
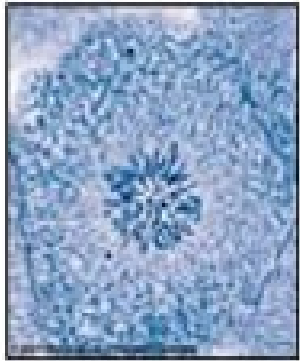


Buněčný cyklus



- **G₁** – fáze (délka závisí na typu buňky)
- **S** – fáze (asi 8 hod.)
- **G₂** – fáze
- **M** – fáze (mitóza) ($G_2 + M$ – fáze = 2,5 – 3 hod.)
- **G₀** – fáze = zastavený cyklus (buňky terminálně diferencované, nedělící se)

Mitóza



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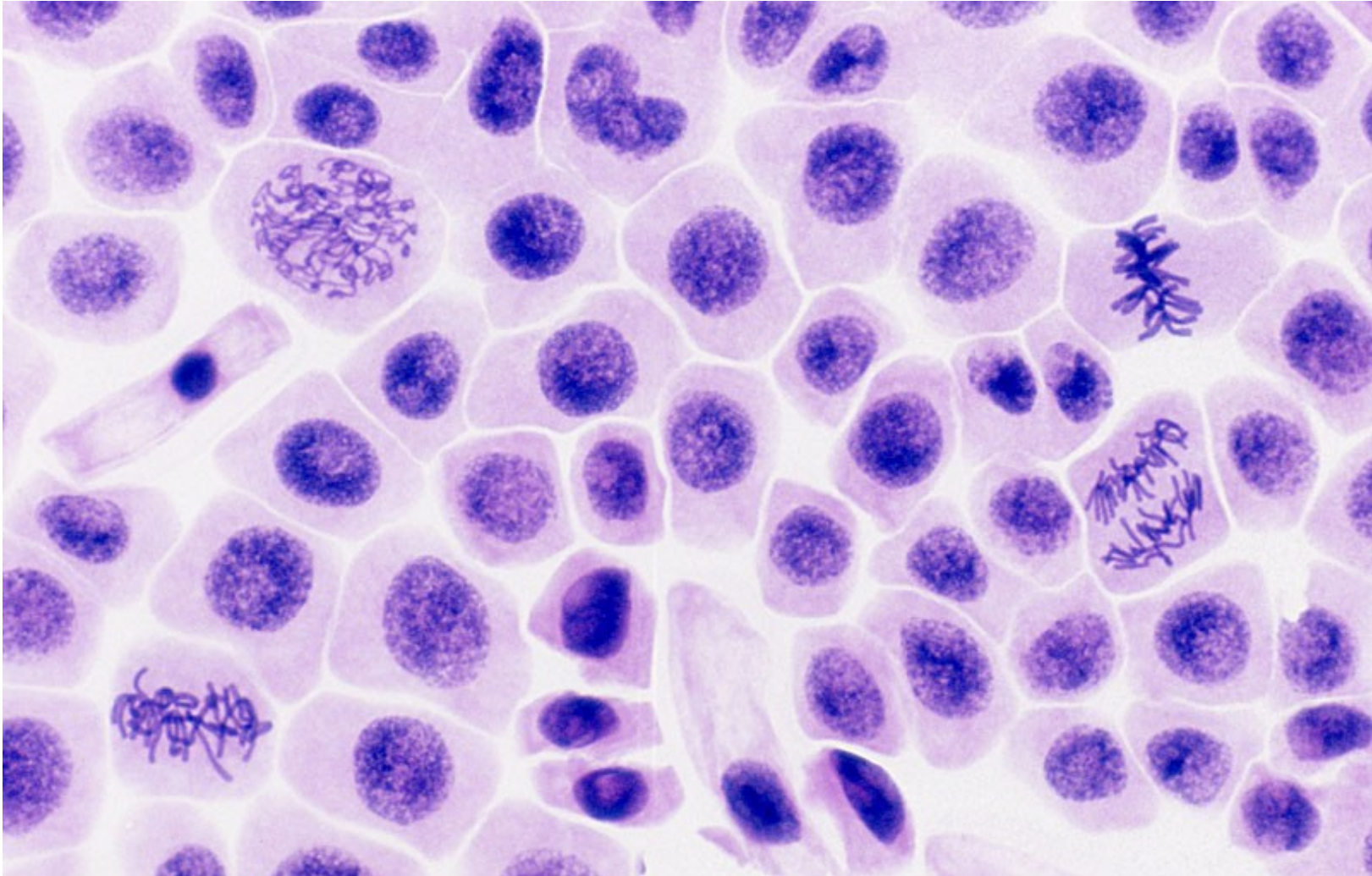
Prophase:
Chromosomes Condense

Prometaphase:
Chromosomes Attach

Metaphase:
Chromosomes align

Anaphase:
Chromosomes separate

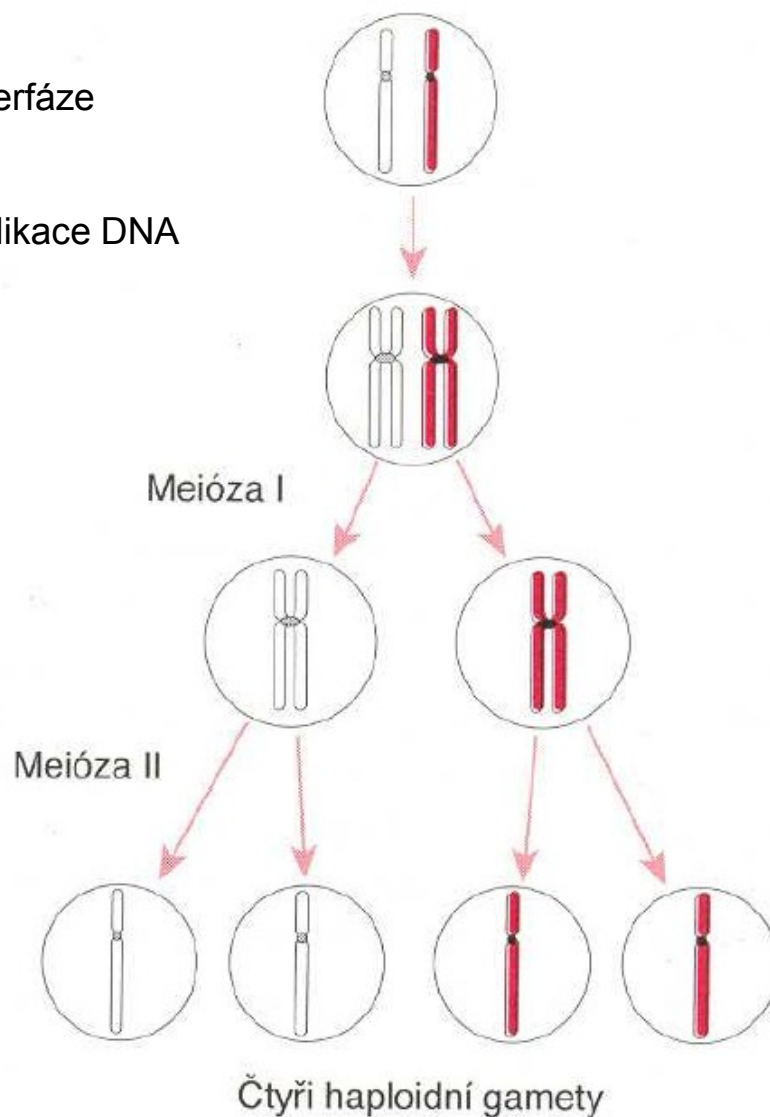
Telophase:
Chromosomes relax



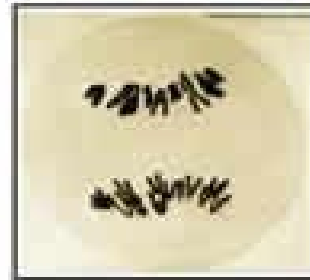
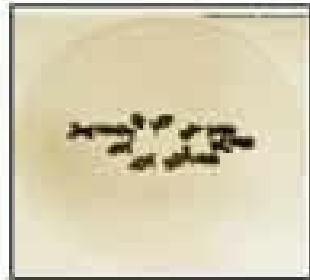
Meióza

Interfáze

- replikace DNA



Zjednodušené znázornění základních stadií meiózy sestávajících z jednoho cyklu replikace DNA, následovaného dvěma cykly segregace chromozomů, prvním a druhým meiotickým dělením.



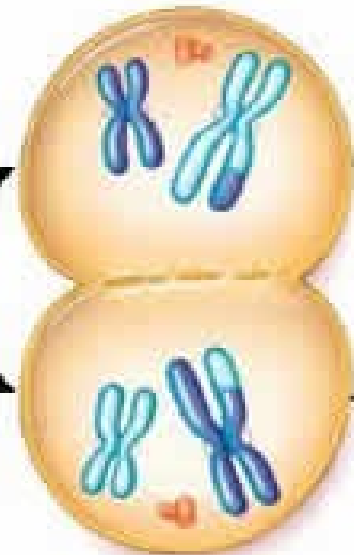
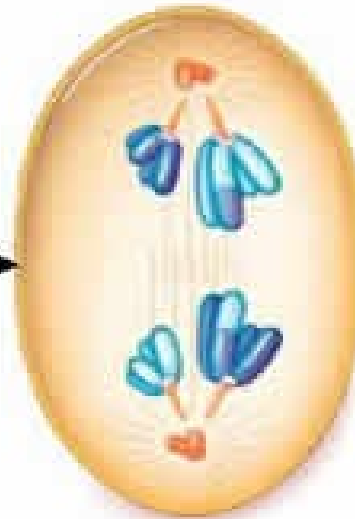
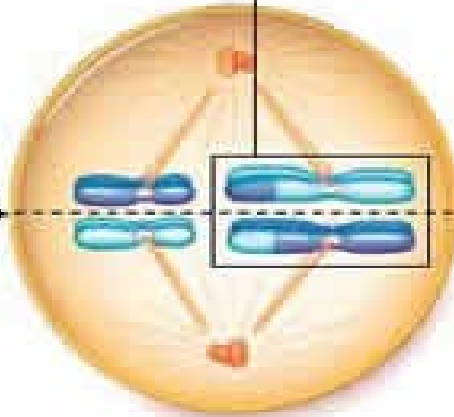
One pair of homologous chromosomes (homologues)

Homologues Condense and cross over

Homologues Align

Homologues Separate

Meiosis I result: homologues separated into 2 cells



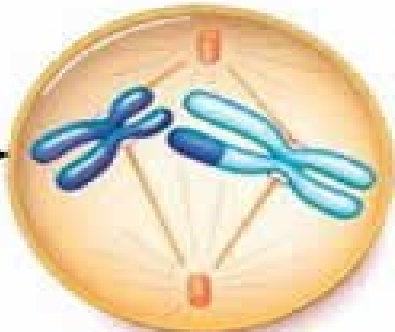
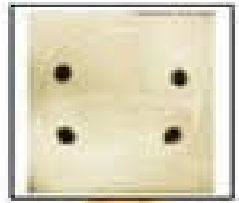
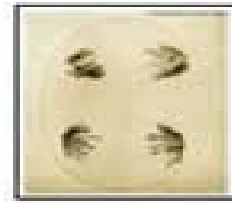
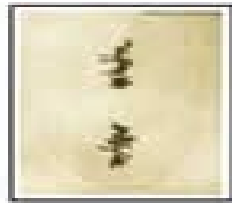
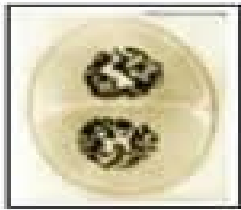
PROPHASE I

METAPHASE I

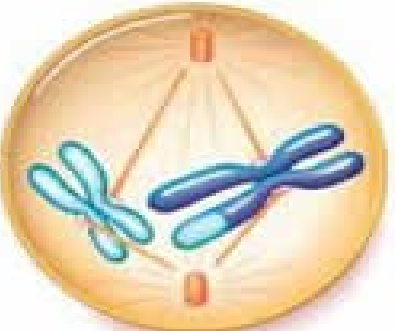
ANAPHASE I

TELOPHASE I

MEIOSIS I: Separate the Homologues



there is no DNA replication between the two divisions



PROPHASE II

METAPHASE II

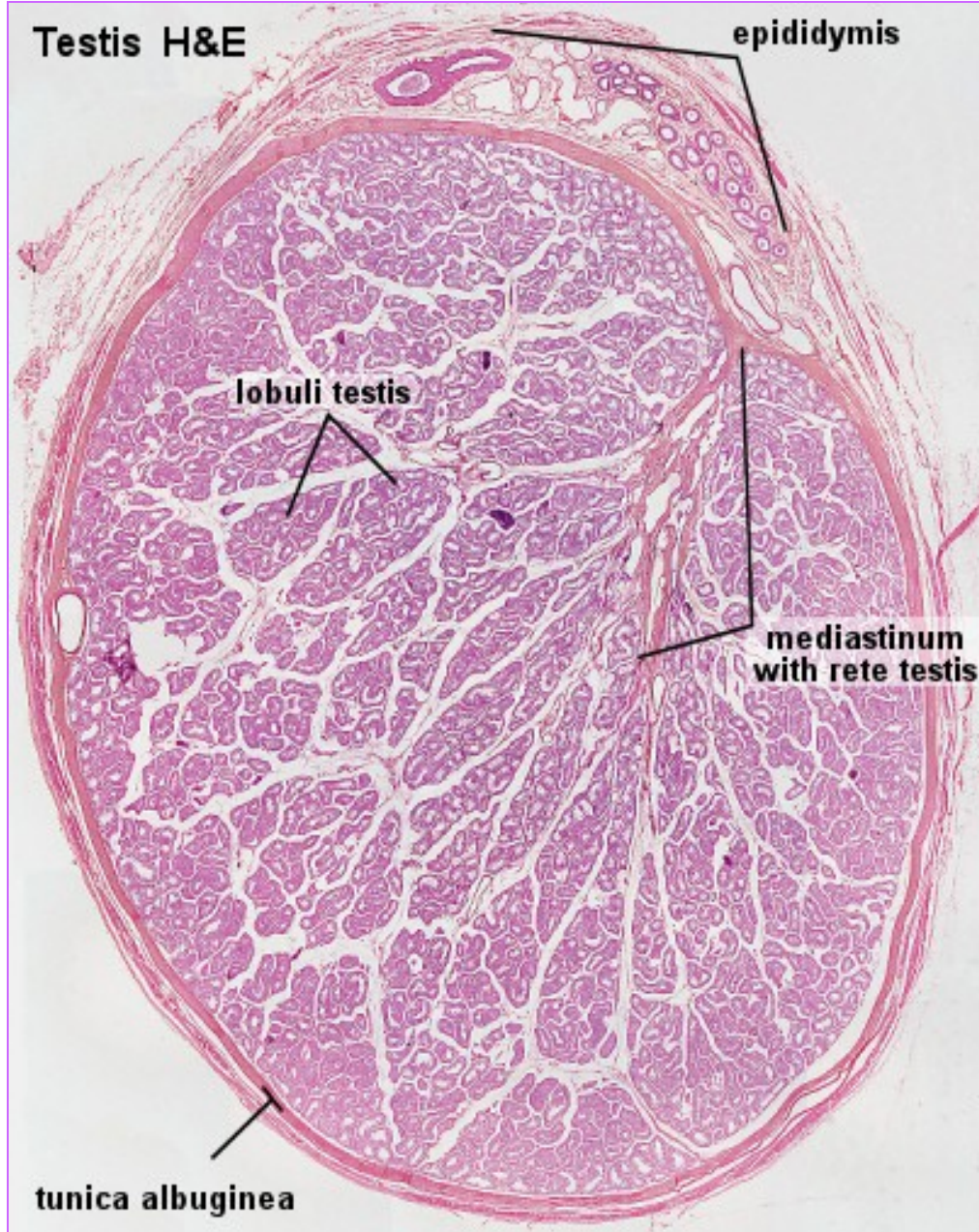
ANAPHASE II

TELOPHASE II

MEIOSIS II: Separate the Sister Chromatids (by mitosis)

Spermatogeneze

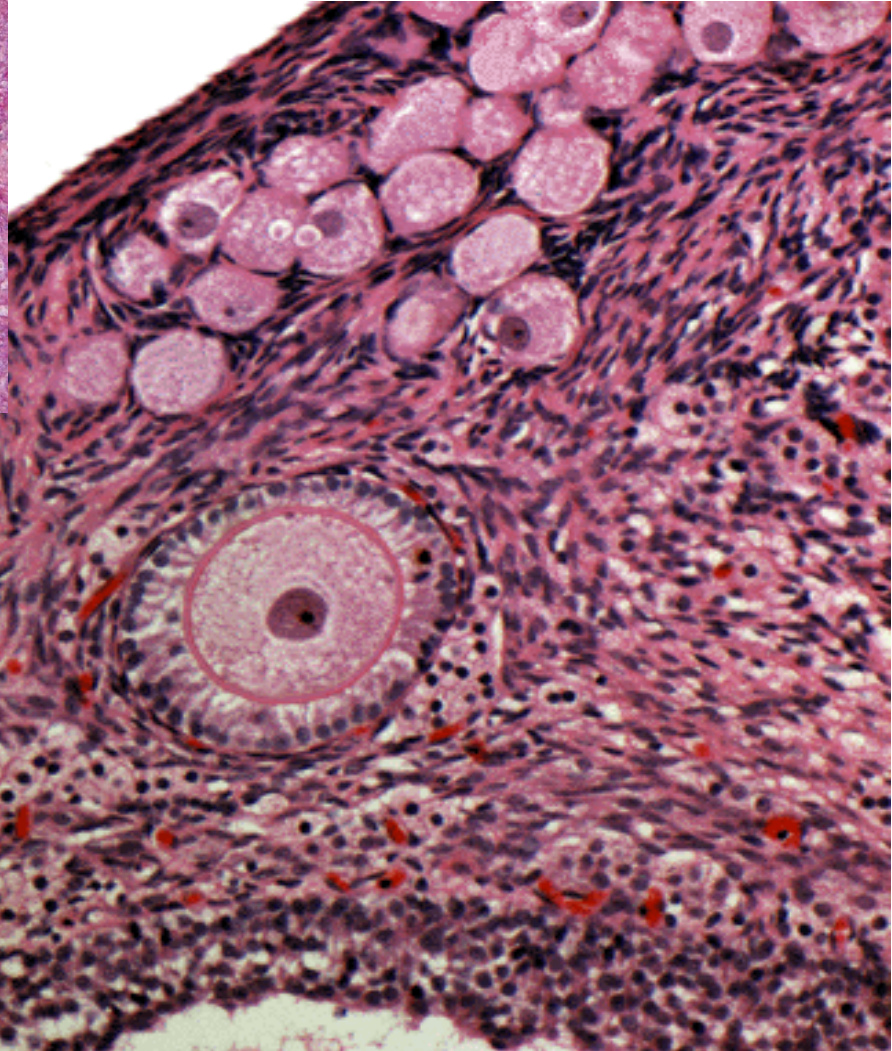
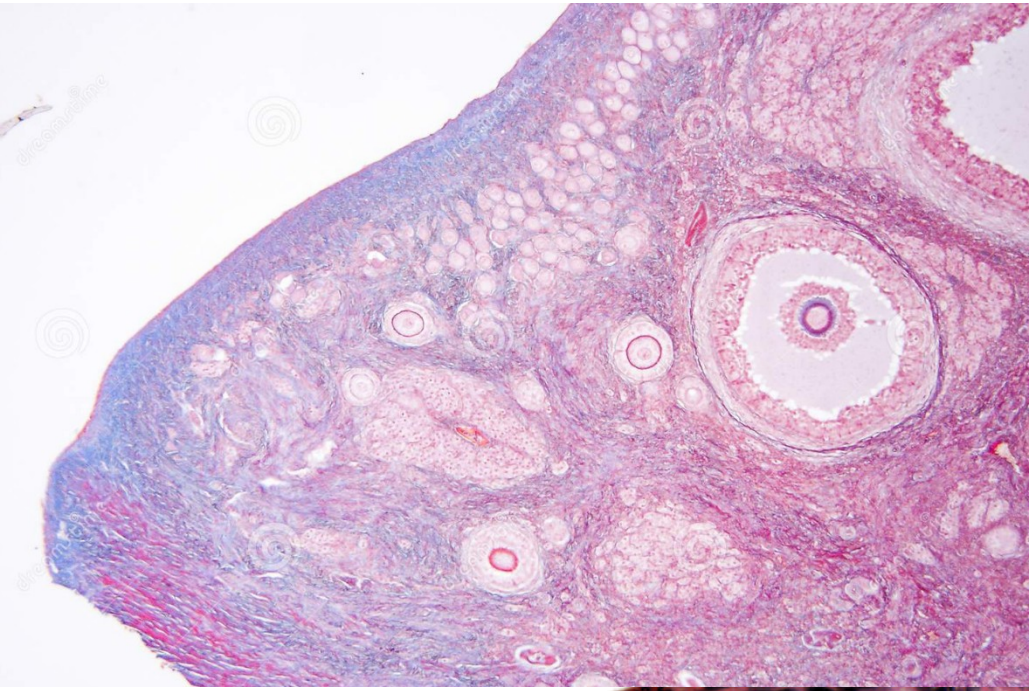
Testis H&E



Testis H&E



Oogeneze



Po dnešní přednášce byste měli umět odpovědět na otázky:

Čím se zabývá histologie?

Co je to buňka?

Jaká je velikost většiny lidských buněk?

K čemu je dobrá kompartmentalizace buňky?

Jaká je struktura biomembrány?

Jaká je stavba a funkce jádra?

Jaká je stavba a funkce jednotlivých organel?

Co jsou to inkluze a jaký mají význam?

Jaké součásti cytoskeletu najdeme v buňce a jaká je jejich stavba a funkce?

Jaké typy mezibuněčných spojů znáte a jaká je jejich funkce?

Jakým způsobem může být modifikovaná buněčná membrána?

Co je to buněčný cyklus a jaké jsou jeho fáze?

Jaké buňky se nachází v tzv. G₀ fázi buněčného cyklu?

Jaké jsou typy dělení lidských buněk?

Jaký je rozdíl mezi mitózou a meiózou?