

Repetitorium der Histologie SS 2024

Daniela Rodler und Fred Sinowatz

Bauplan einer Zelle

Zellkern

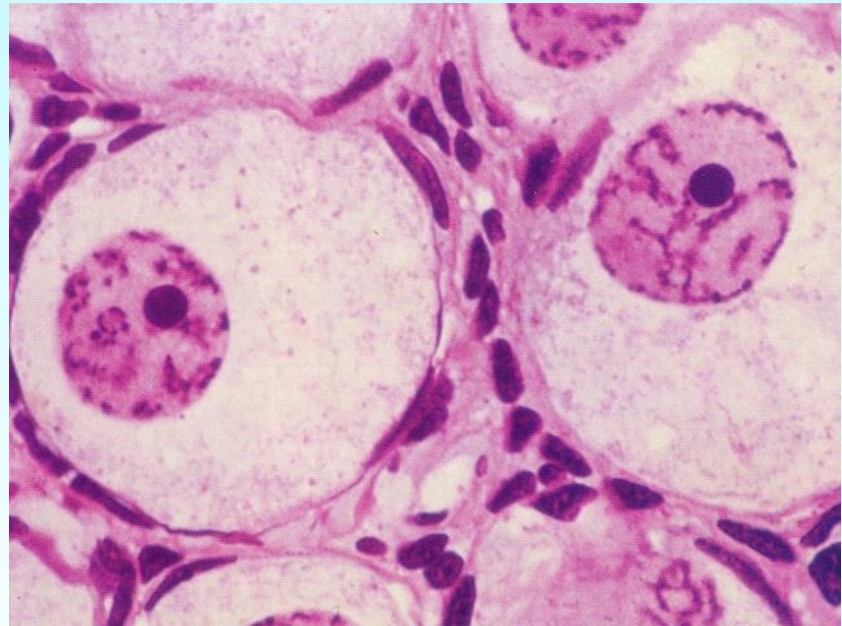
(Nucleus)

Zell-Leib

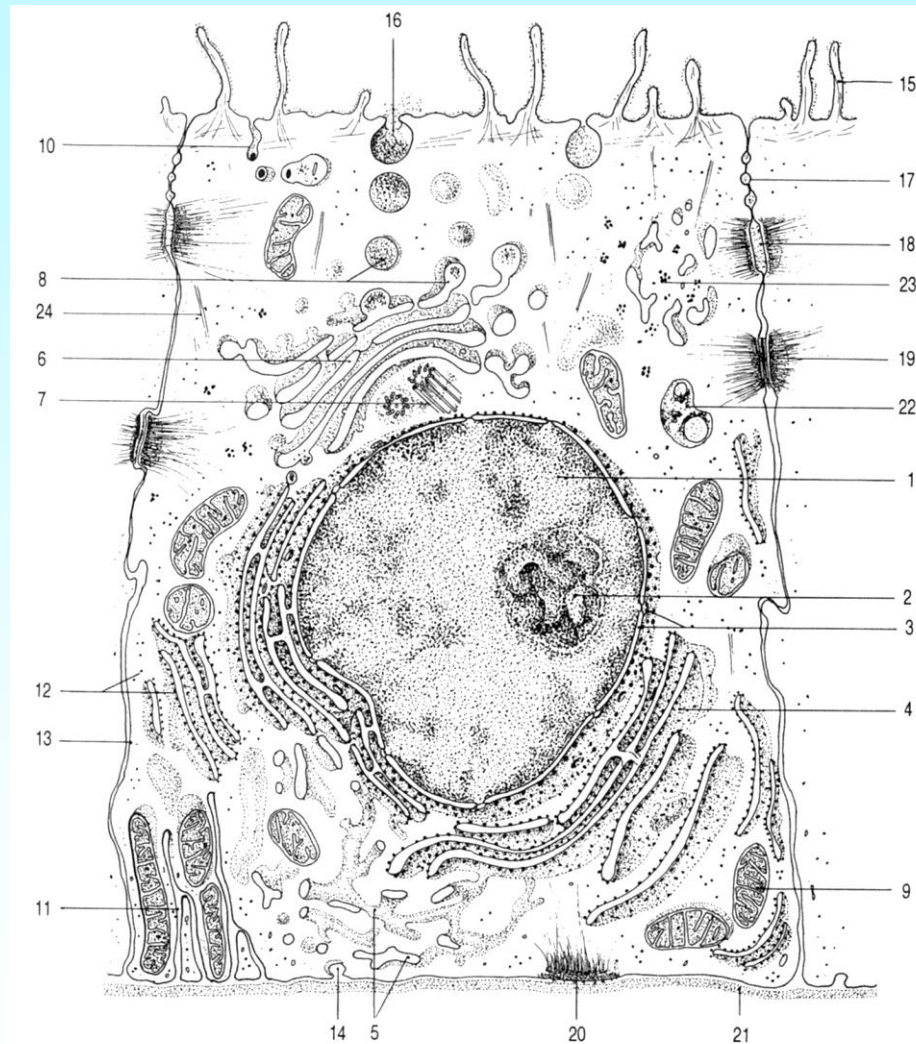
(Zytoplasma)

Zellmembran

(Plasmalemma)

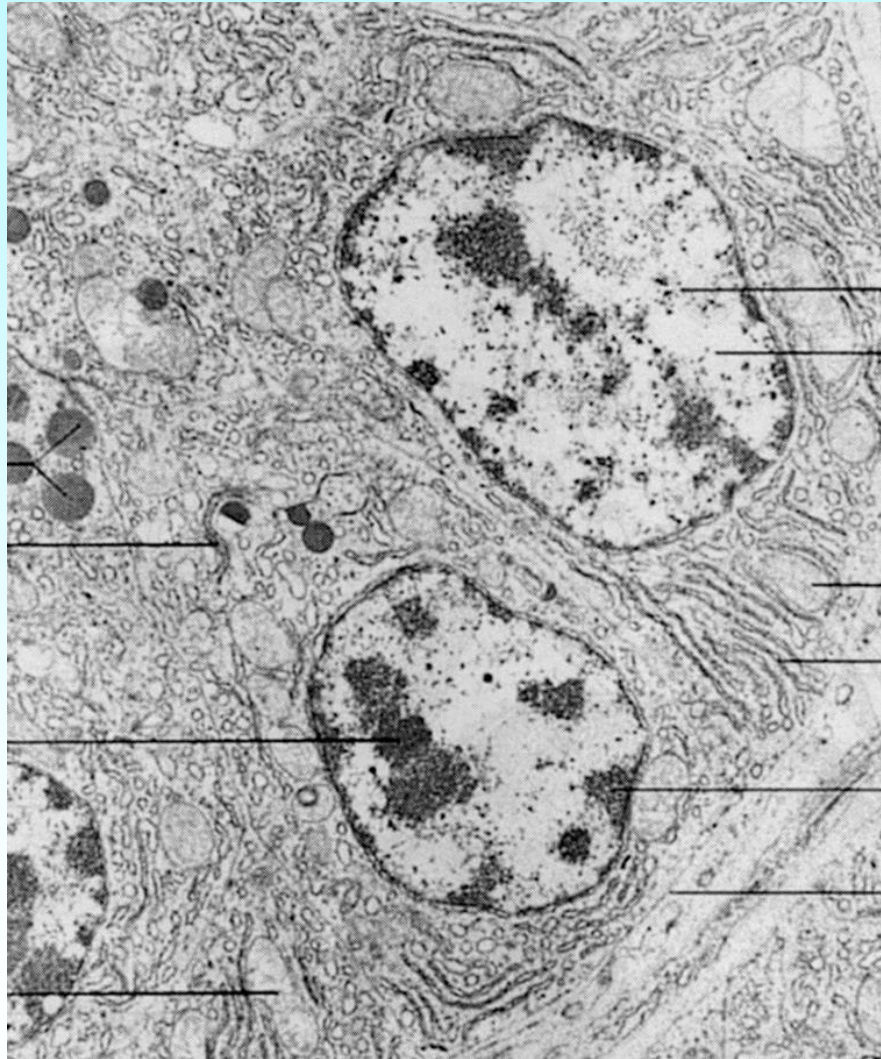


Bauplan der Zelle (EM)

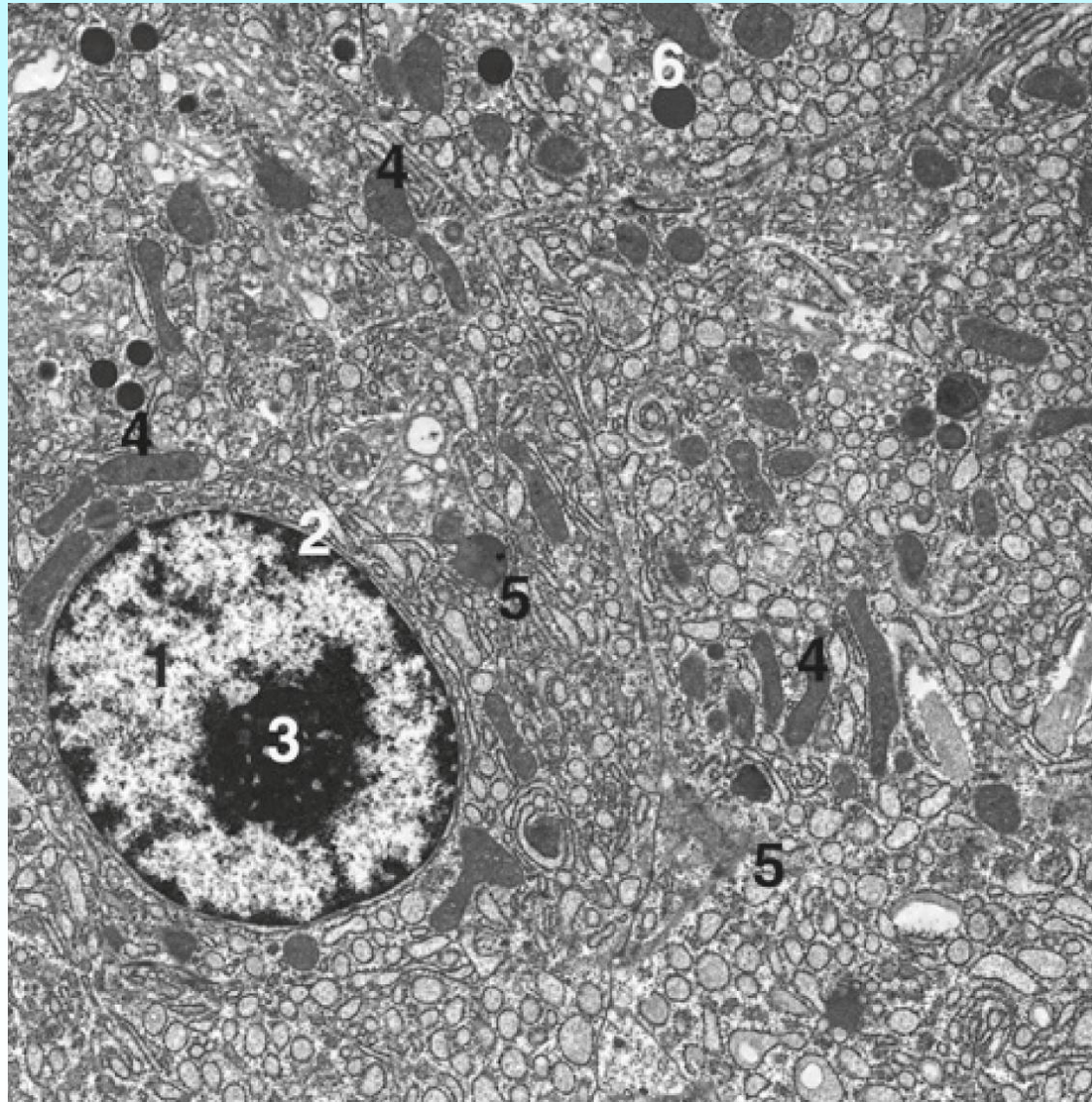


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Zelle - Elektronenmikroskopie



TEM Parotis Rind



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Der Zellkern als diagnostische Hilfe

„Gesicht der Zelle“

- Größe
- Form
- Chromatinverteilung
- Zahl und Größe der Nucleoli

Der Zellkern als diagnostische Hilfe

Lymphozyten: Runder kompakter Zellkern

Granulozyten: Segmentkernige und stabkernige Gz

Radspeichenkern der Plasmazellen

Stäbchenförmiger Kern der glatten Muskelzellen

Spindelförmiger Zellkern der Fibrozyten

Bläschenförmigen, nukleolenhaltigen Zellkern von Ganglienzellen

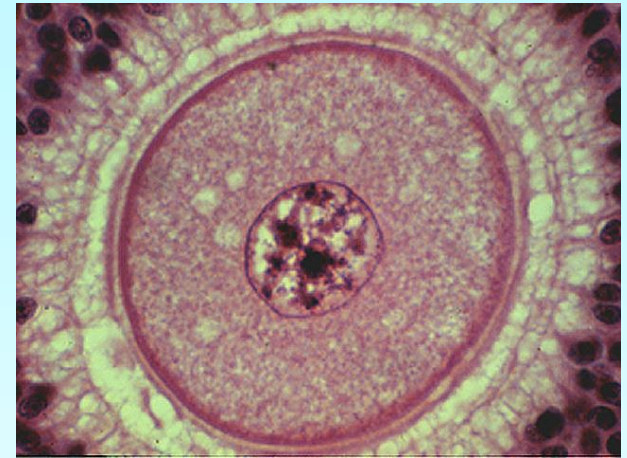
Riesiger, polyploider Kern der Megakaryozyten

Zellkern (Nucleus)

Enthält die Chromosomen (DNA)

Steuert die Proteinsynthese: mRNA

Übergeordnetes Stoffwechselzentrum



Kern-Plasma-Relation

Interphasenkern

Teilungskern

Polyploide

Strukturen des Interphasekerns

Kernhülle

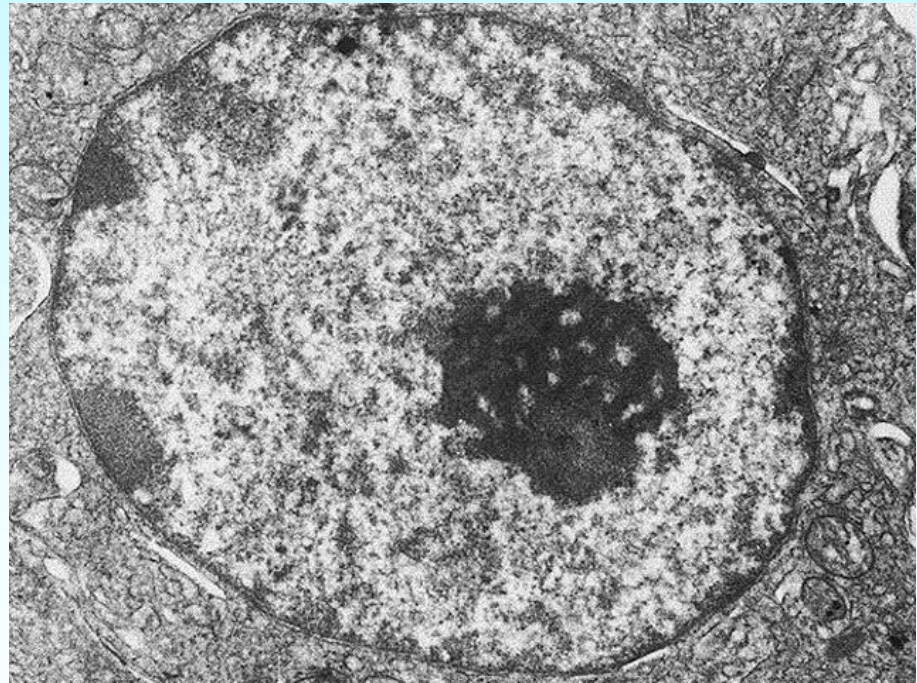
(Karyotheca)

Kernraum

(Karyoplasma)

Kernkörperchen

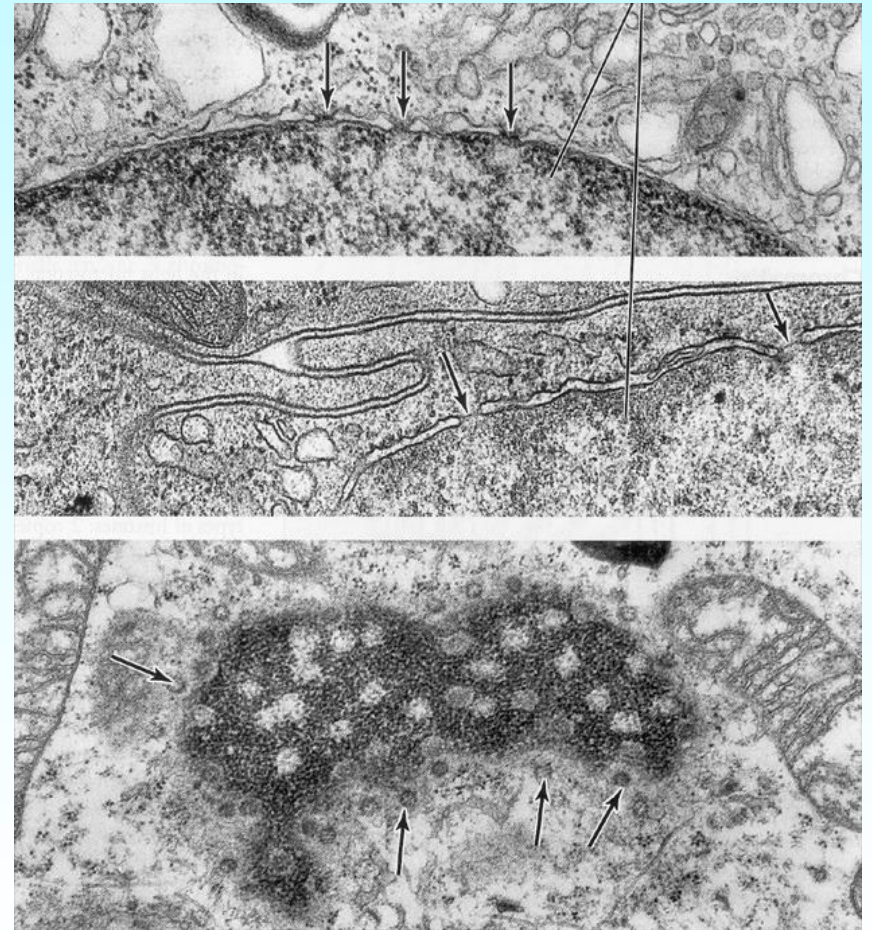
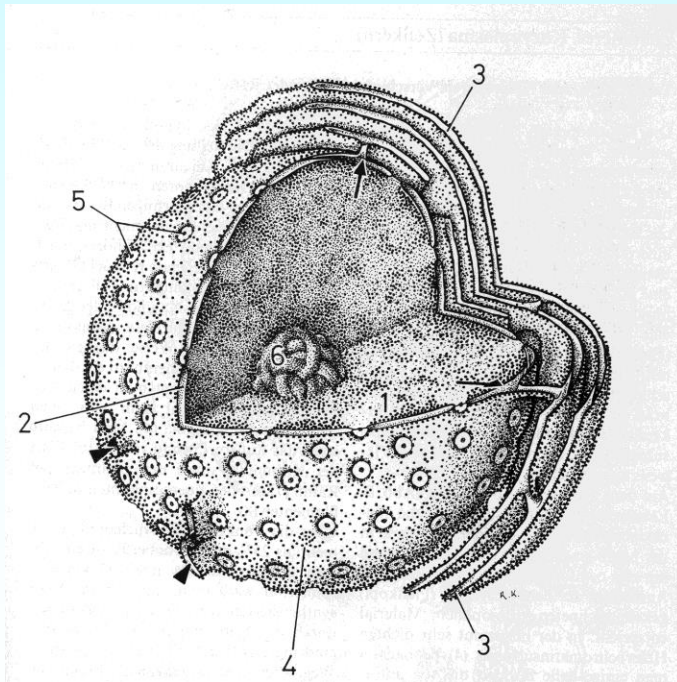
(Nucleolus)



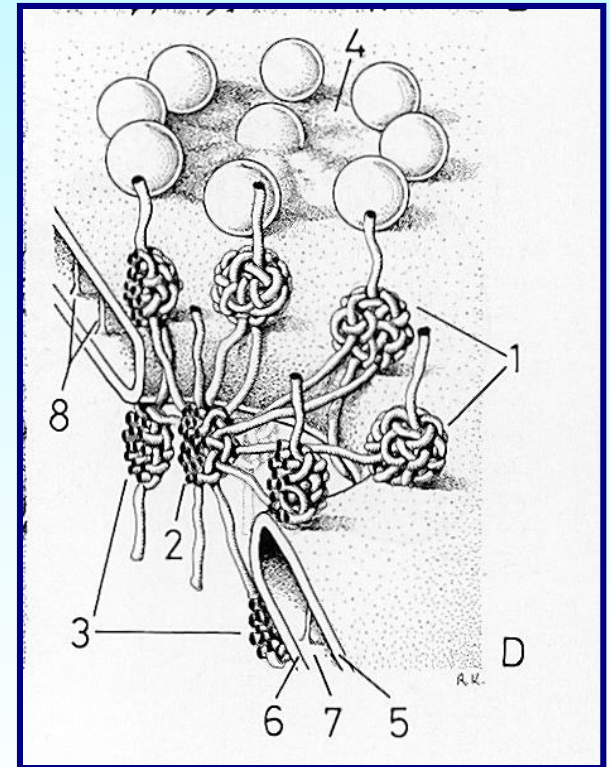
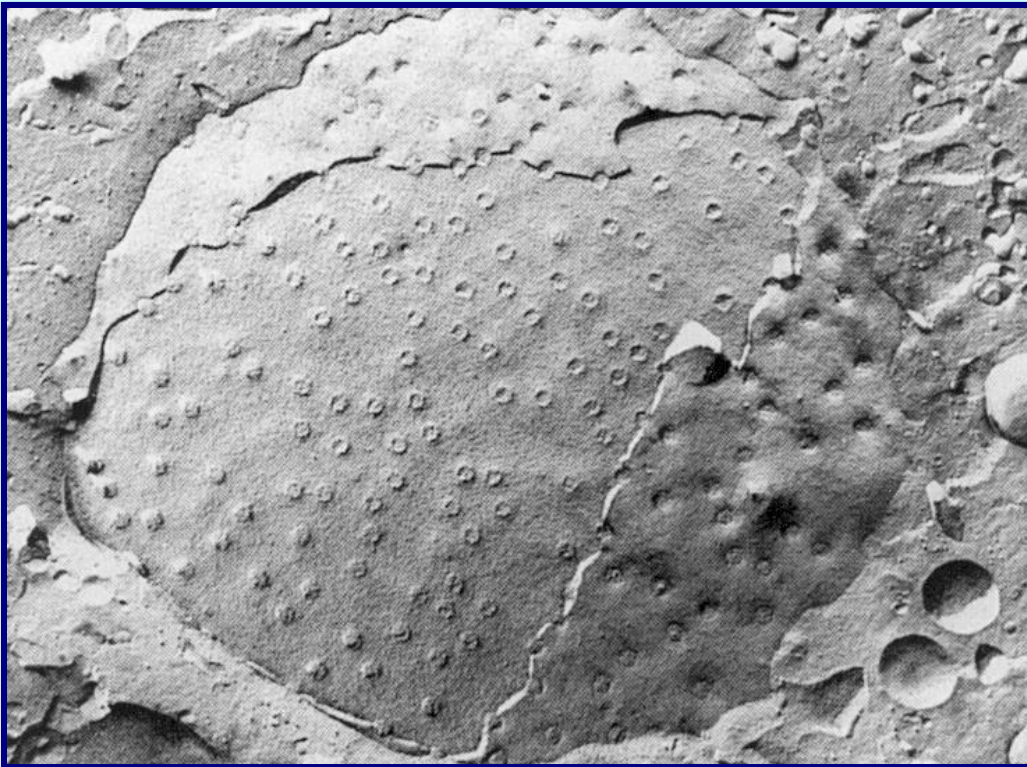
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Kernhülle

Innere und äußere Kernmembran
Perinukleärer Raum



Kernporen



Kernporen: Anulus mit zentralem
Granulum

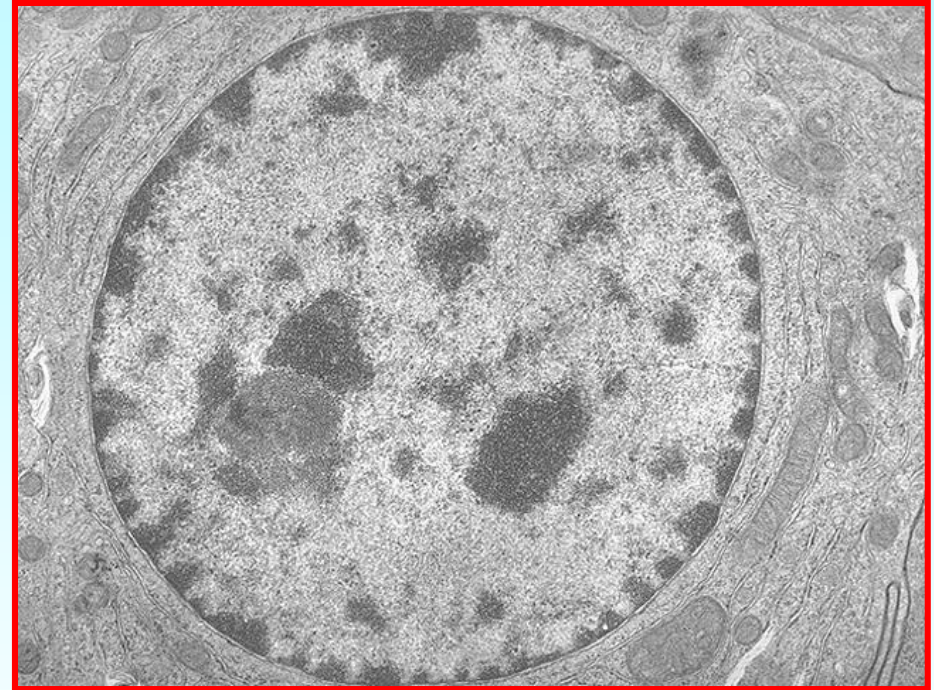
Euchromatin

Genetisch aktiv: Transkription

LiMi: Nur mäßig angefärbt

EM: Mäßig elektronendicht

Chromatin hat lockere Struktur



Heterochromatin

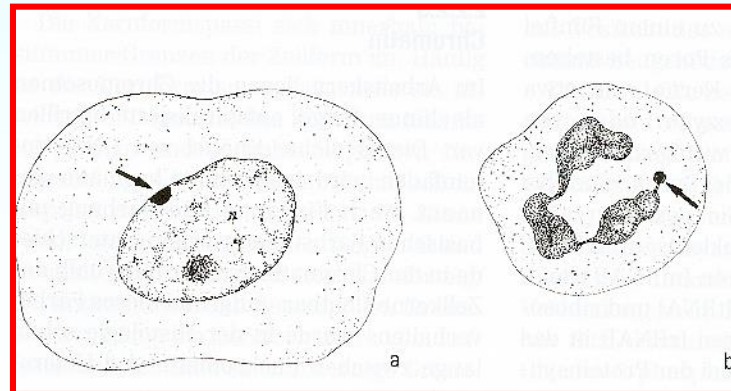
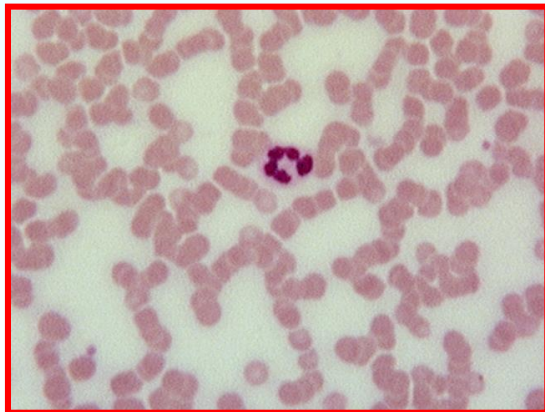
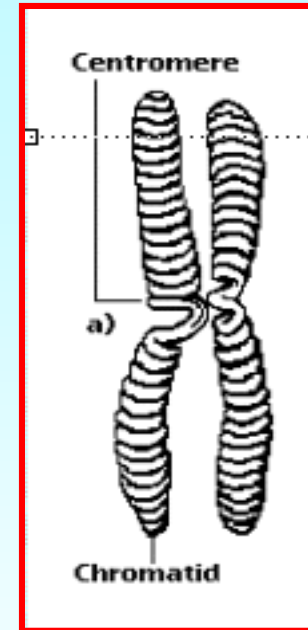
Konstitutives Heterochromatin

zentromernahe Bereiche

Fakultatives Heterochromatin

Barr-Körperchen

Drum sticks



Zellzyklus

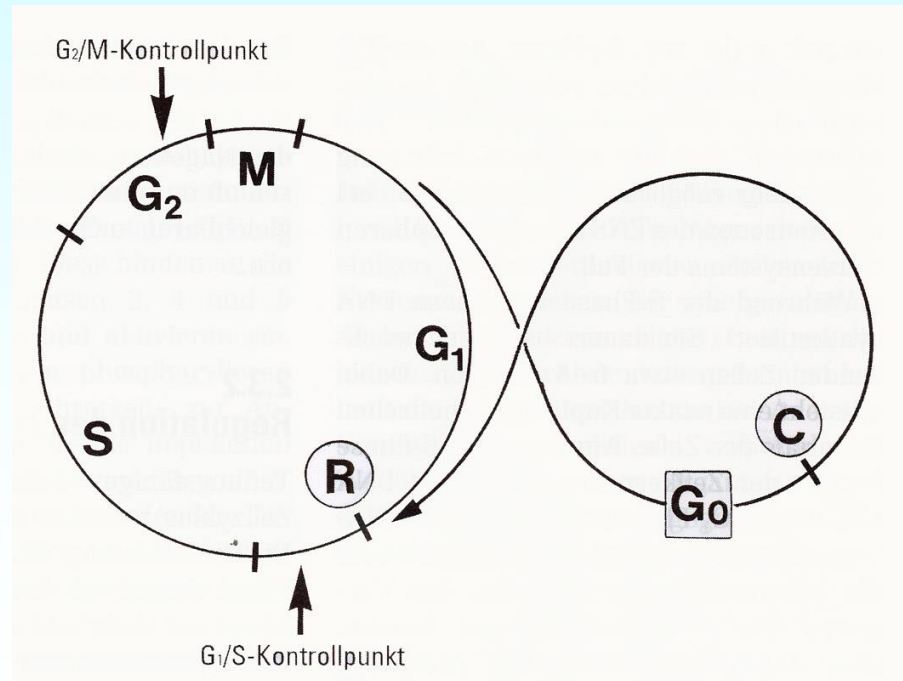
Interphase

G1-Phase („gap“: kein Thymidineinbau)

S-Phase (DNA-Synthese)

G2-Phase

Mitose (M-Phase)



Zellteilung

Mitose (indirekte Kernteilung)

Zytokinese

Äquale Zellteilung

Differentielle Zellteilung

Meiose

Zellmembran

Unit membrane

Flüssigkeits-Mosaik-Modell

Bimolekulare Lipidschicht

Phospholipide

Sterole

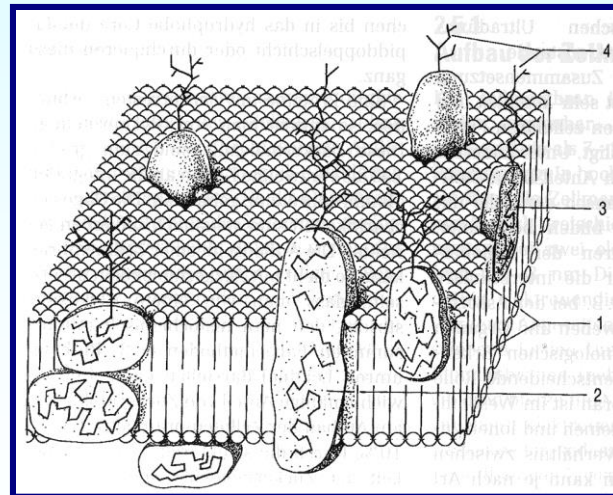
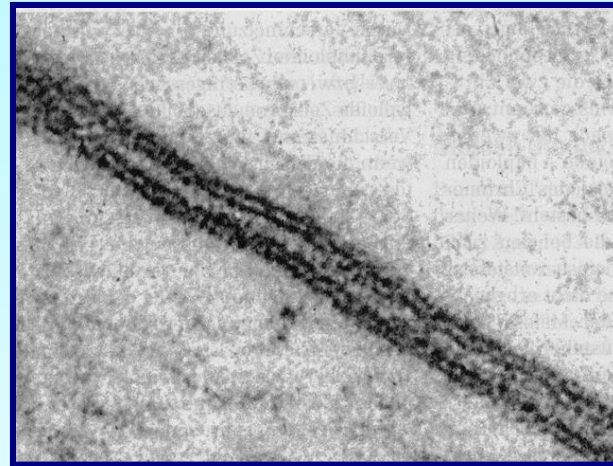
Glykolipide

Proteine

Integrale Membranproteine

Periphere

Suprastruktur



Differenzierung der apikalen Zellmembran

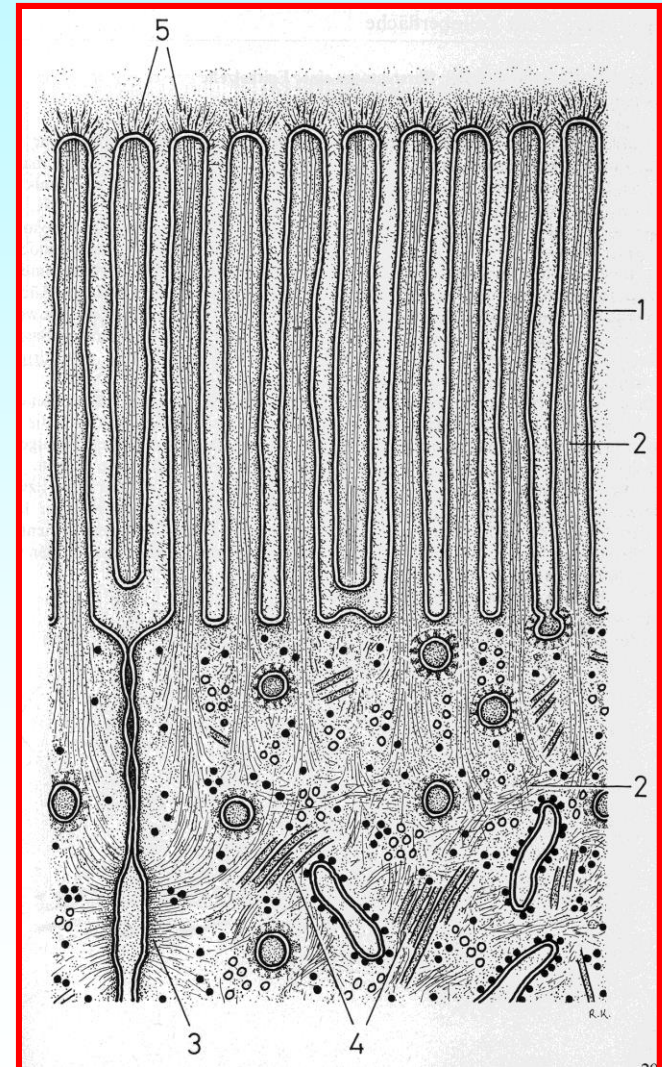
Mikrovilli (100 nm Durchmesser)

Ausstülpungen der Zellmembran

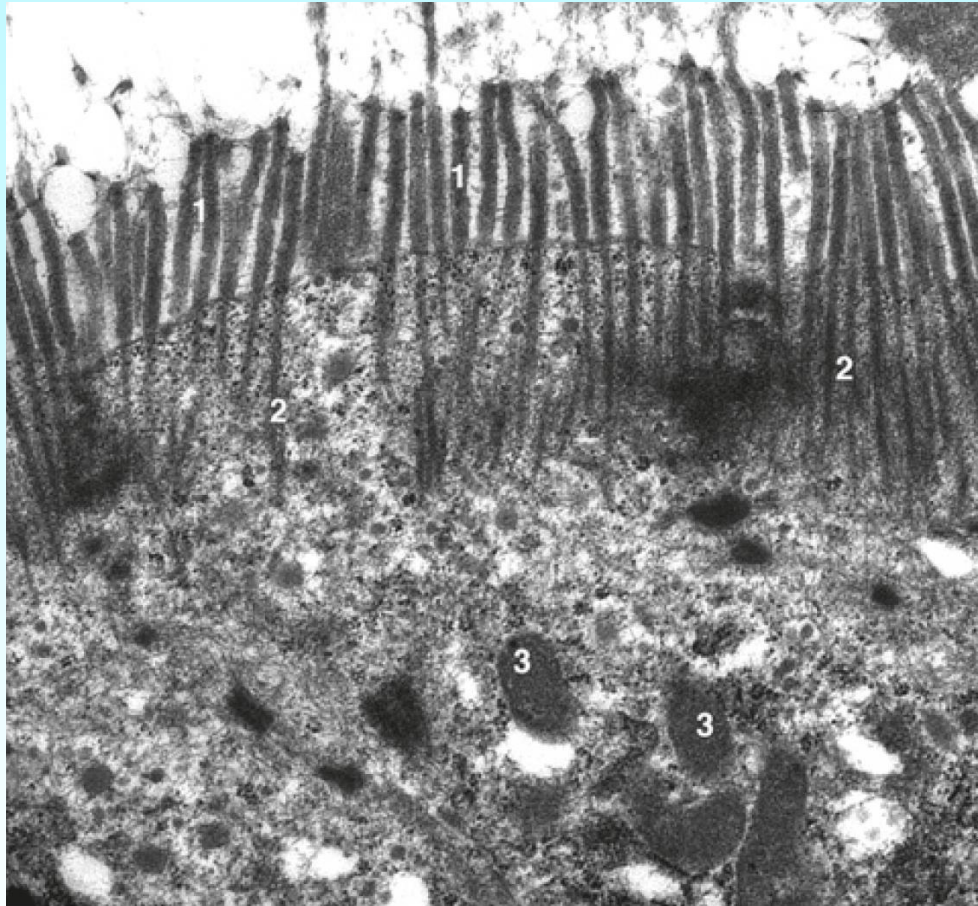
Aktinfilamente

Enzyme

Bürstensaum: Resorption



Mikrovilli, Dünndarm, Rind

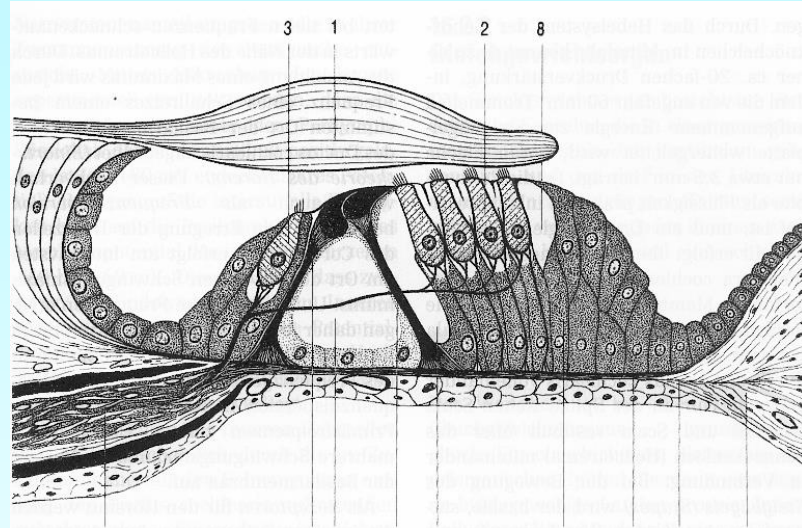


Fimbrin

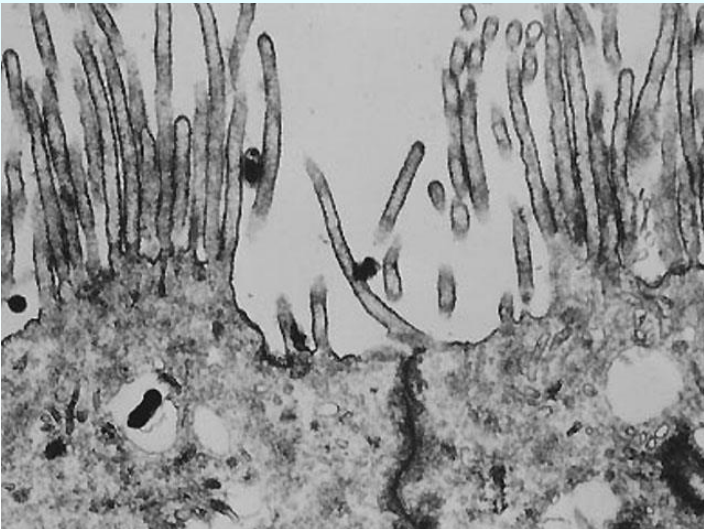
Villin

Terminal web aus Actin-Filamenten

Stereozilien



Unbeweglich
Lange Mikrovilli



Nebenhoden

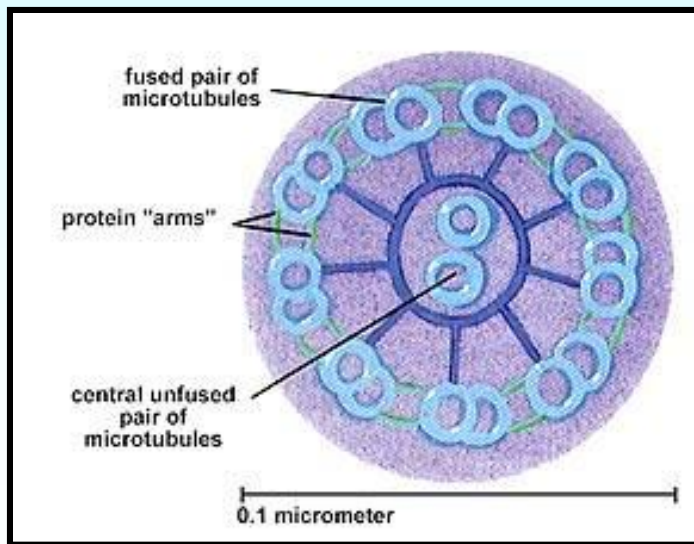
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Kinozilien

Bewegliche Zellfortsätze

Basalkörperchen

Wurzelfasern



Eileiter
Bronchialepithel

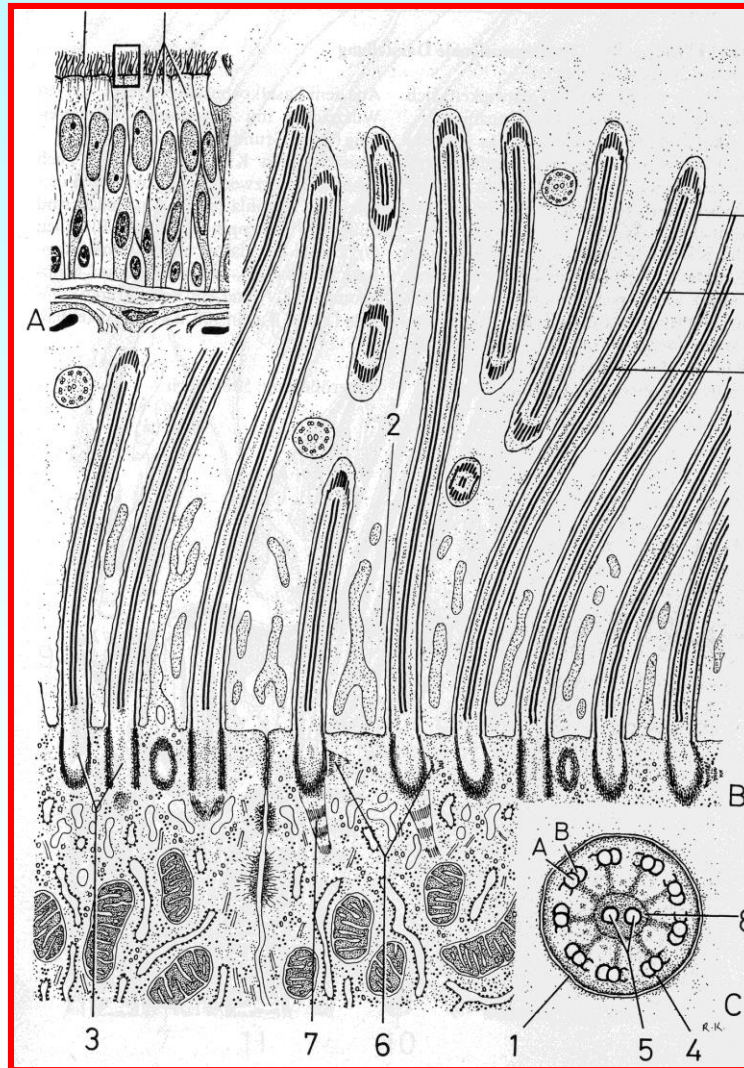
Kinozilien

9 x 2+2 Struktur

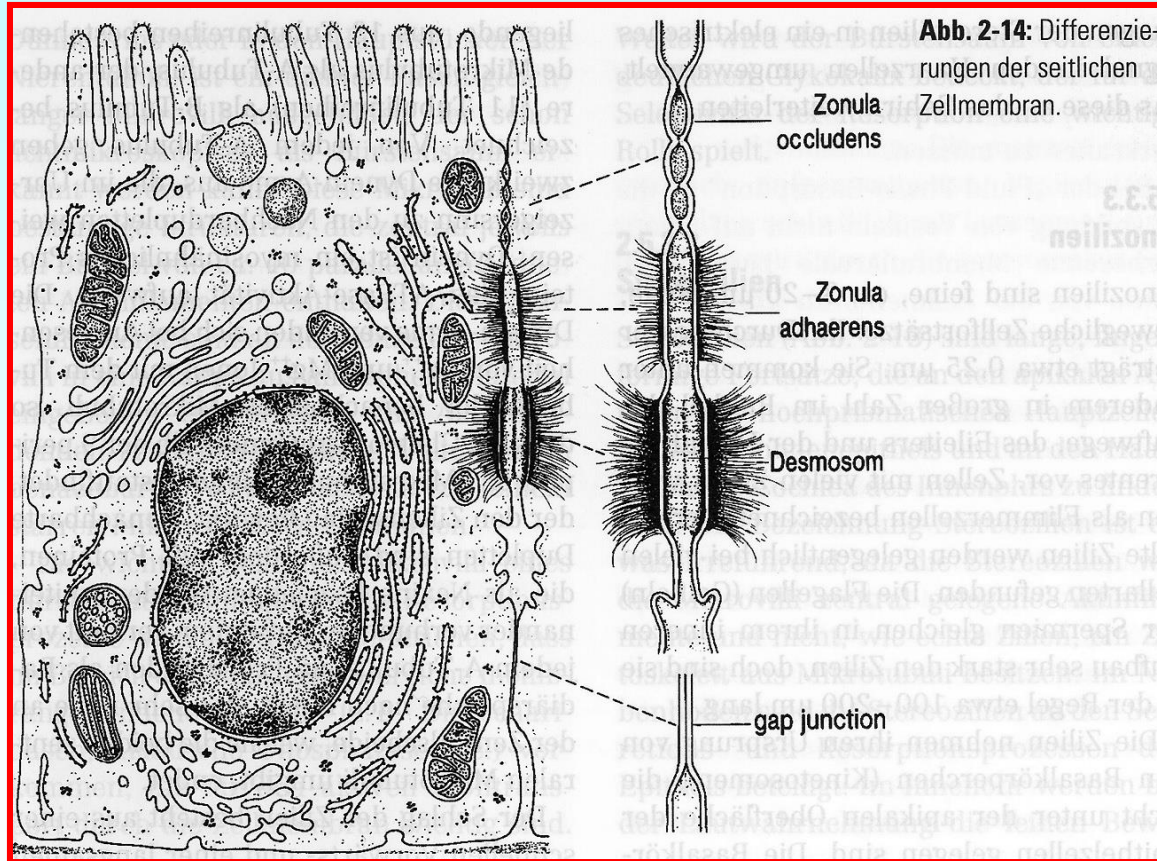
A-Tubulus

B-Tubulus

Dyneinarme



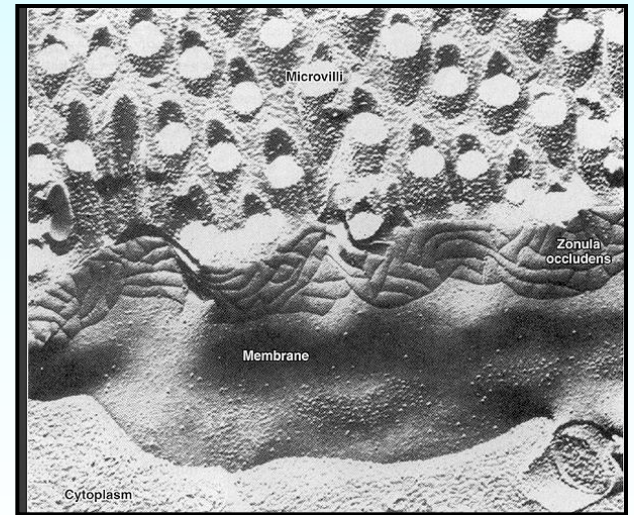
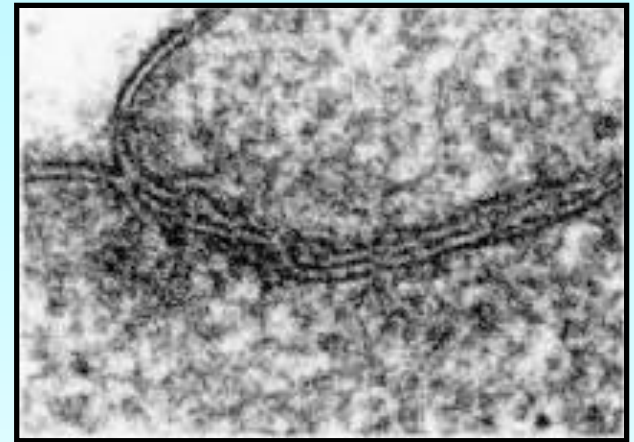
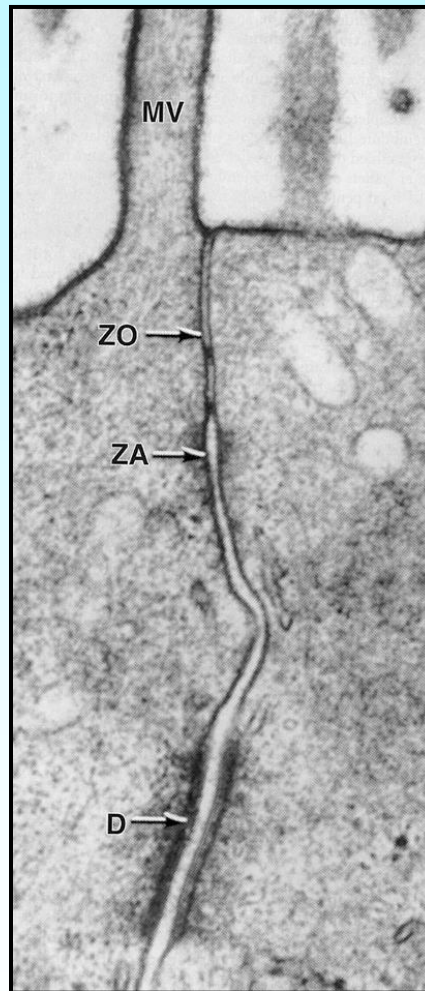
Differenzierungen der seitlichen Zellmembran



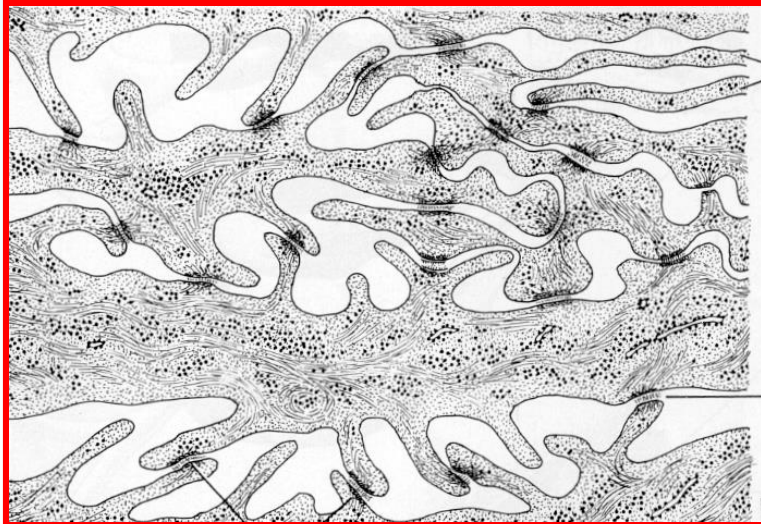
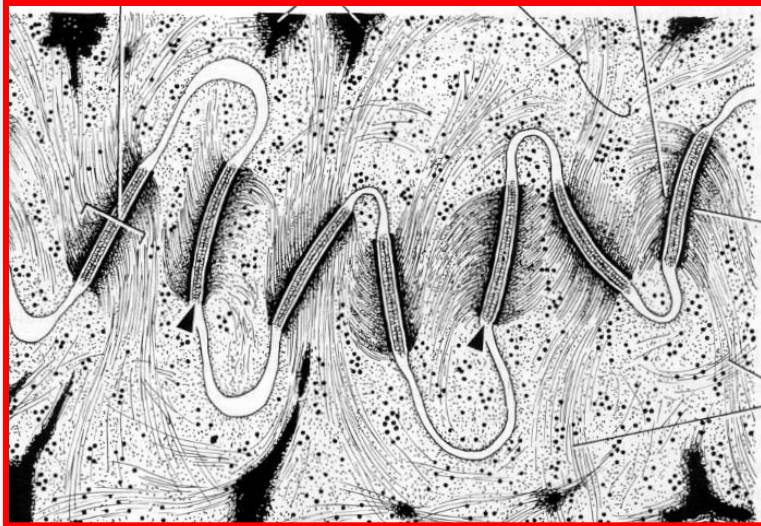
Zonula occludens (Tight junction)

Barrierefunktion

Pentalaminare Struktur



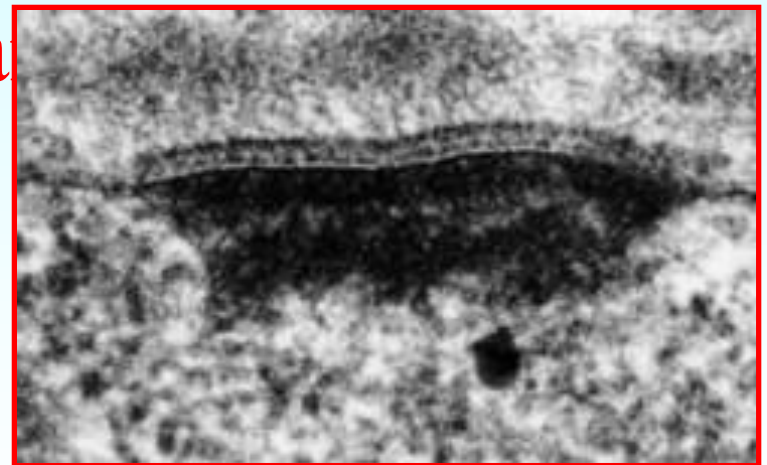
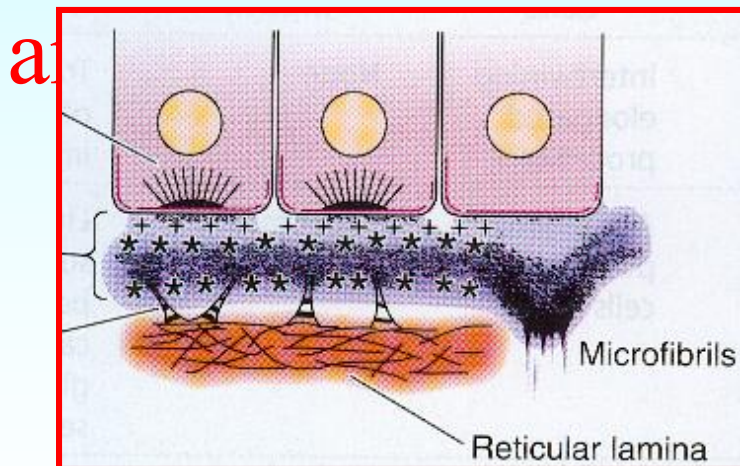
Macula adhaerens (Punktdesmosom)



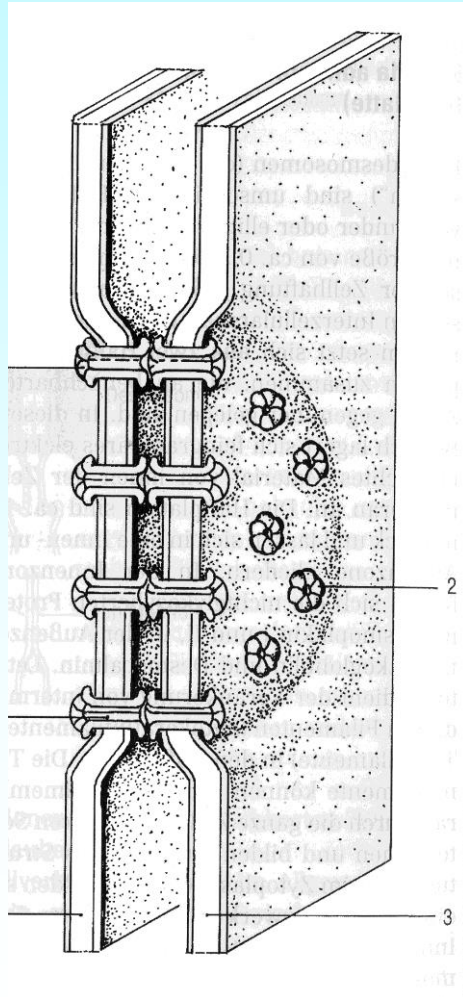
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Hemidesmosom

Nur eine Desmosomenhälfte
ausgebildet



Nexus (Gap junctions)



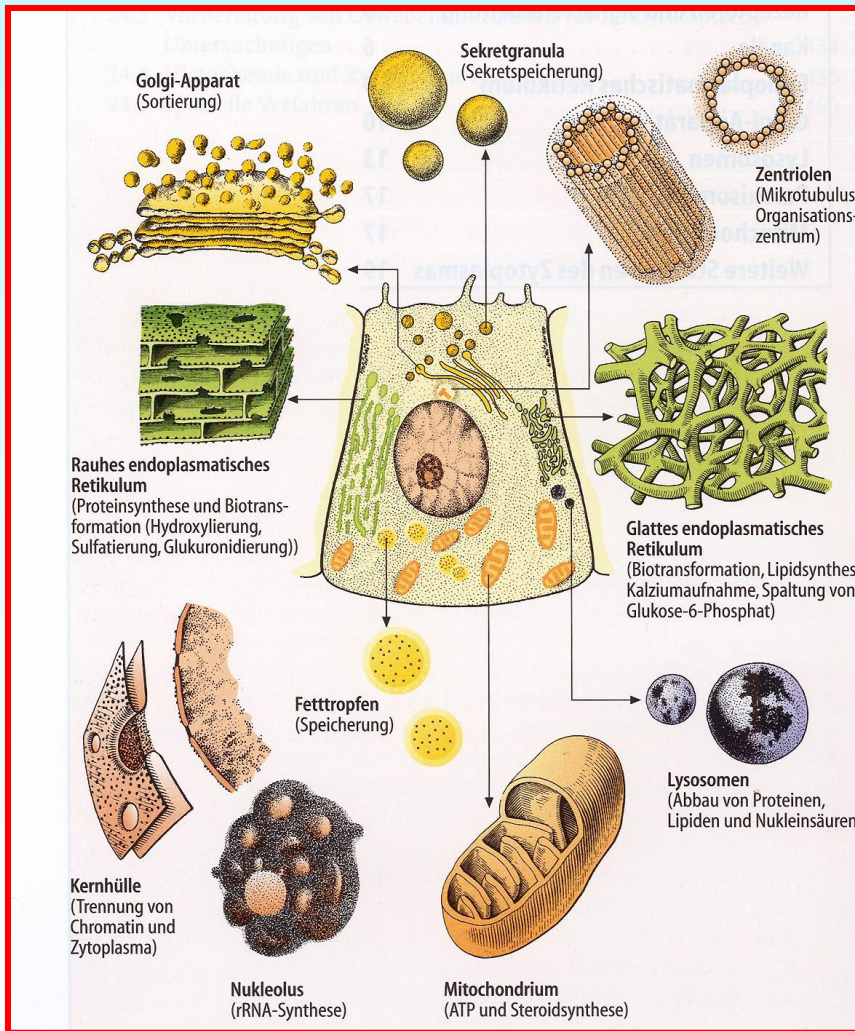
Praktisch ubiquitär (außer:
Skelettmuskulatur, freie
Zellen

Kommunikative Verbindung

Aufgebaut aus Konnexonen

Dienen der metabolischen und
ionalen Kopplung

Zytoplasma



Hyaloplasma

(Grundplasma), homogene

Matrix

Zellorganellen

Membranbegrenzte

Zellorganellen

Nicht membranbegrenzte

Zellorganellen

Metaplasmatische

Strukturen

Paraplasma: Reserve- und

Speicherstoffe

Mitochondrien

Energieproduzenten

Aufbau

Äußere Membran

Innere Membran

Atmungskette

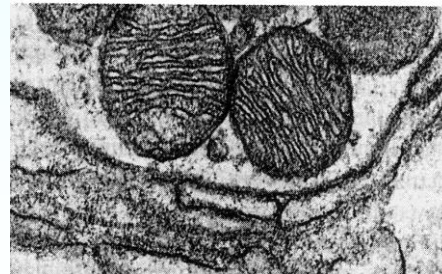
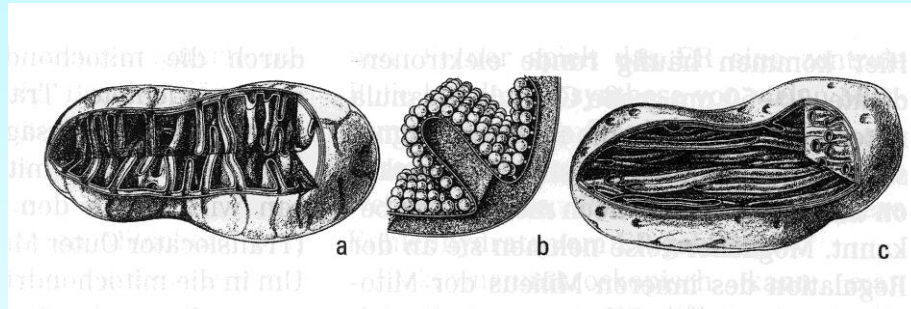
Oxidative Phosphorylierung

Mitochondrienmatrix

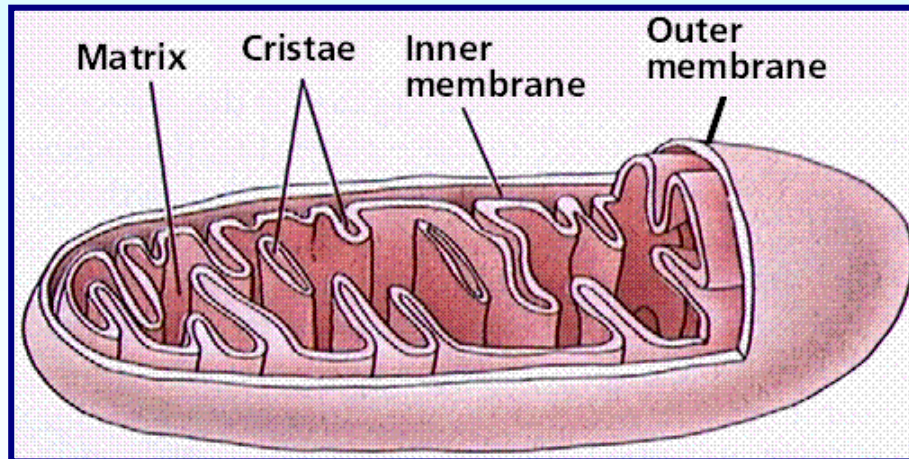
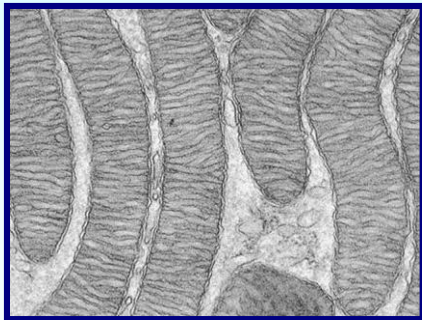
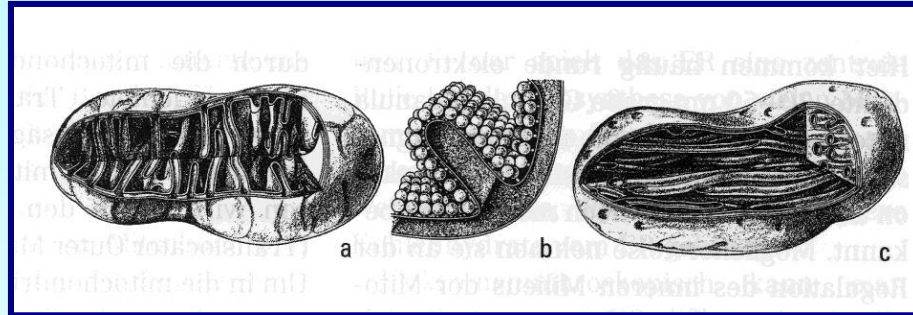
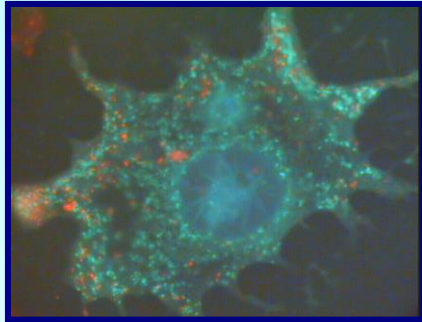
Zitronensäurezyklus

Fettsäureabbau

Mitochondrien vom Cristae-Typ
Mitochondrien vom Tubulus-Typ



Mitochondrien



Eigene DNA
Eigene Ribosomen

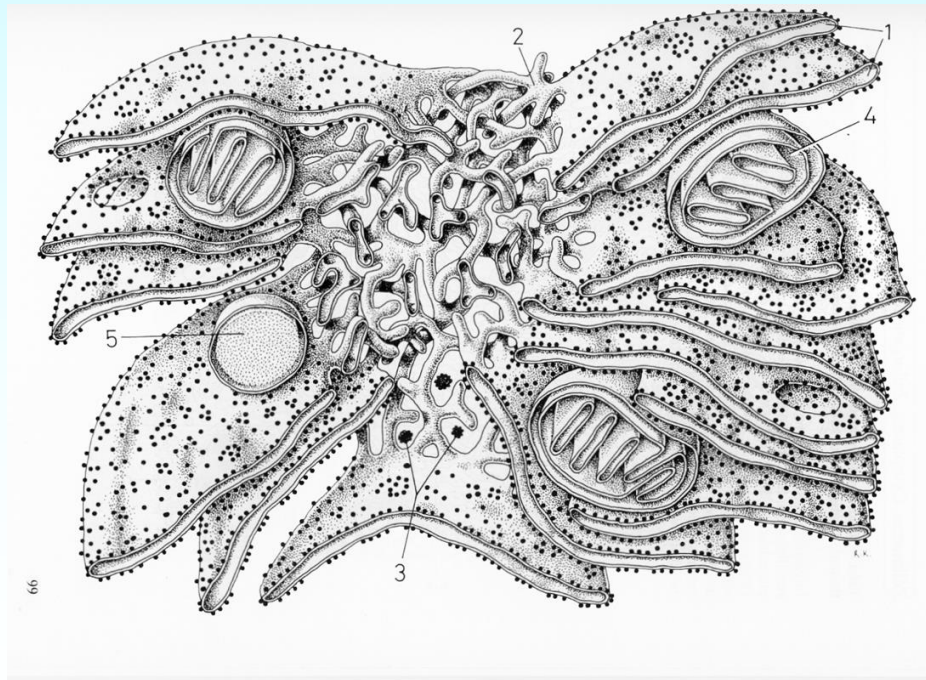
Symbiontische Bakterien
Maternale Vererbung

Endoplasmatisches Reticulum

Intrazelluläre Kompartimentierung

Glattes endoplasmatisches Retikulum

Raues endoplasmatisches Retikulum mit Ribosomen

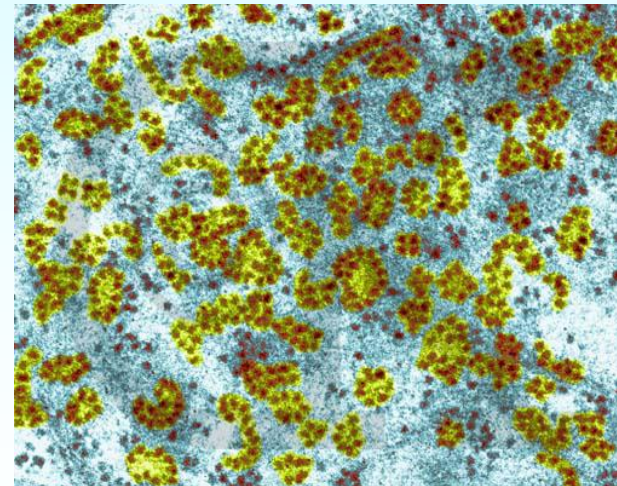
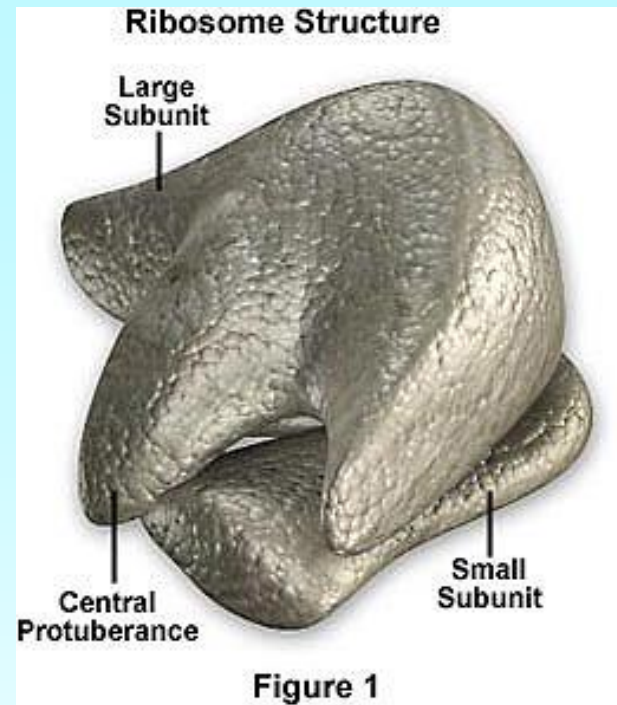
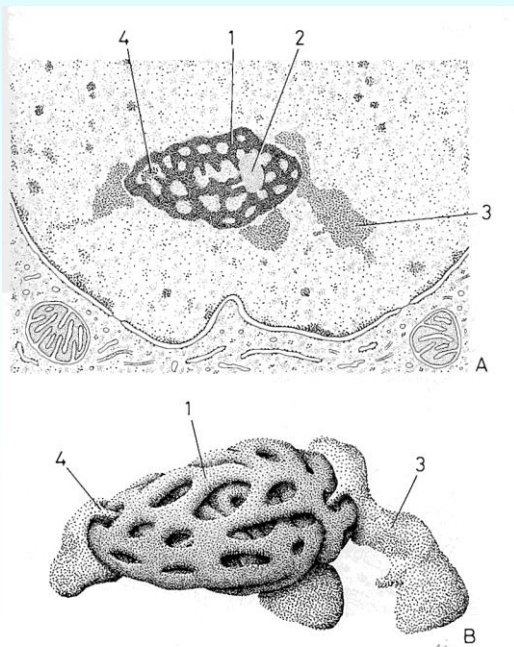


Ribosomen

Große Untereinheit (60S)

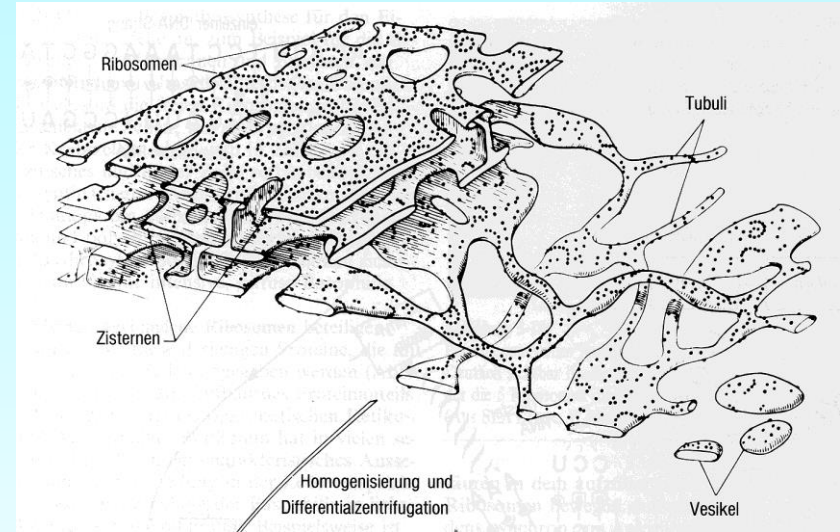
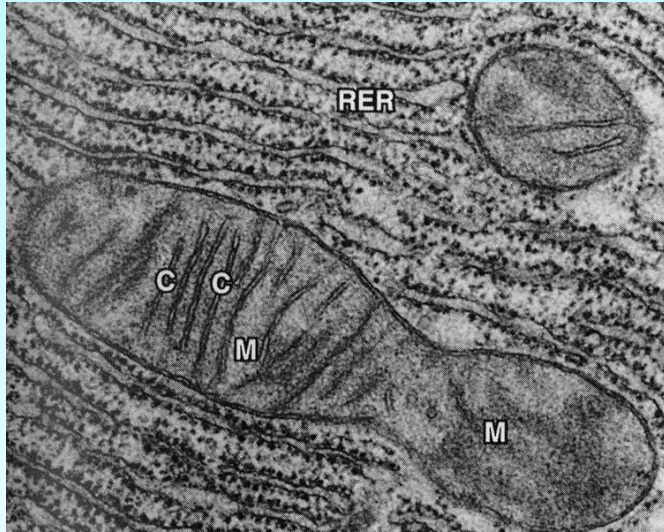
Kleine Untereinheit (40S)

Im Nucleolus gebildet, im
Zytoplasma zusammengesetzt



Polyribosomen: Proteinsynthese

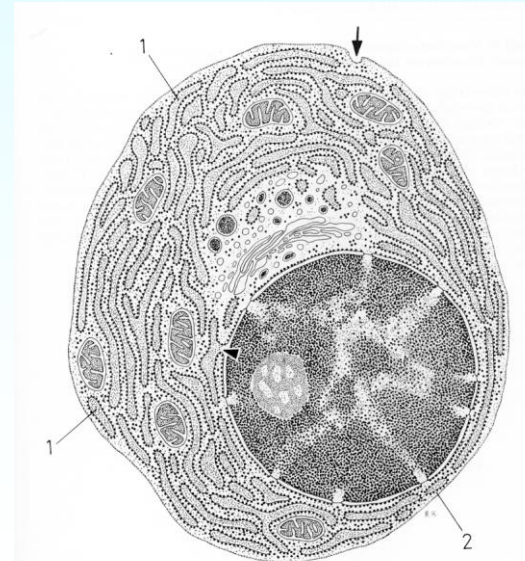
Raues Endoplasmatisches Reticulum



Raues ER

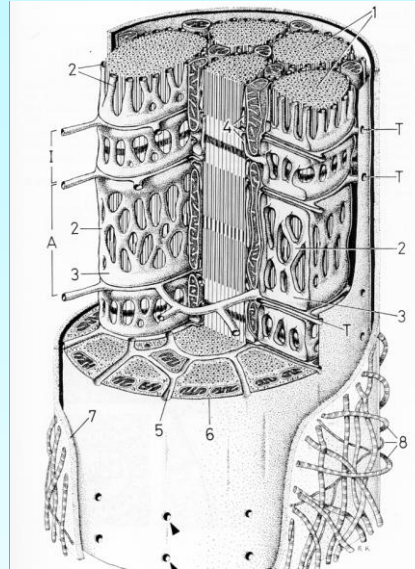
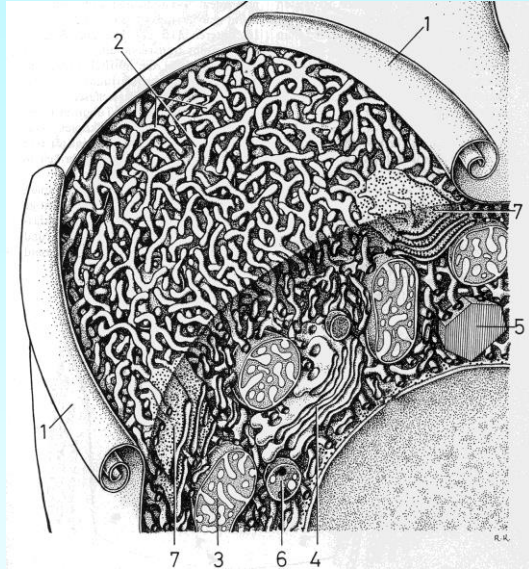
basophil, Ergastoplasma

Proteinsynthese:
Exportproteine



Plasma-Zelle

Glattes Endoplasmatisches Reticulum



Glattes ER

komplex Lipide und Steroidhormone

Speicher für Ca^{2+} -Ionen

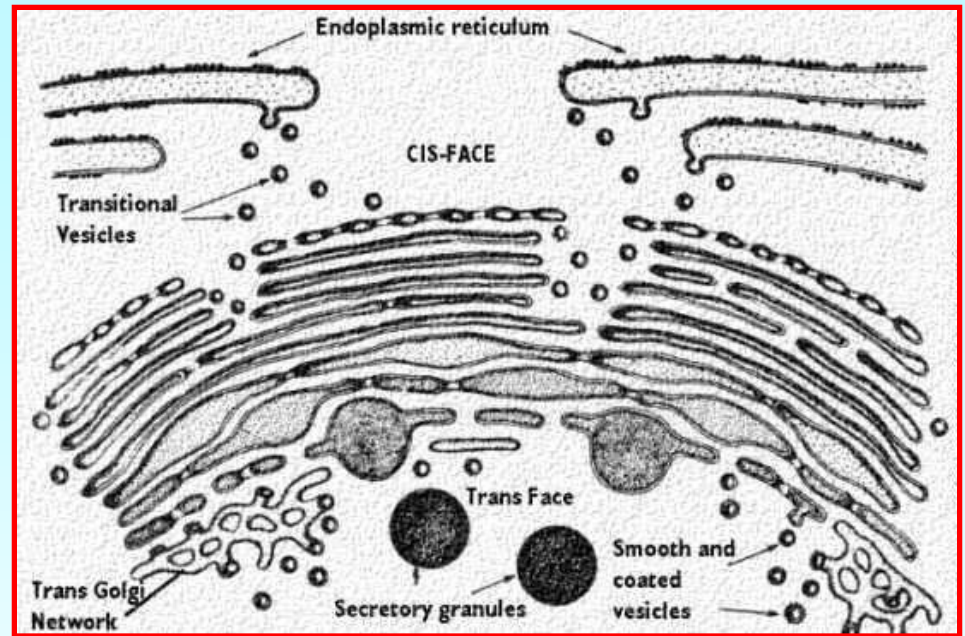
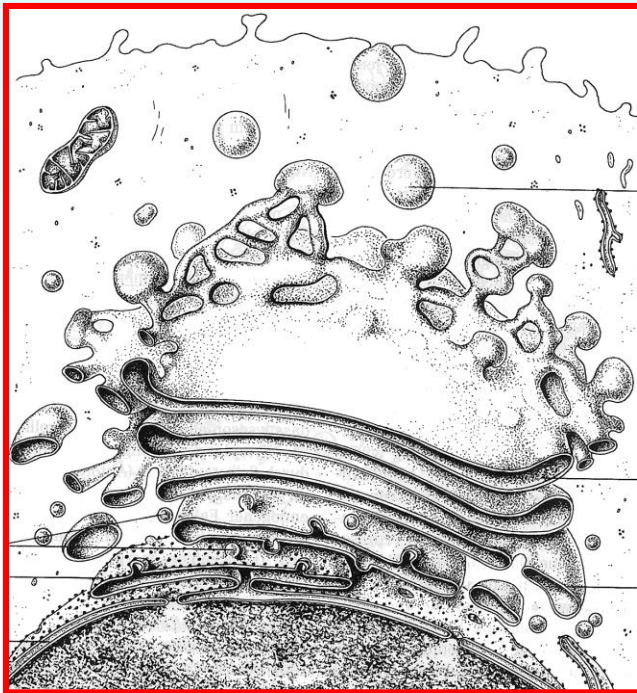
Glykogensynthese

Golgi-Apparat

Dictyosomen

Stapel von Zisternen und Vesikel

cis-Seite und trans-Seite

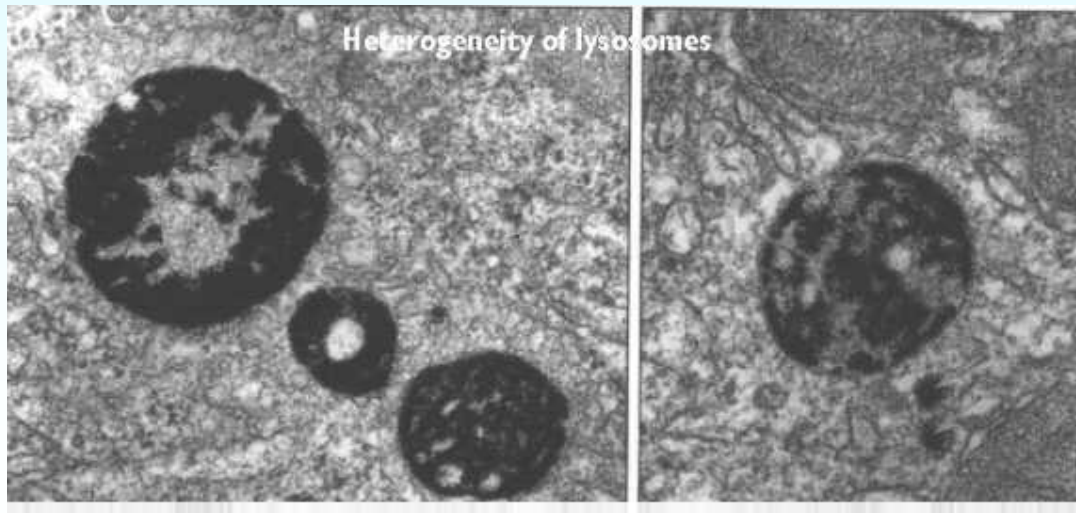
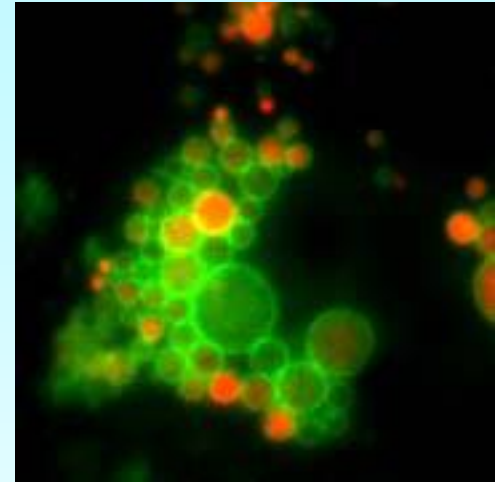


Lysosomen

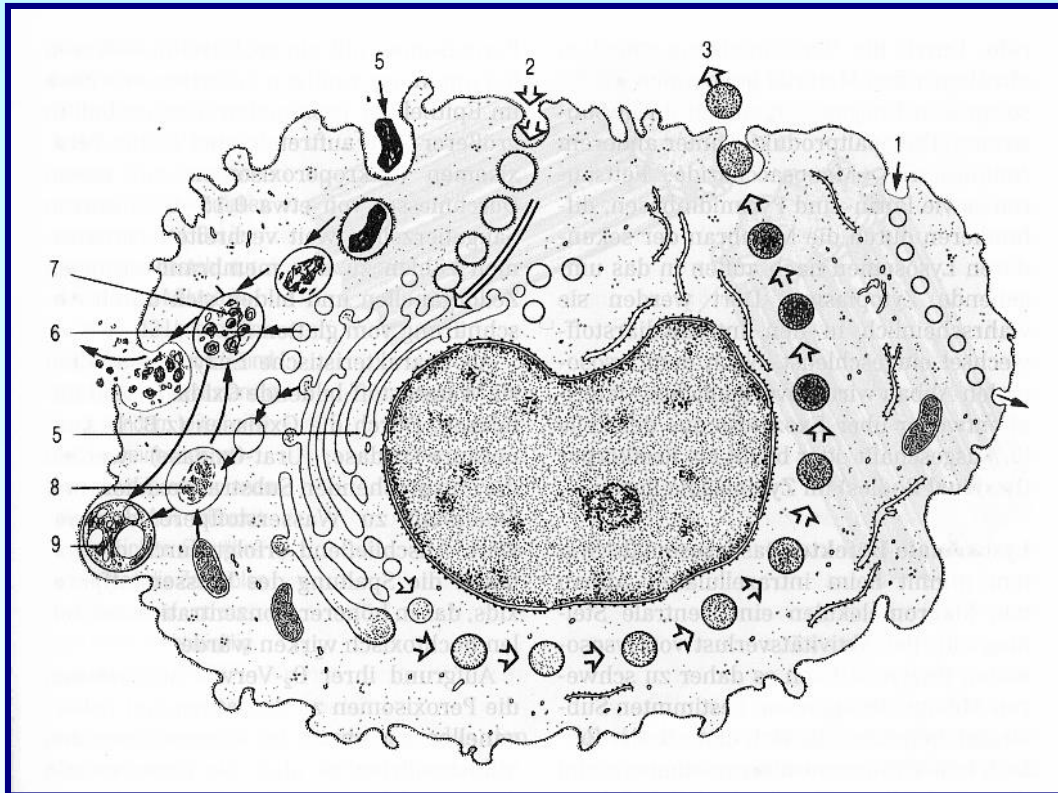
Intrazelluläres Verdauungssystem

Hydrolytische Enzyme

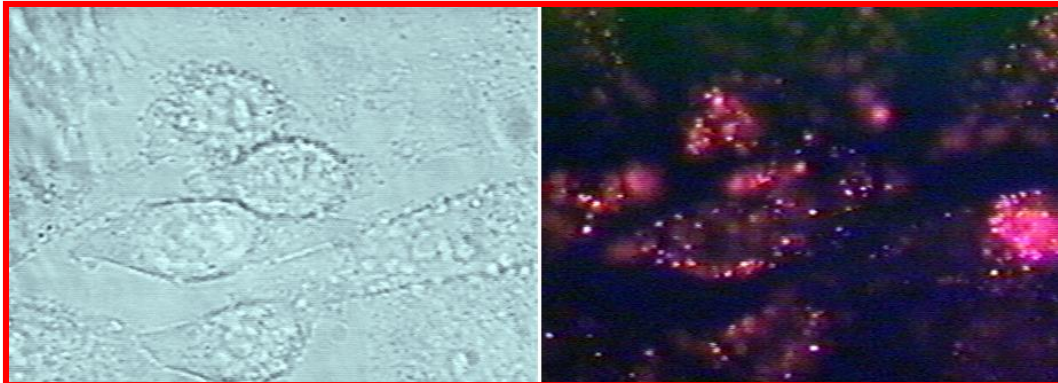
Leitenzym: Saure Phosphatase



Lysosomen



Primäre
Lysosomen
Sekundäre
Lysosomen
Autolysosomen
Heterolysosomen
Restkörper



Peroxisomen

Enzyme: Oxidasen, Katalase

Funktionen

Fettstoffwechsel

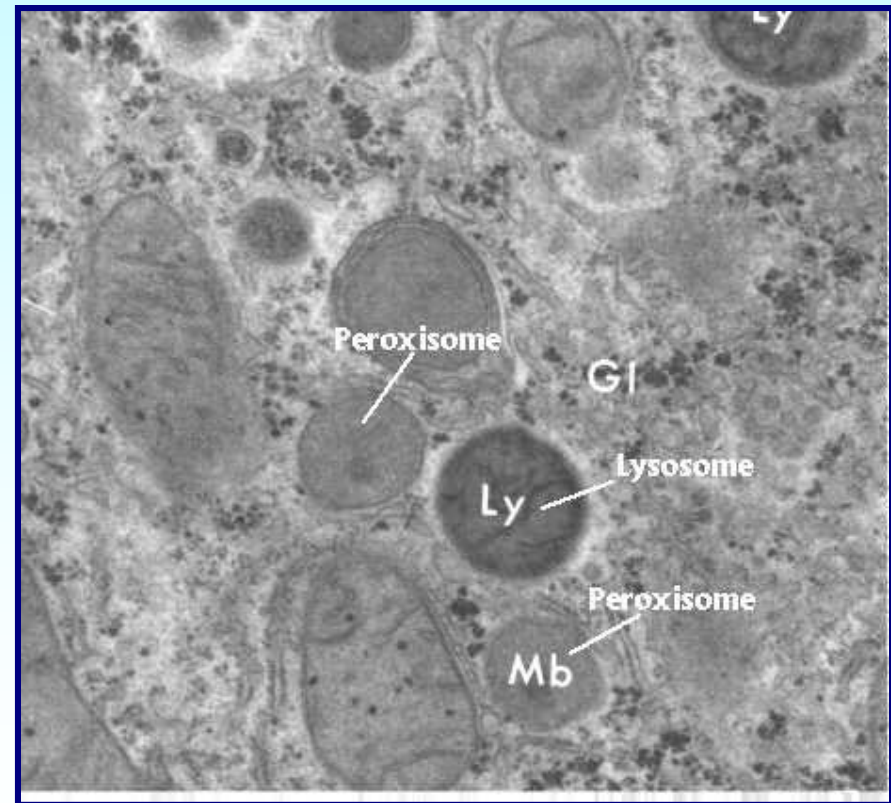
Gluconeogenese

Entgiftung

Zellweger-Syndrom

Fehlen der Peroxisomen

Zerebral-hepatisch-renales Syndrom



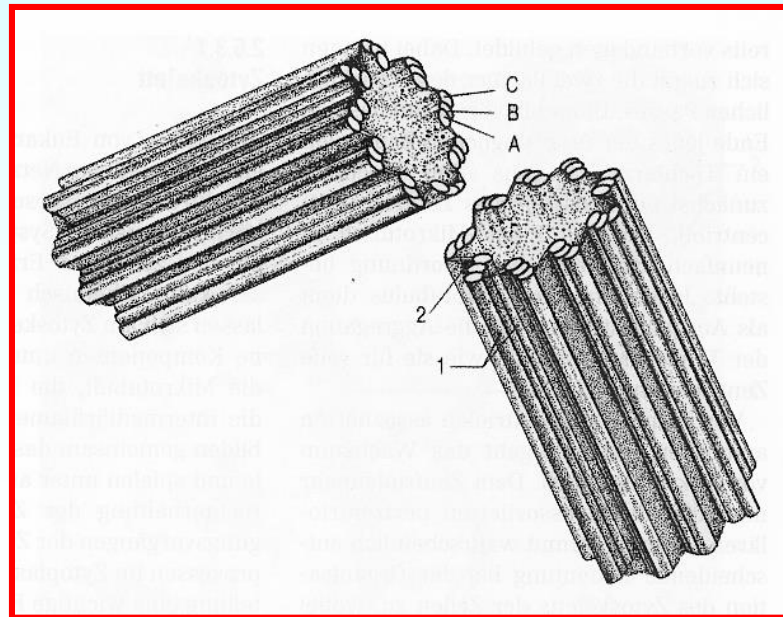
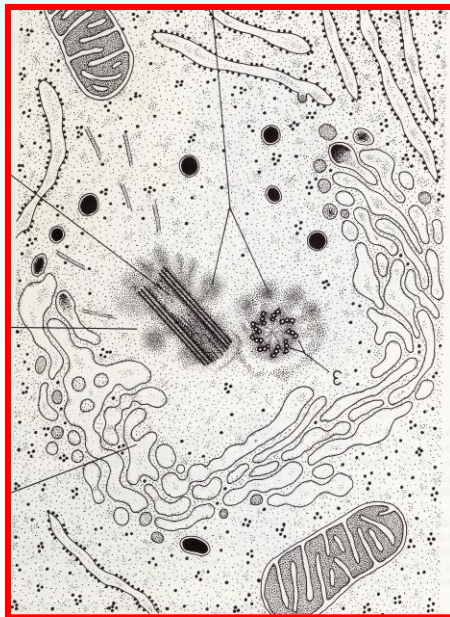
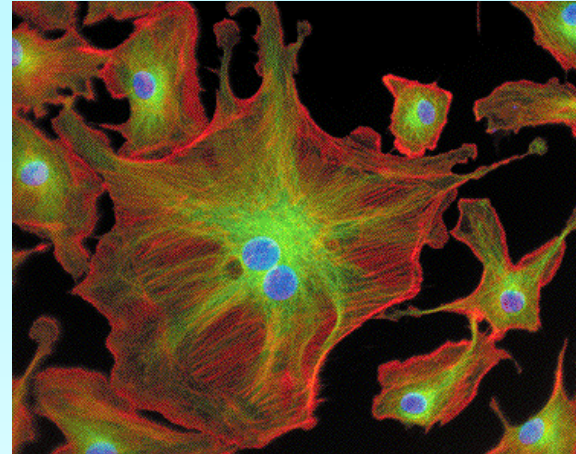
Zentriol

Mikrotubuli: 9 x 3 Struktur

Perizentrioläres Material

Zellteilung

Organisation des Zytoskeletts



Metaplasma

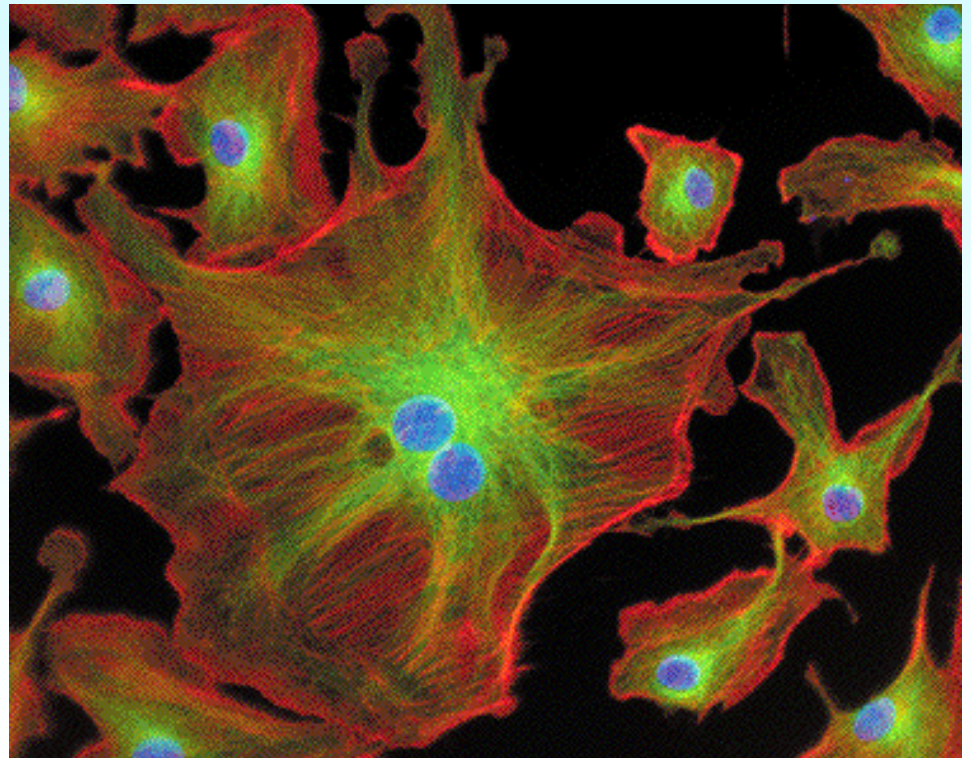
„Berufsstrukturen“ der Zelle

Zytoskelett:

Aktin

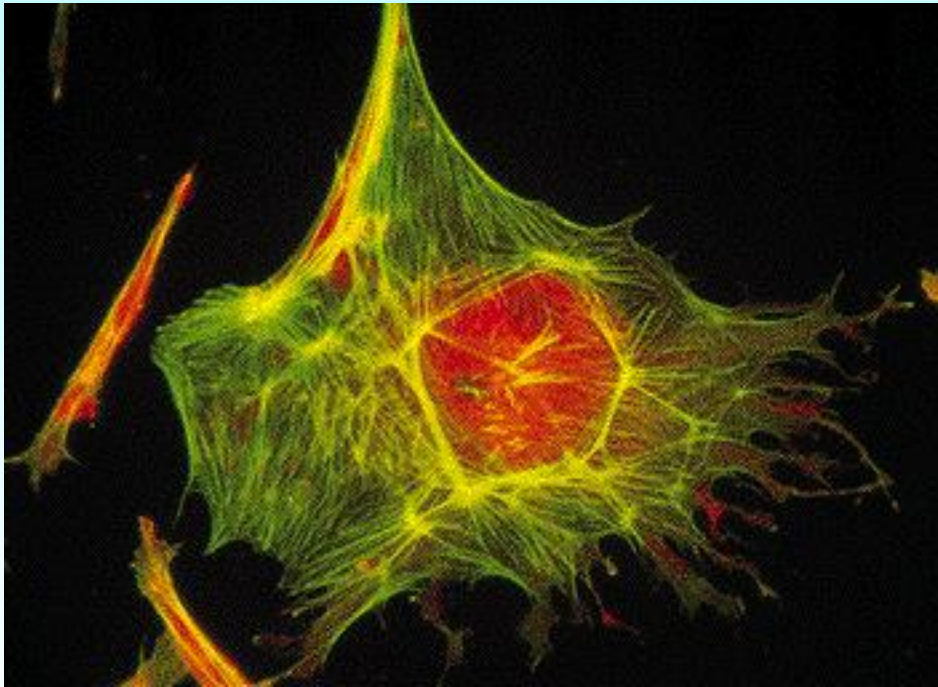
Mikrotubuli:

Intermediärfilamente:



Aktin-Filamente

Mikrofilamente: Durchmesser 5-7 nm



Aktin G

Aktin F

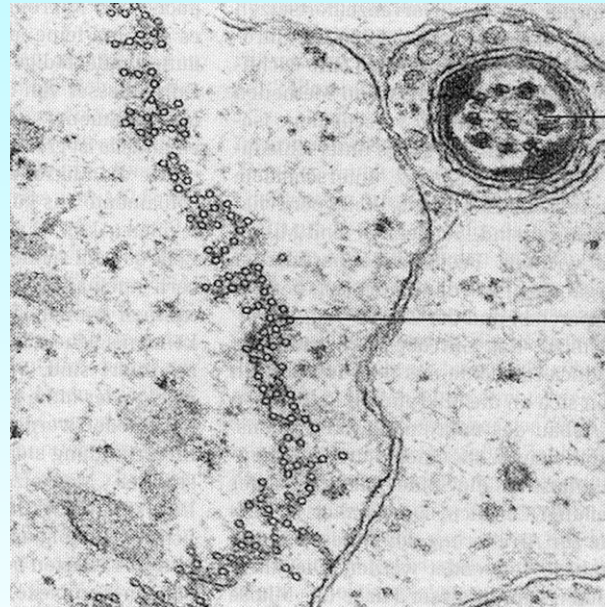
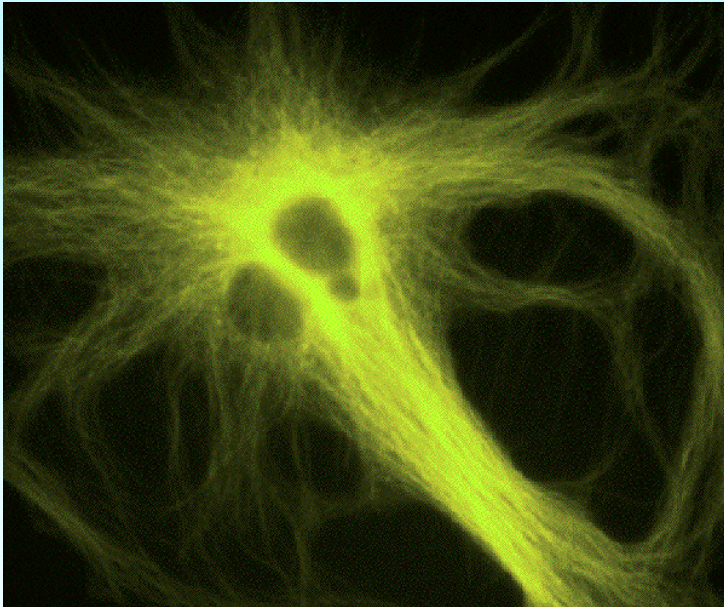
Aktin-Myosin

Aktin-bindende Proteine

Filamin: Gelzustand des Zytoplasmas

Gelsolin: Trennung der Aktinfilamente

Mikrotubuli



Durchmesser 24 nm

Tubulin, 13 Protofilamente

Intermediärfilamente

Durchmesser 8-10 nm

Faserige Polypeptide

Stabilste Komponente des Zytoskeletts

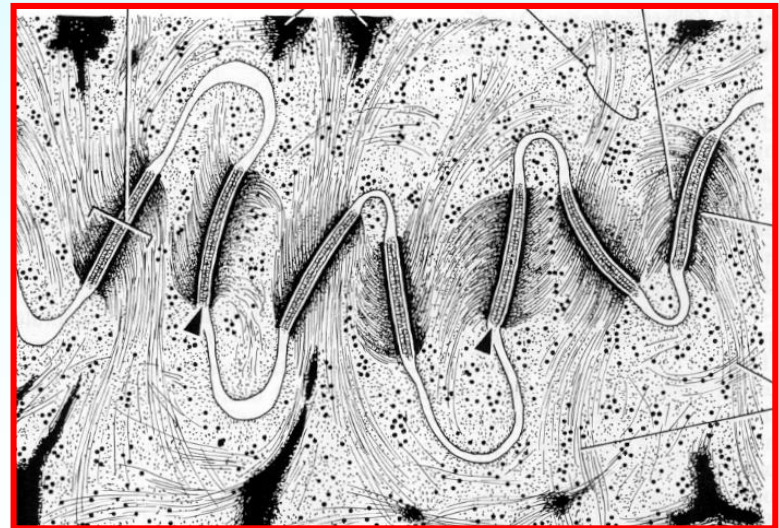
Chemisch unterschiedlich

Zytokeratine

Vimentin

Desmin

Neurofilamente



Zytoskelett

Tabelle 2-2: Bestandteile des Zytoskeletts

		Durchmesser	Protein	Vorkommen
Aktinfilamente		6 nm	G-Aktin	In allen Zellformen
Intermediäre Filamente				
	Klasse I	8–11 nm	Saure Keratine	Epithelzellen, Derivate der Epidermis
	Klasse II	8–11 nm	Basische Keratine	Epithelzellen
	Klasse III	8–11 nm	Vimentin	Viele mesenchymale Zellen
		8–11 nm	Desmin	Muskelzellen
		8–11 nm	Glial Fibrillary Acidic Protein	Astrozyten
	Klasse IV	8–11 nm	Neurofilamentäres Tripletprotein	Nervenzellen
	Klasse V	8–11 nm	Nukleäre Lamine	Zellkern
Mikrotubuli		25 nm	Tubulin, Dimer aus α -, β -Tubulin	In allen Zellformen im Zentriol, als Bestandteil der Mitosespindel, in Zilien und Basalkörperchen

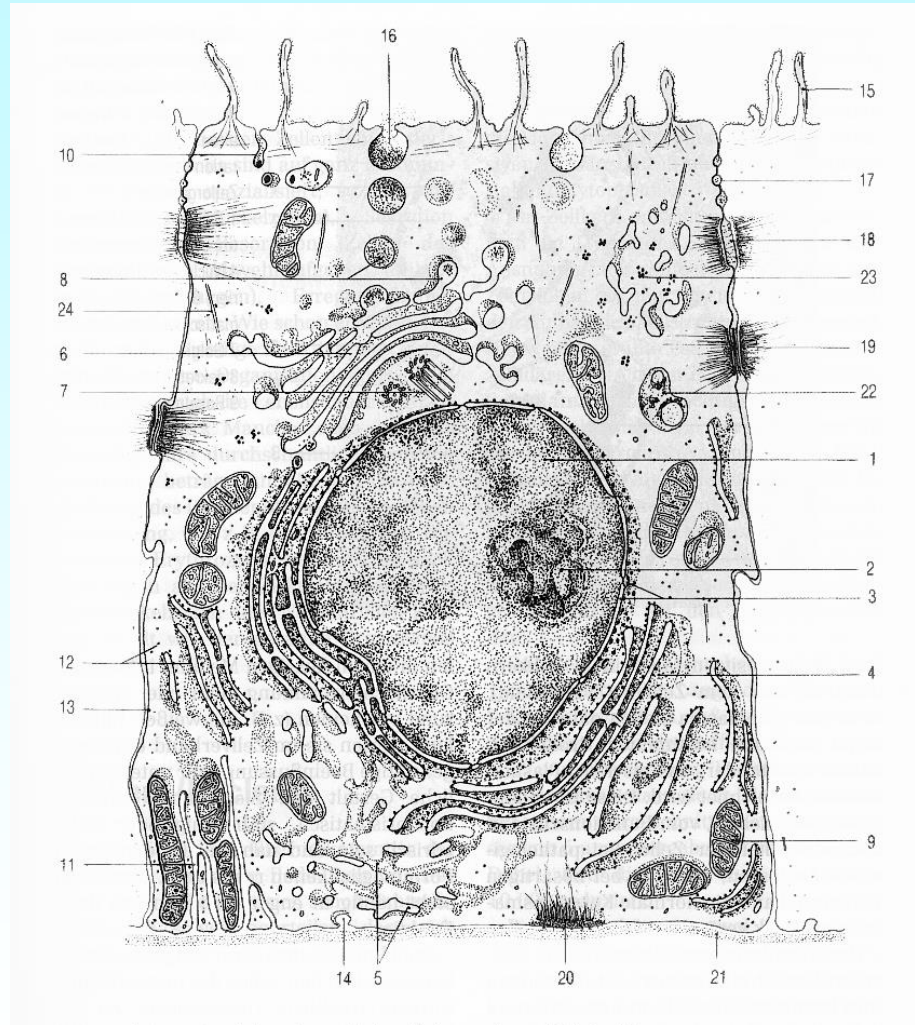
Paraplasma (Zytoplasmatische Einschlüsse)

Sekretgranula

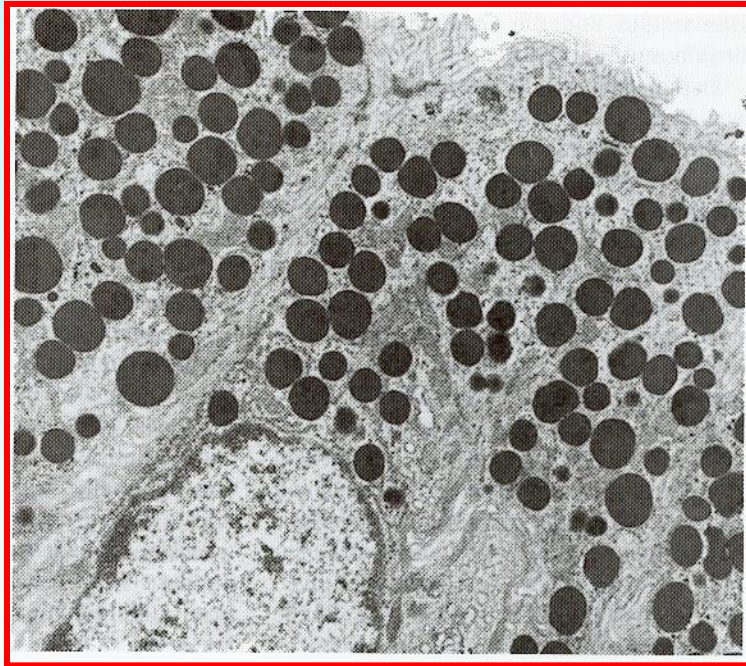
Glykogen

Lipidtropfen

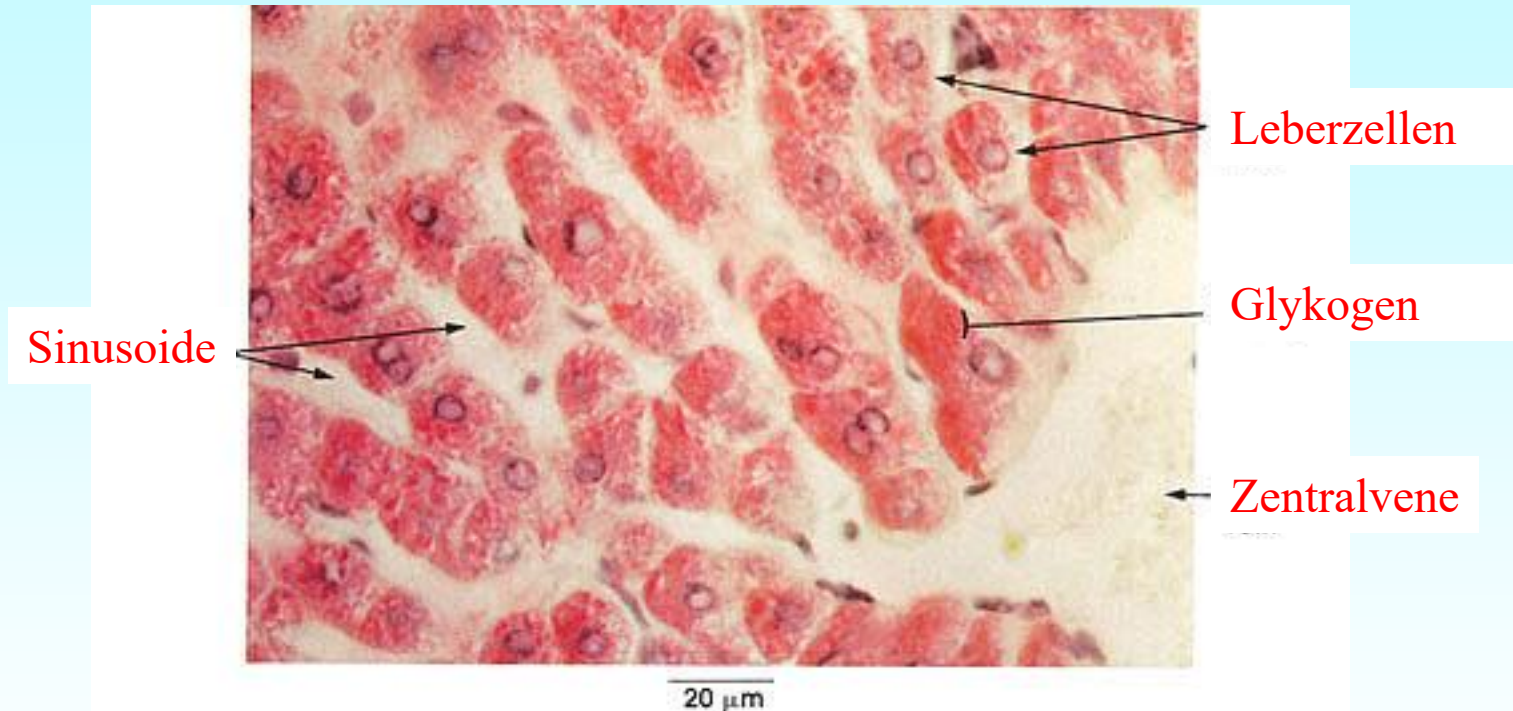
Pigmente



Sekretgranula

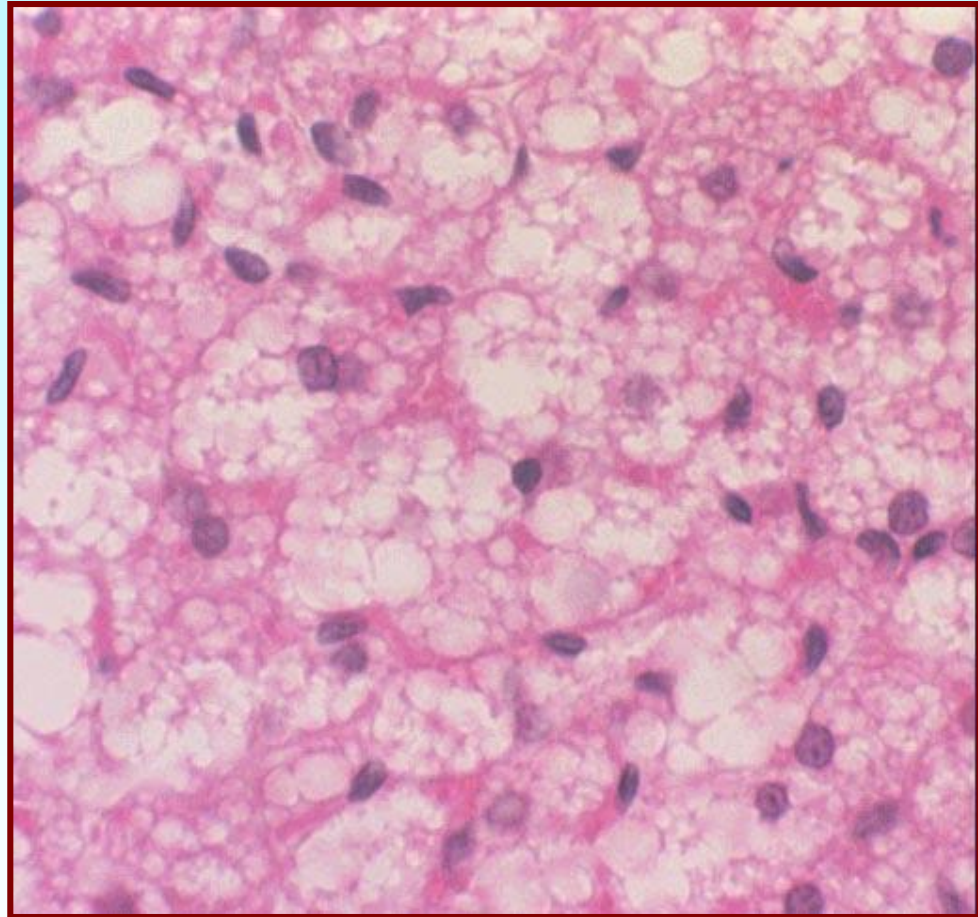
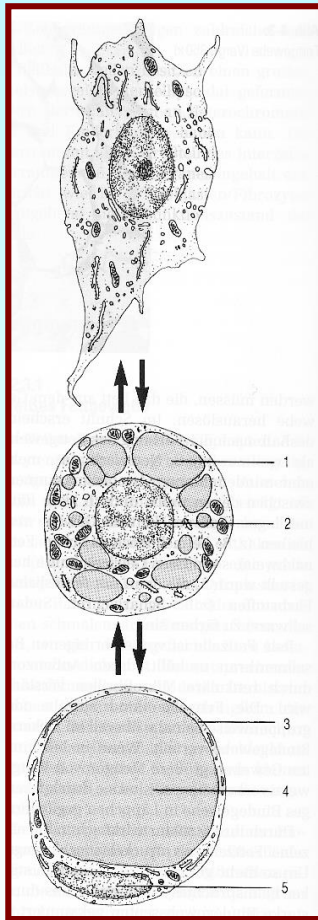


Glykogen



PAS-Reaktion (Perjodsäure-Schiff-Reaktion)

Lipidtropfen



Gefrierschnitte

Sudan III-Rot, Osmiumtetroxid

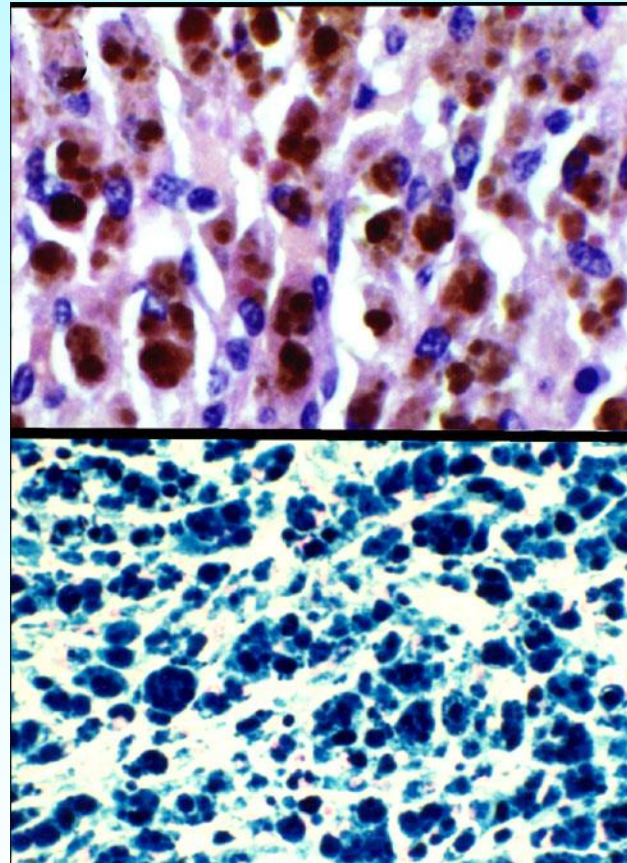
Daniela Rodler und Fred Sinowatz

Pigmente

Endogene



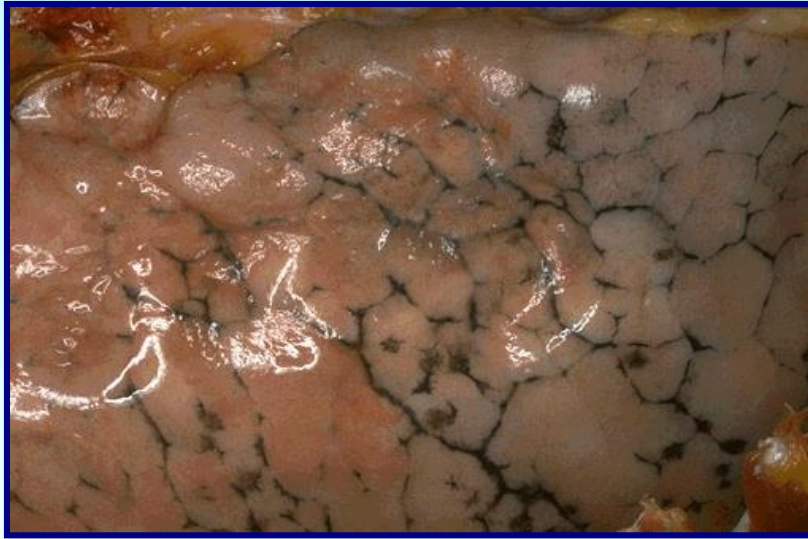
Melanin



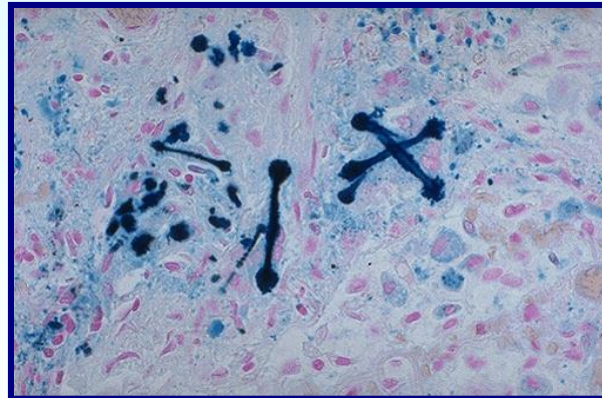
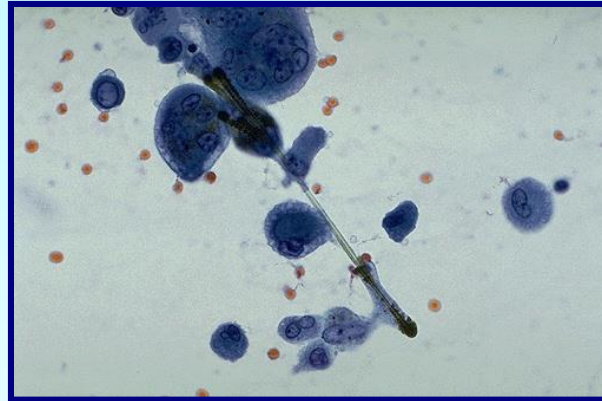
Hämosiderin

Pigmente

Exogene Pigmente

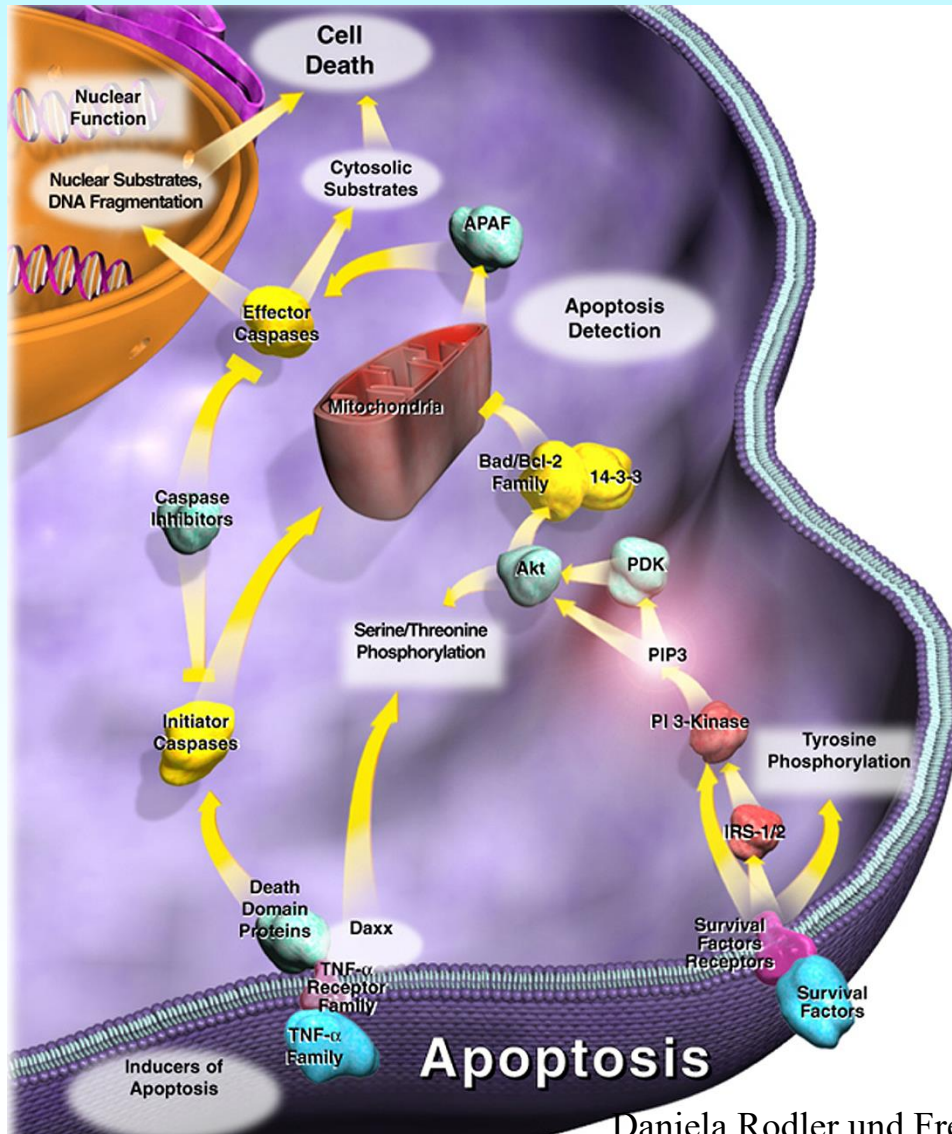


Ruß



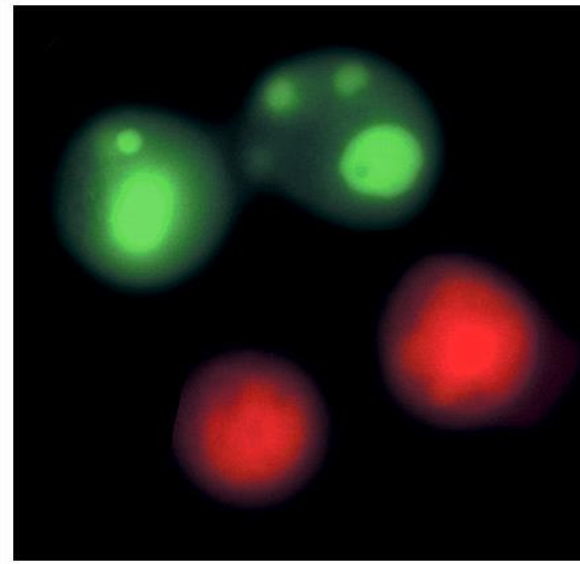
Asbest

Apoptose (Programmierter Zelltod)



Unterscheide: Nekrose

Initiator-Caspasen
Effektor-Caspasen
Apoptotic bodies



Zellteilung

Mitose (indirekte Kernteilung)

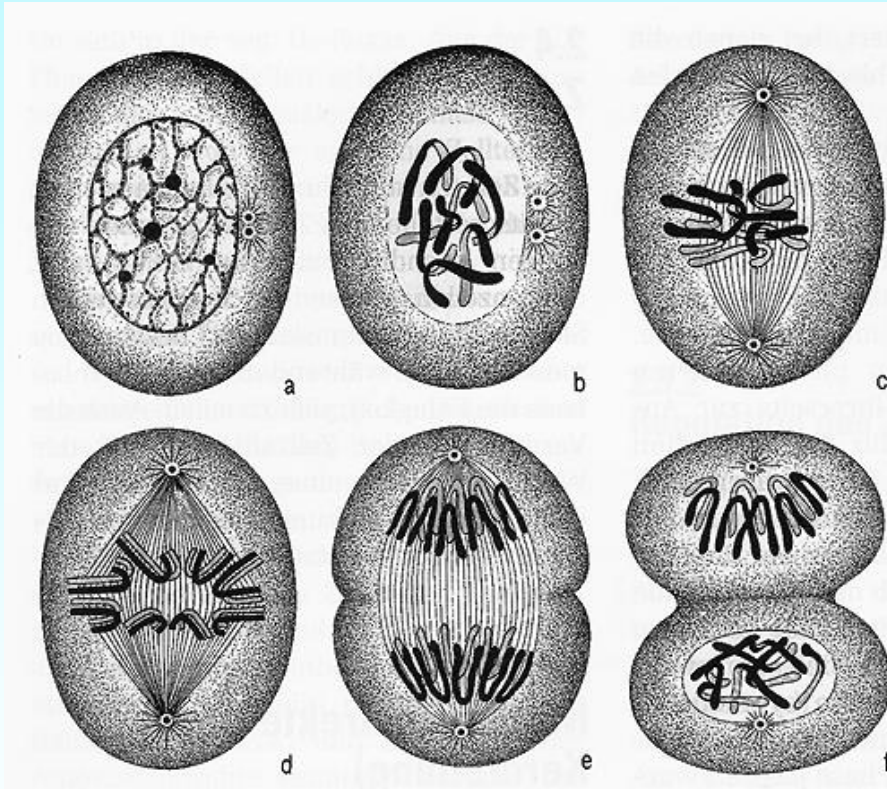
Zytokinese

Äquale Zellteilung

Differentielle Zellteilung

Meiose

Mitose



Prophase

Spiralisierung der Chromosomen

Metaphase: Monaster

Spindel aus Mikrotubuli

Polare Mikrotubuli

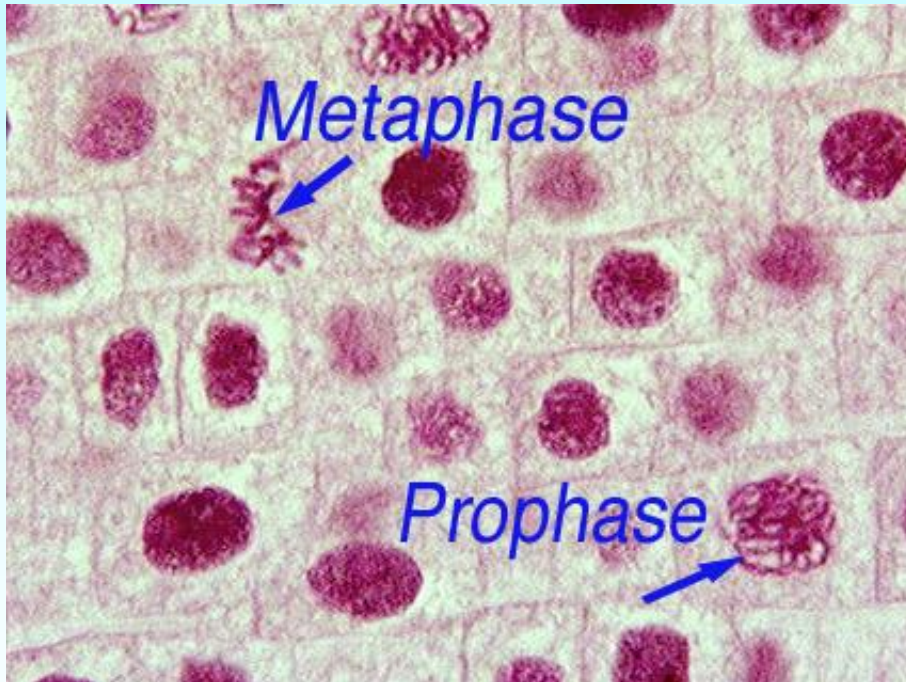
Kinetochoresmikrotubuli

Anaphase: Diaster

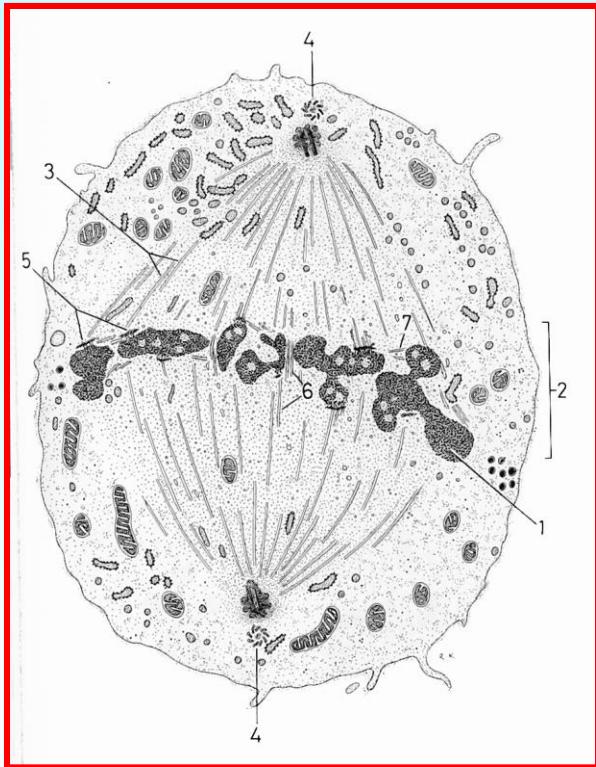
Telophase 2 Tochterzellen

Äquatorialebene

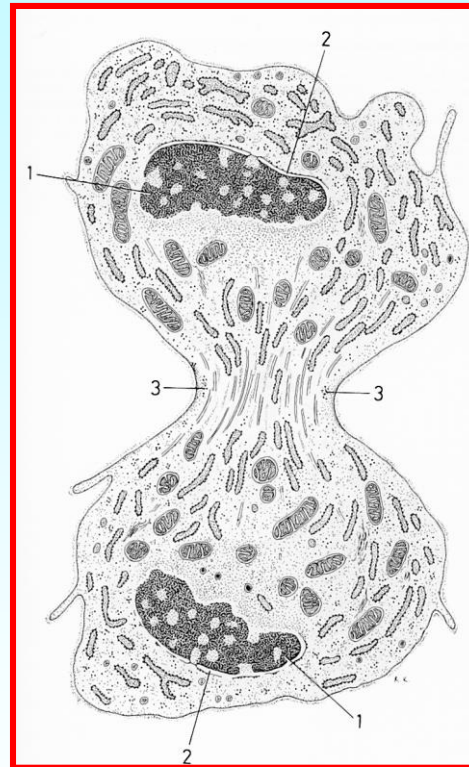
Mitose



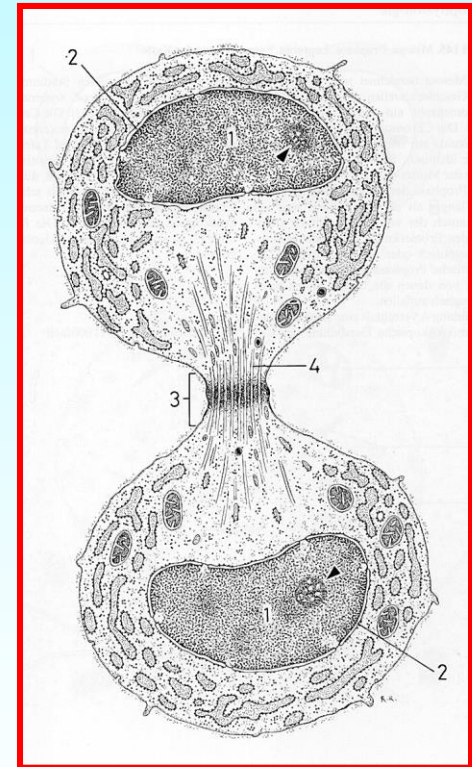
Ultrastruktur der Mitose



Metaphase



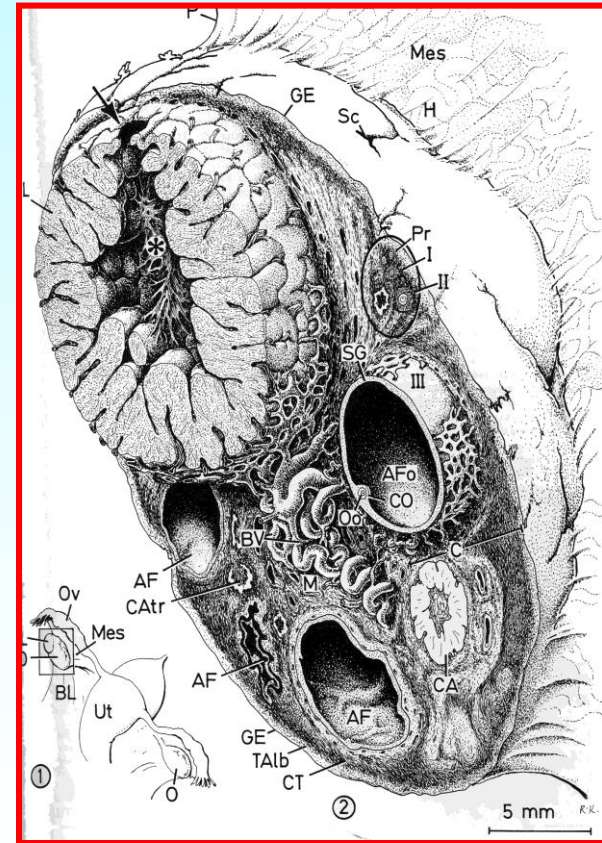
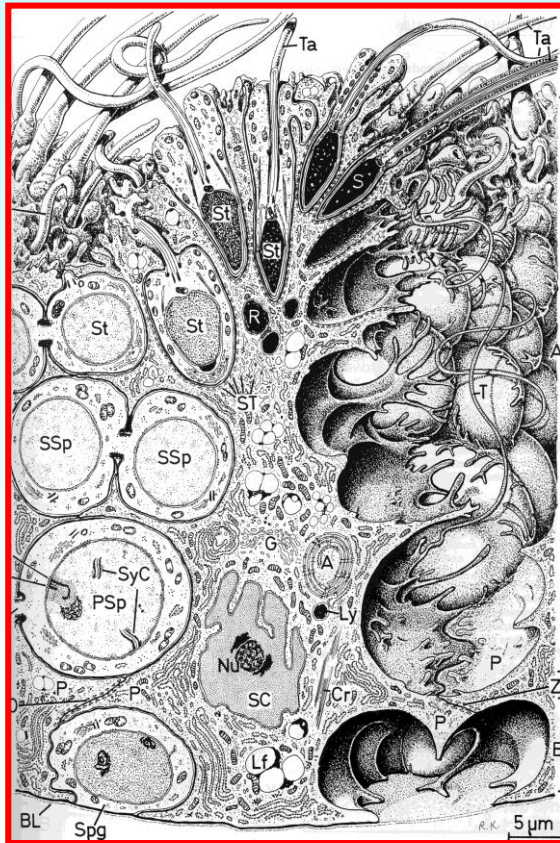
Anaphase



Telophase

Meiose (Reduktionsteilung, Reifeteilung)

Nur bei Bildung der Keimzellen



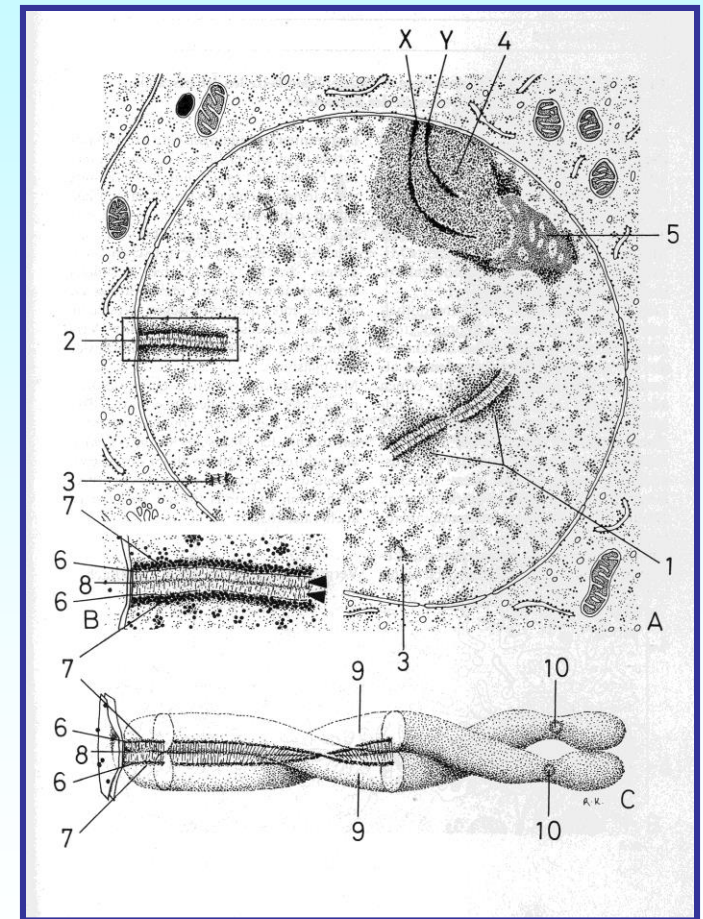
Meiose (Reduktionsteilung, Reifeteilung)

Reduzierung des diploiden Chromosomensatzes zu einem haploiden

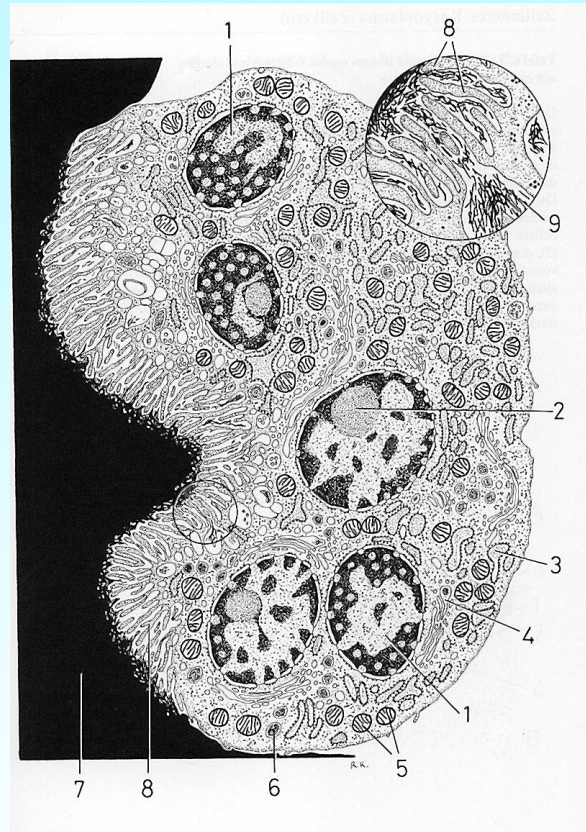
Lange Prophase: Austausch von genetischem Material

Trennung ganzer Chromosomen

Synaptonemaler Komplex



Weitere Teilungsformen



Endomitose

Amitose