General Surgical Sciences Examination Tips and Resources

Matthew Jacob Smith

GSSE Basics

- Digital MCQ examination covering anatomy, physiology, and pathology
- Pre-requisite to applying to SET for all RACS specialties (excl. OMFS)
- Sittings in February, June, and October
  - Applications open 2-3 months before the sitting
  - Results are released 1 month following
- Costs $4,500 per sitting
- Venues in all state capitals

GSSE Structure

- Two 150 minute (2.5 hour) exams held on consecutive days; anatomy first followed by physiology and pathology
- Conducted digitally with a Moodle-like format, you can access all questions and change your answers throughout the exam
- Four types of questions:
  - Type A: classical MCQ, four to five answers provided, with one being ‘most’ correct
  - Type B: statement, reason, and relationship
  - Type X: ‘bulk’ true/false
  - Spot test: only in the anatomy exam, answers being only a few words, typed out by the examinee

Question Type: Type A

19348 – Structures penetrating the diaphragm include

A. the oesophagus at the level of T8
B. the aorta at the level of T10
C. the splanchnic nerves, through the crura
D. the right phrenic nerve through the muscle of the right dome
E. the left phrenic nerve through the central tendon

726 – The right hepatic artery may arise anomalously from the

A. superior mesenteric artery.
B. left gastric artery.
C. splenic artery.
D. superior pancreatic-duodenal artery.
E. short gastric arteries.

Question Type: Type B

20199 – S. The femoral nerve remains outside the femoral sheath BECAUSE R. the femoral nerve lies behind the fascia iliaca

Answer: S is true, R is true and a valid explanation of S

15928 – S:Complement activation through the 'bypass' mechanism is of critical importance in early defence against infection by virulent pyogenic bacteria not previously encountered because R:some subgroups of immunoglobulin G (IgG) do not activate complement by the 'classical' pathway following reaction with specific (bacterial) antigen.

Answer: S is true, R is true but not a valid explanation of S

Question Type: Type X

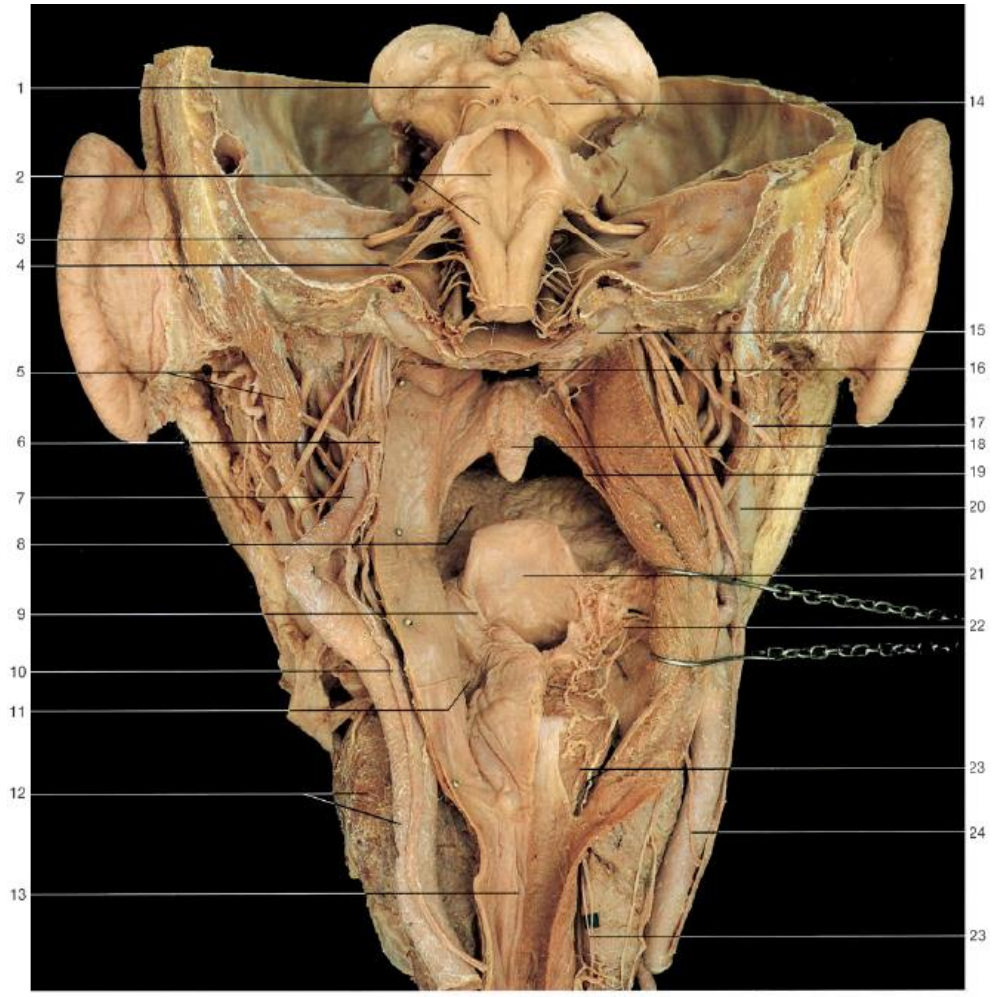
22609 – Antibiotics/combinations which are adequate prophylaxis for biliary surgery include

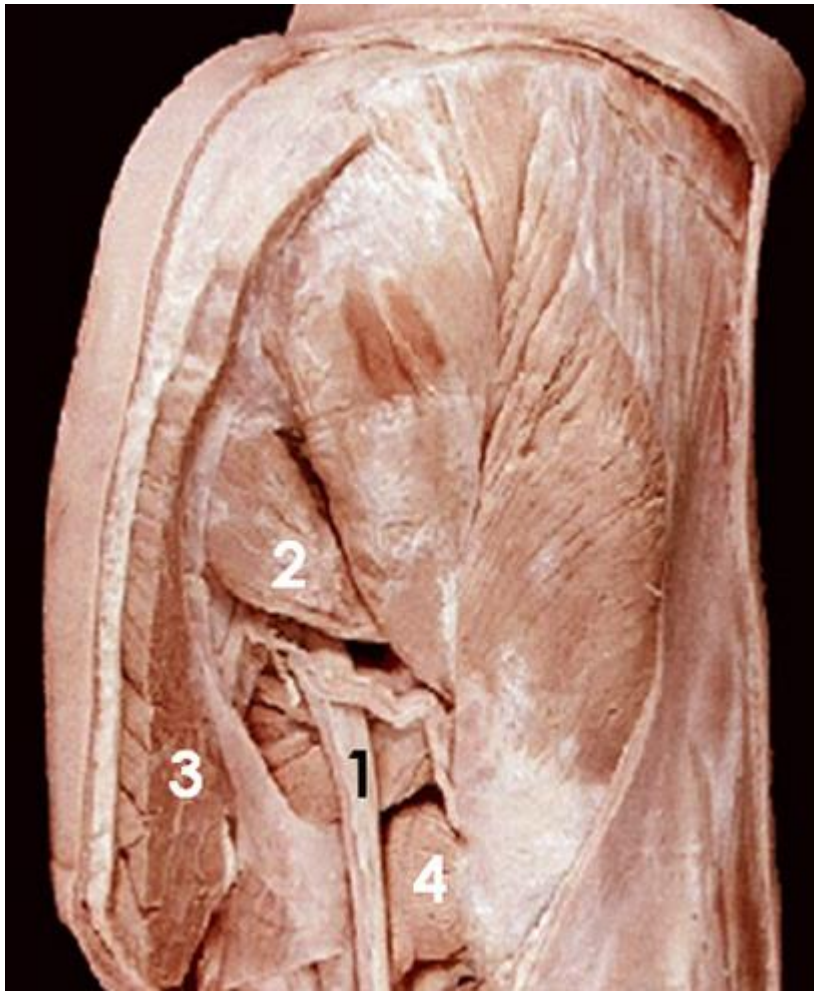
1: Augmentin (co-amoxyclav)
2: penicillin
3: amoxycillin plus gentamicin
4: flucloxacillin plus metronidazole

27523 – The right ovary

1 : is covered by peritoneum in the adult
2: has its lymphatic drainage to internal iliac nodes
3: has a mesovarium attached equatorially around the ovary
4: is attached to the anterior (inferior) layer of the broad ligament

Question Type: Spot Tests





Question Breakdown

Anatomy category	Number of MCQs
Abdomen	9
CNS	3
Development	2
Head & neck	10
Histology	2
Lower limb	9
Upper limb	9
Pelvis	7
Thorax	9

Type X: 60 questions
Spots: 20 questions
50% of overall mark

Pathology category	Number of MCQs
Antibiotics	4
Blood	2
General Pathology	11
Immunology	6
Infection	11
Neoplasia	12
Pharmacology	4
Statistics	4
Response to injury	11

Type A&B: 15 questions
Type X: 45 questions
25% of overall mark

Physiology category	Number of MCQs
Blood	5
Cardiovascular	10
Endocrine	5
Gastrointestinal	10
Metabolism	5
Neurophysiology	5
Respiratory	10
Urinary	10

Type A&B: 12 questions
Type X: 48 questions
25% of overall mark

Passing the GSSE

- Candidates must pass the examination on the basis of their overall score, but also through meeting benchmarks for each component (anatomy, pathology, physiology)
- Previously stated pass mark was 65%, although this has changed to a dynamic/calculated benchmark
- Most candidates fail the examination in pathology or physiology

Passing the GSSE

Anatomy	Map Code	Candidate's Score	Cohort's Average	Pathology	Map Code	Candidate's Score	Cohort's Average	Physiology	Map Code	Candidate's Score	Cohort's Average
Abdomen	AB	86%	77%	Antibiotics	AN	75%	74%	Cardiovascular	CAR	87%	70%
CNS	CNS	100%	75%	General pathological phenomena	GPP	93%	70%	Endocrine	EN	95%	72%
Development	DE	100%	80%	Immunology	IM	81%	74%	Gastro	GA	90%	68%
Head And Neck	HN	89%	64%	Infection	IN	72%	62%	Metabolism and Nutrition	MN	90%	71%
Histology	HI	88%	78%	Neoplasia	NE	85%	75%	Neurophysiology	NP	95%	79%
Lower Limb	LL	100%	79%	Pathology of Blood	PAB	100%	68%	Physiology of Blood	PHB	79%	70%
Pelvis	PE	100%	76%	Pharmacology	PHA	92%	66%	Respiratory	RE	90%	71%
Respiratory	RE	75%	75%	Statistics	ST	92%	77%	Urinary Tract	UT	74%	66%
Thorax	TH	92%	71%	Systems	SY	100%	72%				
Upper Limb	UL	97%	74%	Tissue response to injury	TRI	88%	64%				
Spots		90%	60%								

Component	Your Score (%)	Minimum Standard (%)	Component Result
Anatomy	92.2	57.7	Component Requirement Met
Pathology	85.1	61.4	Component Requirement Met
Physiology	87.1	63.9	Component Requirement Met

Overall	Your Overall Score (%)	Required Overall Score to Pass (%)	Overall Result
	89.1	66.6	PASS

Reference Texts/Curricula

Primary Texts

- Last's Anatomy, Regional and Applied, 9th Edition
- Rohen’s Color Atlas of Anatomy, 8th Edition
- Robbins and Cotran Pathologic Basis of Disease, 9th Edition *(first 10 chapters)*
- Ganong’s Review of Medical Physiology, 25th Edition
- West’s Respiratory Physiology, 10th Edition

Supplemental Resources

- Instant Anatomy
- Gray’s Anatomy
- Radiopaedia
- RACS Question Bank
- Prof Mundy’s questions and mock exams
- Leon Lai’s physiology notes

Additional Recommended Readings

Wheater's Functional Histology 6th Edition, 2013 - Young, B., Lowe, J. S., Stevens, A., and Heath, J.W., Churchill Livingstone

Langman's Medical Embryology, 13th Edition,2014 - Sadler T.W., Lippincott Williams and Wilkins

Infectious Diseases: A Clinical Approach 3rd Edition, - Yung A et al (eds). Melbourne: IP Communications, December 2010.

Clinical Biostatistics and Epidemiology Made Ridiculously Easy - Ann Weaver and Stephen Goldburg, 2011

Pharmacology 9th Edition, 2019 – Rang.HP; Dale MM; Ritter JM; and Moore PK Churchill Livingstone

Textbook of Medical Physiology, 13th Edition Guyton and Hall

Are you going to find the time?

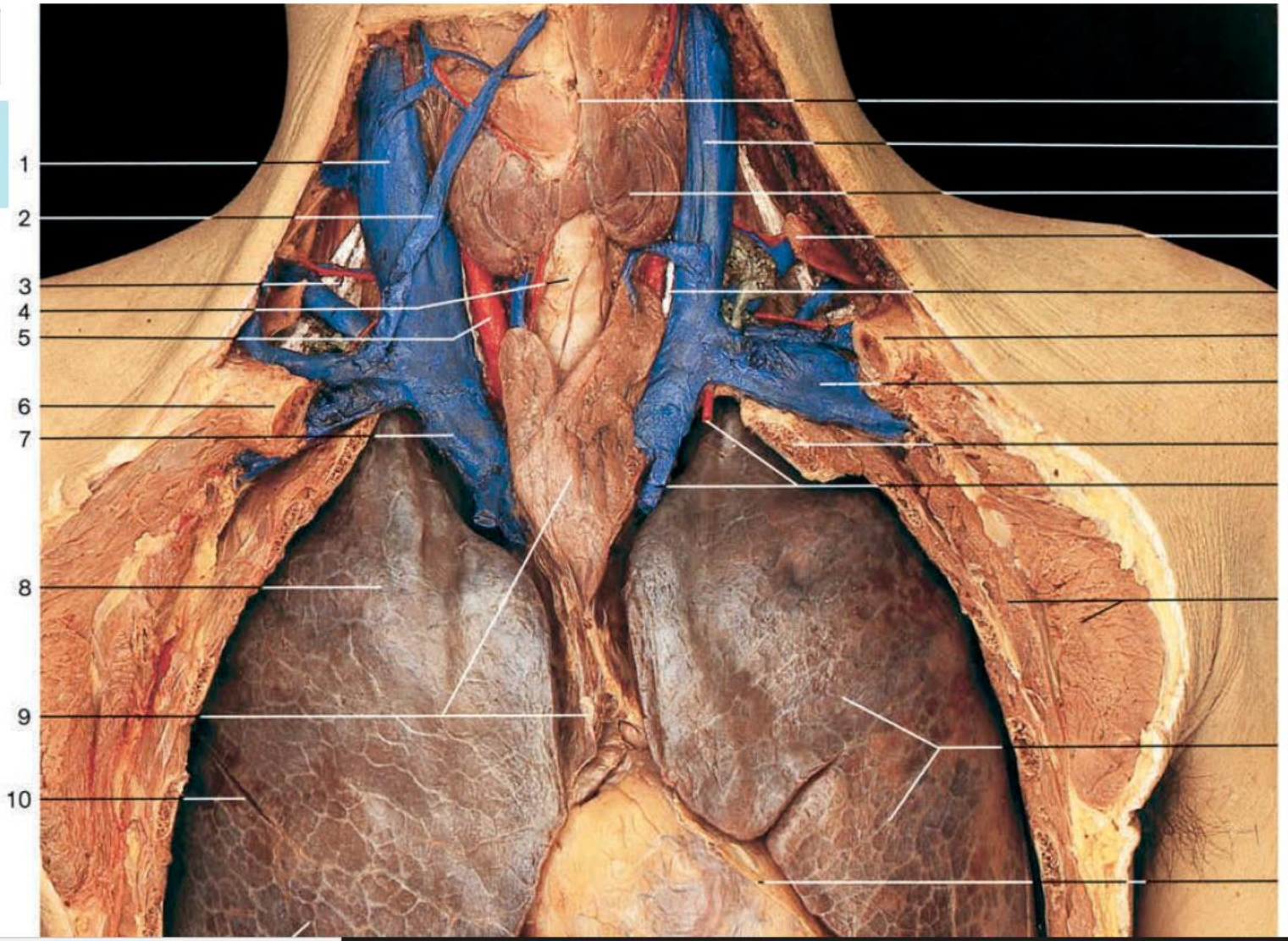
Study Plan

1. Decide what sitting fits best into your terms (when will you be on relief/ED/ICU) and when you can get study leave/annual leave
2. Sign up for the sitting as soon as applications opens (light the fire)
3. Spend a day charting your course and gathering resources
4. Begin reading the primary texts two to three months out from the exam (consensus is one or two cover-to-cover reads of each)
5. Two to three weeks out of the exam start going through the question bank and other supplemental/supportive resources. This should coincide with a period of leave
6. Return to areas of deficit you have identified within the primary texts
7. Don’t be afraid to withdraw

Additional Tips

- Get in contact with Prof Mundy as soon as you know which session you will be sitting to be added to the resource/mock exam mailing list
  - Julie.Mundy@health.qld.gov.au
- Have a resource that provides illustrations supplement Lasts
  - Examples include Gray's, Netter's, Instant Anatomy, or Google Images
- Wait until you have gone through all the texts before tackling the question bank and Rohen's
- Have an efficient system for going through Rohen's and the question bank, these should only take a few days each
- Spend equal amounts of time studying each of the three sections, despite the difference in weighting
- ? Sign up for paid courses

Anatomy. Rohan. 8th Ed.pdf - Adobe Acrobat Pro DC (32-bit)
File Edit View Sign Window Help
Home Tools The Bank.pdf Anatomy. Rohan. 8...
292 / 562 125%



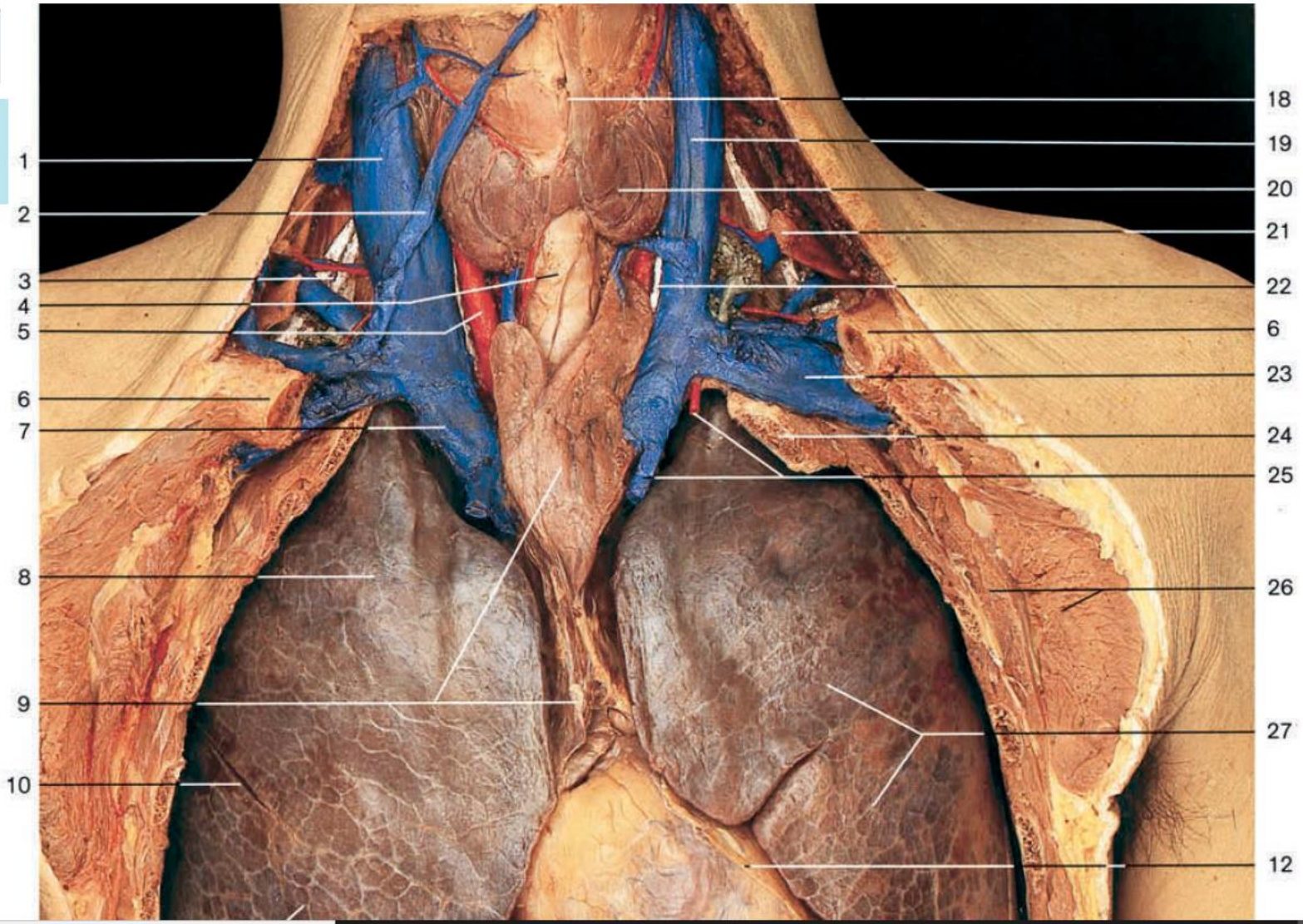
Snipping Tool
File Edit Tools Help
New Mode Delay

1 Internal jugular vein
2 External jugular vein (displaced medially)
3 Brachial plexus
4 Trachea

Untitled - Notepad
File Edit Format View Help

Type here to search
ENG 2:07 PM 21/03/2021

Anatomy. Rohan. 8th Ed.pdf - Adobe Acrobat Pro DC (32-bit)
File Edit View Sign Window Help
Home Tools The Bank.pdf Anatomy. Rohan. 8...
292 / 562 125%



Snipping Tool
File Edit Tools Help
New Mode Delay

1 Internal jugular vein
2 External jugular vein (displaced medially)
3 Brachial plexus
4 Trachea
5 Right common carotid artery

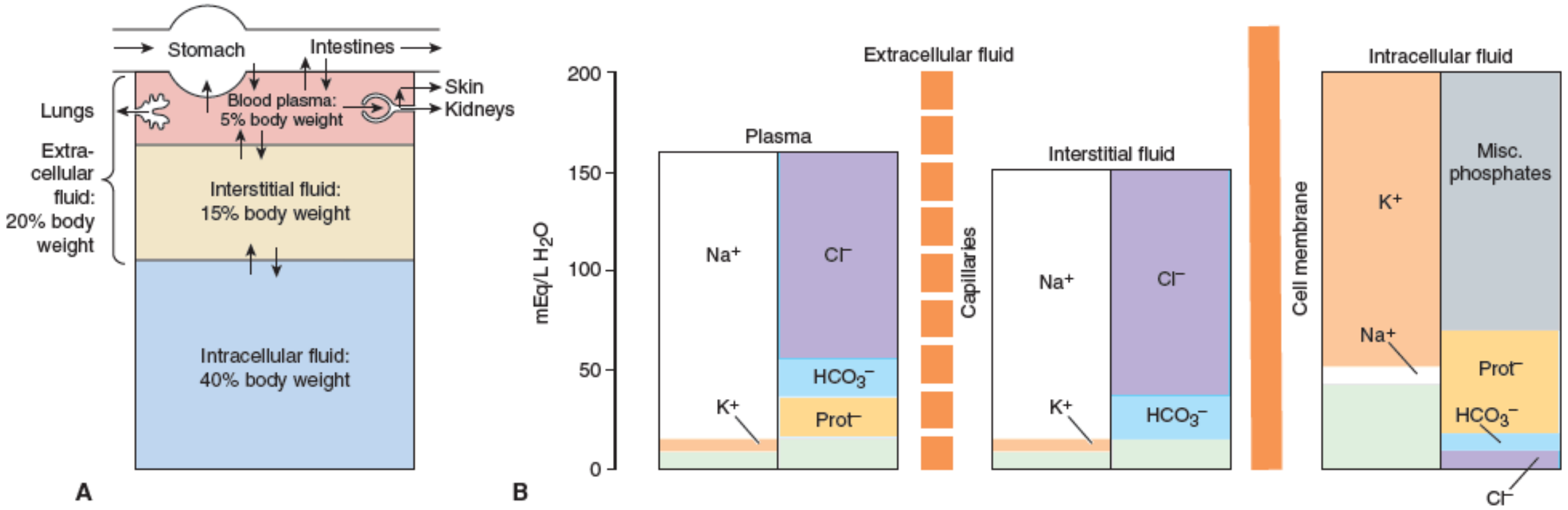
Untitled - Notepad
File Edit Format View Help

Type here to search
ENG 2:08 PM 21/03/2021

GSSE Physiology Part I: General Cellular Physiology

Matthew Jacob Smith

Body Fluid Composition



Donnan Effect and Gibbs-Donnan Equation

Consider the following:

Vascular	M	Interst.
K+	|	K+
Cl-	|	Cl-
Prot.-	|	

From a starting point of electrical neutrality (anions = cations):
[Cl-]i > [Cl-]v
Therefore Cl- will diffuse with its chemical gradient into the vascular compartment
Vascular compartment will become relatively negatively, prompting K to move to the interstitium, resulting in:
[K+]i > [K+]v

Overall, the sum solutes in the vascular compartment will exceed the interstitum, due to the presence of a non-diffusible ion:

[K+]v + [Cl-]v + [Prot-]v > [K+]i + [Cl-]i

It can further be derived that for a pair of permeable solutes (anion + cation) the following relationship occurs

$$\frac{[K^+_X]}{[K^+_Y]} = \frac{[Cl^-_Y]}{[Cl^-_X]}$$

$$[K^+_X][Cl^-_X] = [K^+_Y][Cl^-_Y]$$

Nernst Equation

$$E_{Cl} = \frac{RT}{FZ_{Cl}} \ln \frac{[Cl_o^-]}{[Cl_i^-]}$$

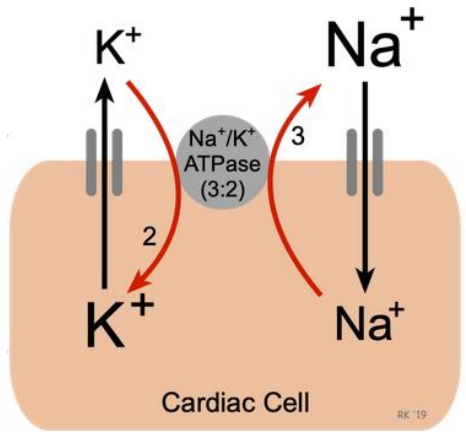
where

E_{Cl} = equilibrium potential for Cl^-
R = gas constant
T = absolute temperature
F = the Faraday number (number of coulombs per mole of charge)
Z_{Cl} = valence of Cl^- (–1)
$[Cl_o^-]$ = Cl^- concentration outside the cell
$[Cl_i^-]$ = Cl^- concentration inside the cell

TABLE 1–1 Concentration of some ions inside and outside mammalian spinal motor neurons.

Ion	Concentration (mmol/L of H_2O)		Equilibrium Potential (mV)
	Inside Cell	Outside Cell	
Na^+	15.0	150.0	+60
K^+	150.0	5.5	–90
Cl^-	9.0	125.0	–70

- The Nernst Equation allows calculation of the equilibrium potential
- The equilibrium potential is the membrane potential for which no net movement of a solute occurs across a semipermeable membrane
- A normal resting membrane potential for a neuron is -70 mV, therefore there is the following net drive:
  - Sodium influx into the cell
  - Potassium efflux out of the cell
  - No net influx or efflux of chloride
- The relatively low intracellular sodium concentration and high intracellular potassium concentration must therefore be maintained with Na/K ATPase

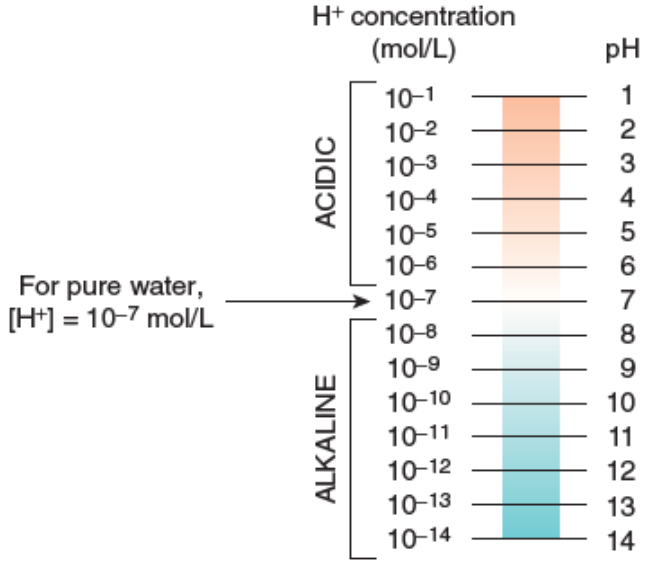


Acids, Bases, Henderson-Hasselbalch

- Acids donate protons, whilst bases accept them
- On donation of a proton, an acid will form its conjugate base (and vice-versa)
- Acidity is measured as pH, the negative logarithm of [H+]

$$\mathrm{HA} + \mathrm{B} \rightleftharpoons \mathrm{A}^- + \mathrm{HB}^+$$

Acid Base C. Base C. Acid



- The Henderson-Hasselbalch equation allows calculation of a solutions pH if , the derivation follows:

$$\mathrm{HA} \leftrightharpoons \mathrm{H^+} + \mathrm{A^-}$$

According to the laws of mass action, a relationship for the dissociation can be defined mathematically as:

$$K_a = [H^+][A^-]/[HA]$$

$$[H^+] = K_a\,[HA]/[A^-]$$

If the logarithm of each side is taken:

$$\log[H^+] = \log K_a + \log[HA]/[A^-]$$

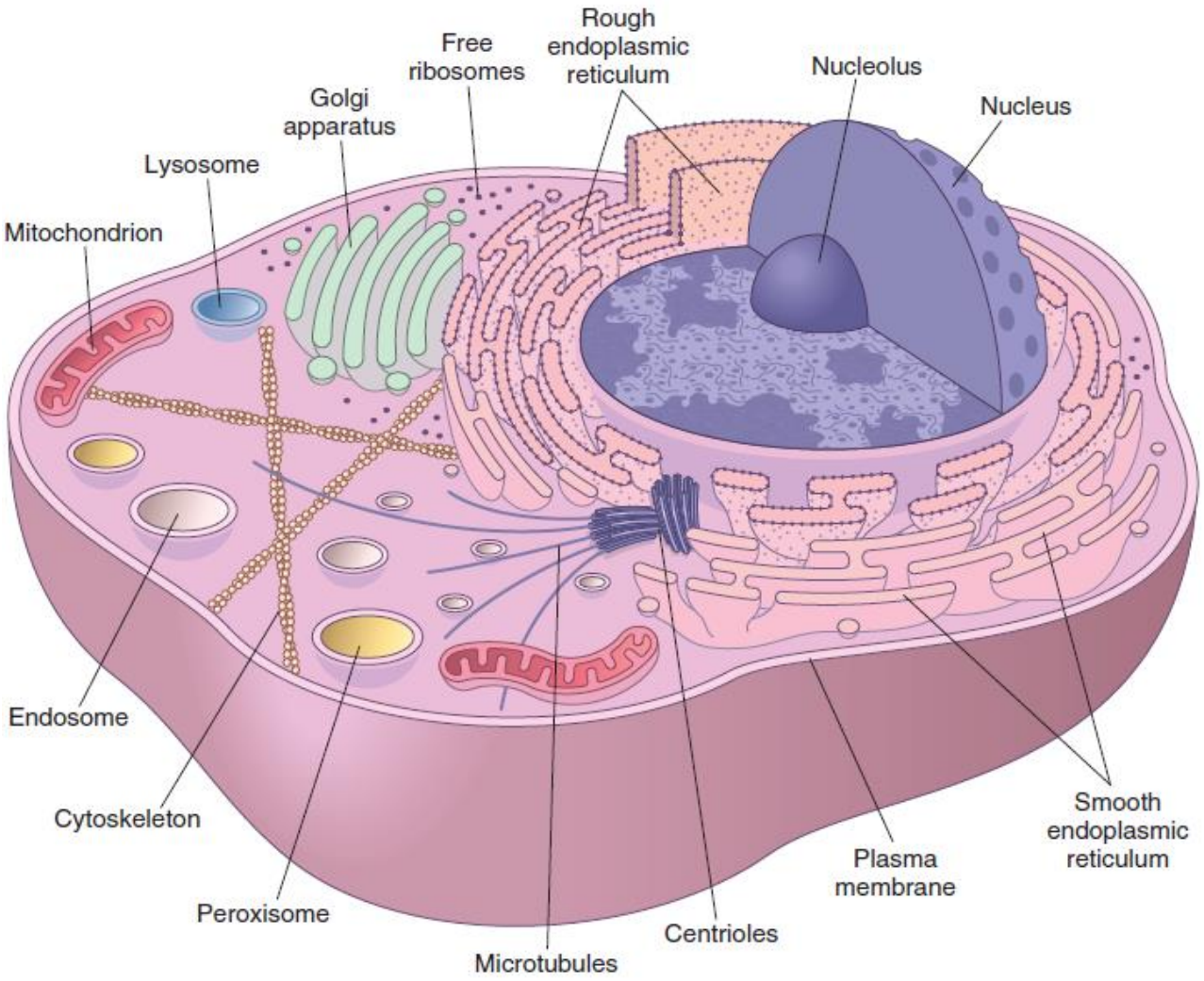
Both sides can be multiplied by –1 to yield:

$$-\log[H^+] = -\log K_a + \log[A^-]/[HA]$$

This can be written in a more conventional form known as the **Henderson-Hasselbalch equation:**

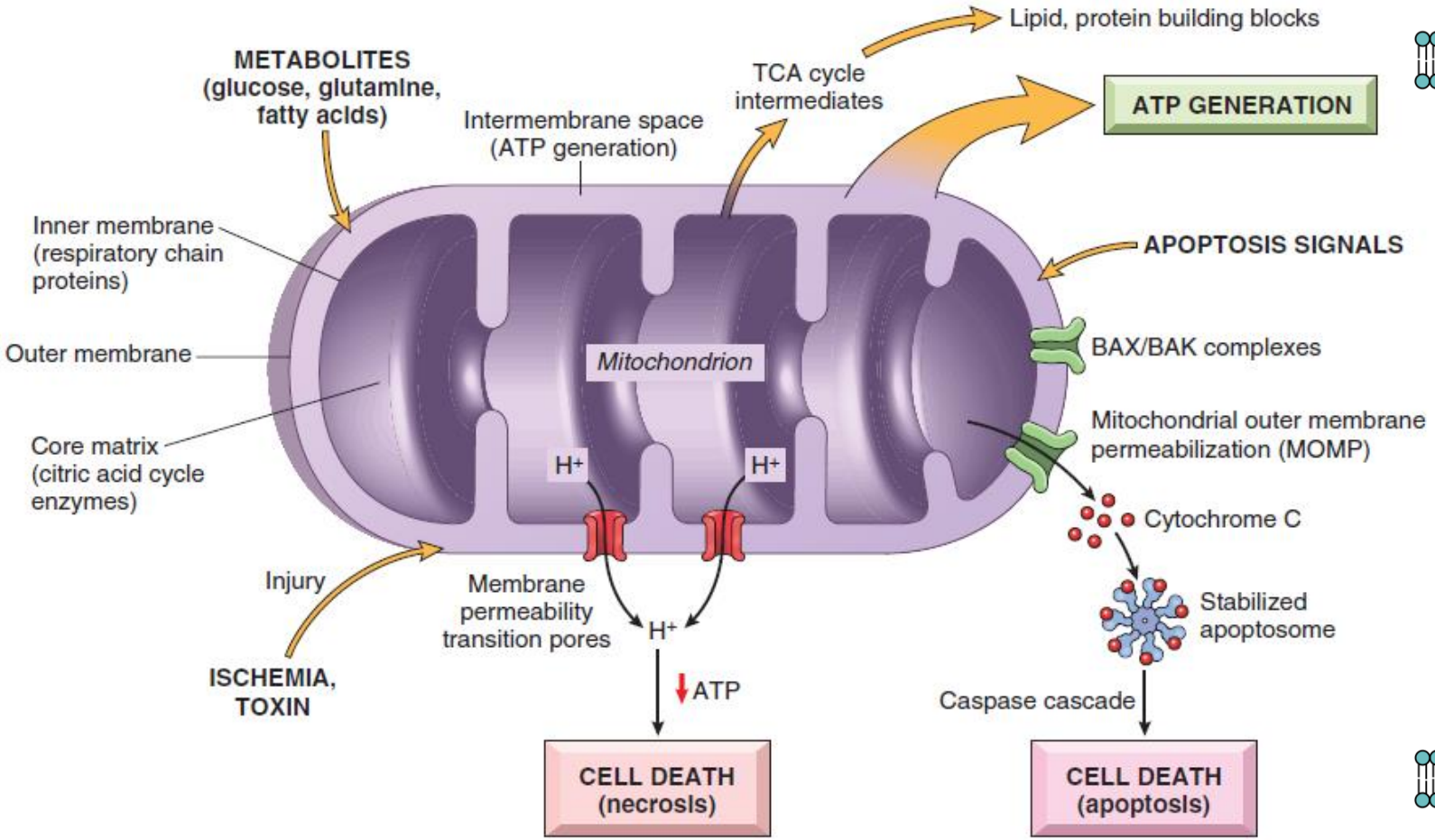
$$pH = pK_a + \log[A^-]/[HA]$$

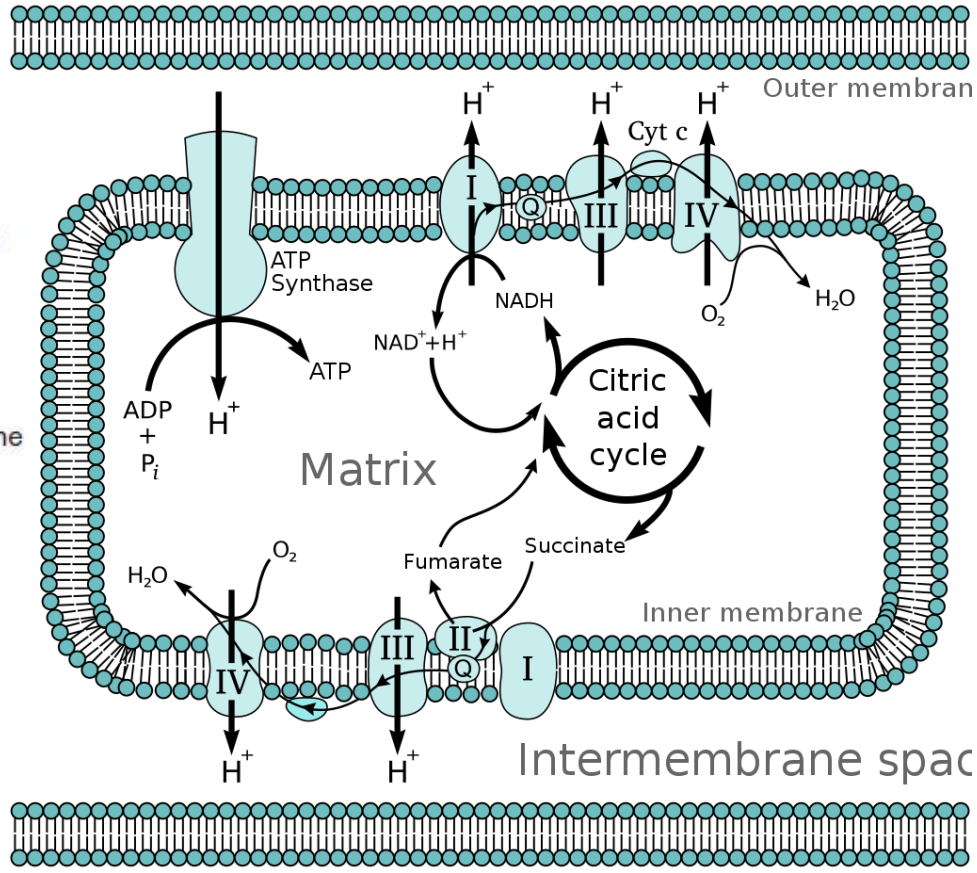
Cellular Structure and Organelles



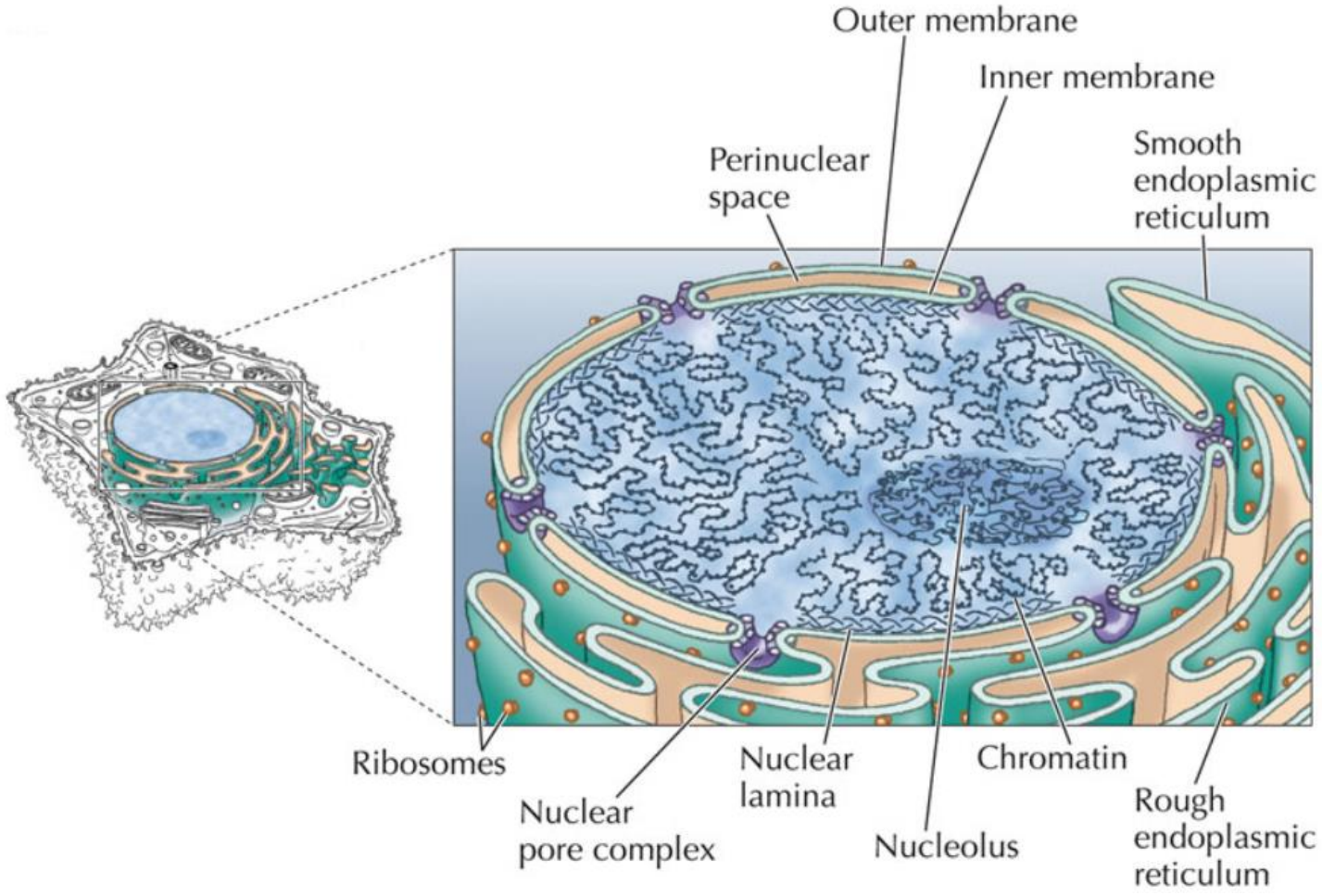
Compartment	Role in the cell
Cytosol	Metabolism, transport, protein translation
Mitochondria	Energy generation, apoptosis
Rough ER	Synthesis of membrane and secreted proteins
Smooth ER	Lipid and steroid synthesis, detoxification
Golgi	Protein modification, sorting, catabolism
Nucleus	Cell regulation, proliferation, DNA transcription
Endosomes	Intracellular transport and export, ingestion of extracellular substances
Lysosomes	Cellular catabolism
Peroxisomes	Very long-chain fatty acid metabolism

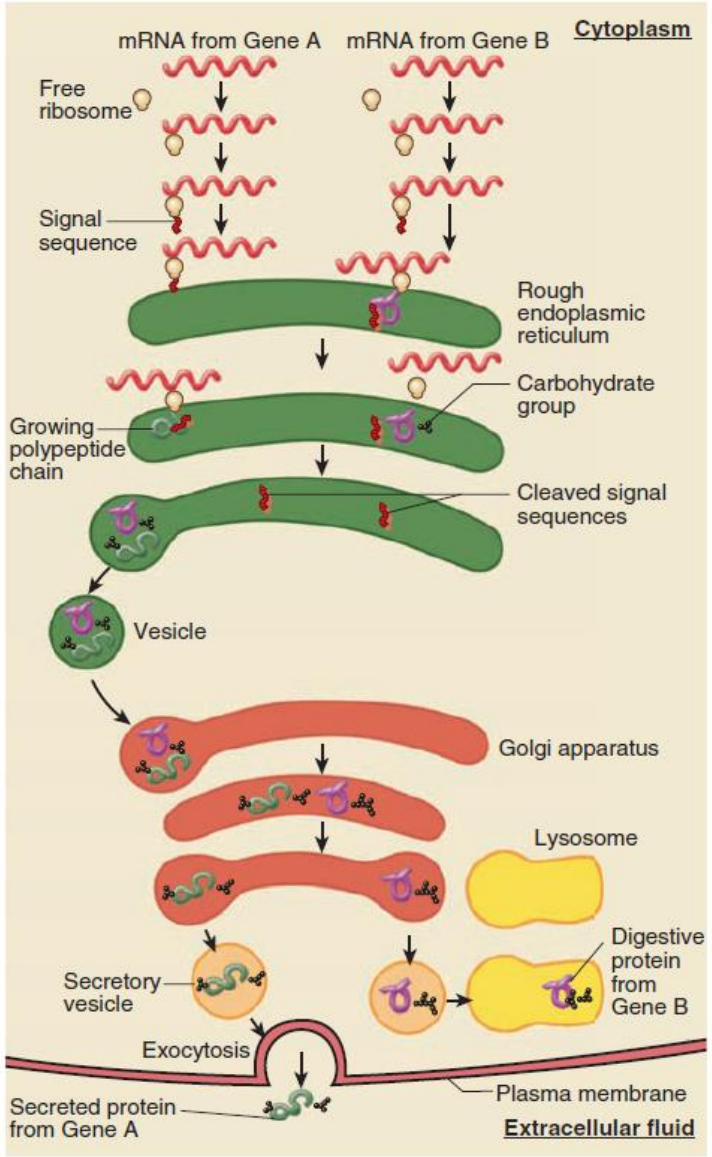
Mitochondria



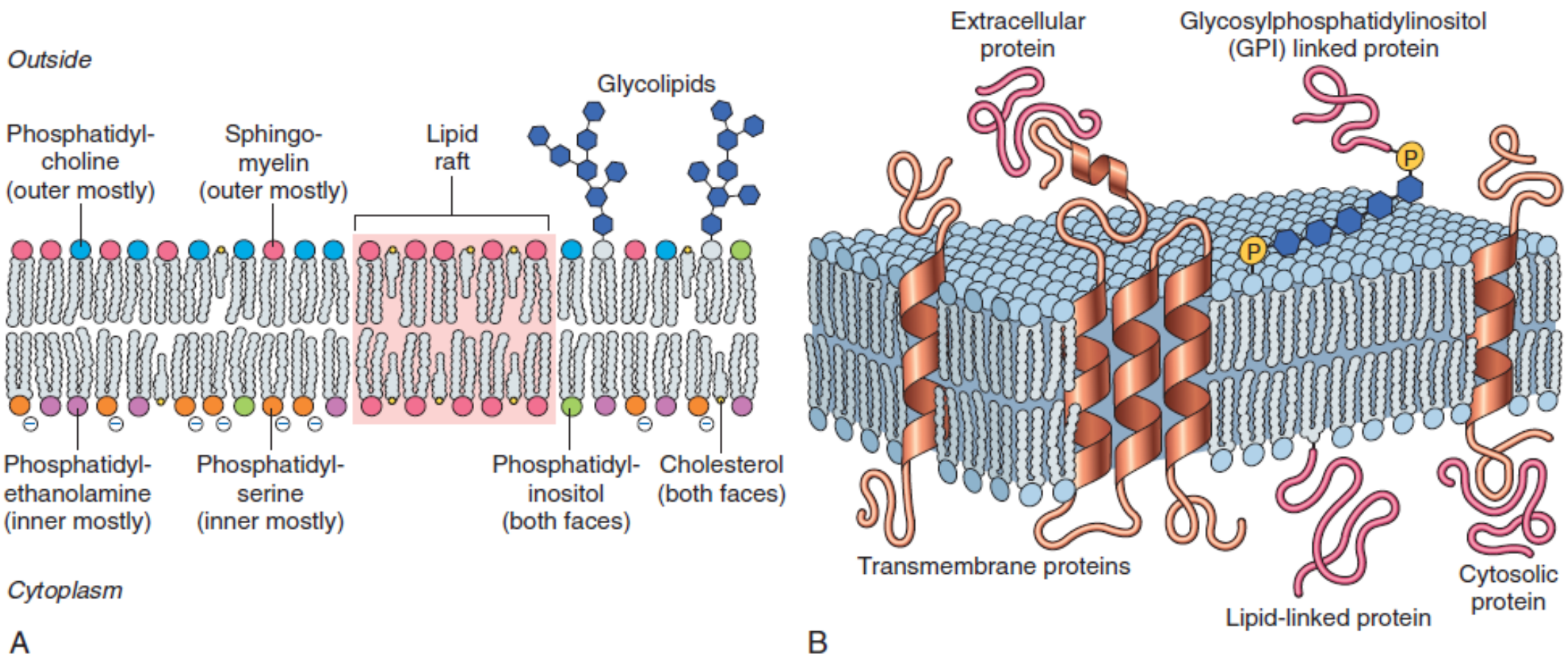


Endoplasmic Reticulum and Golgi

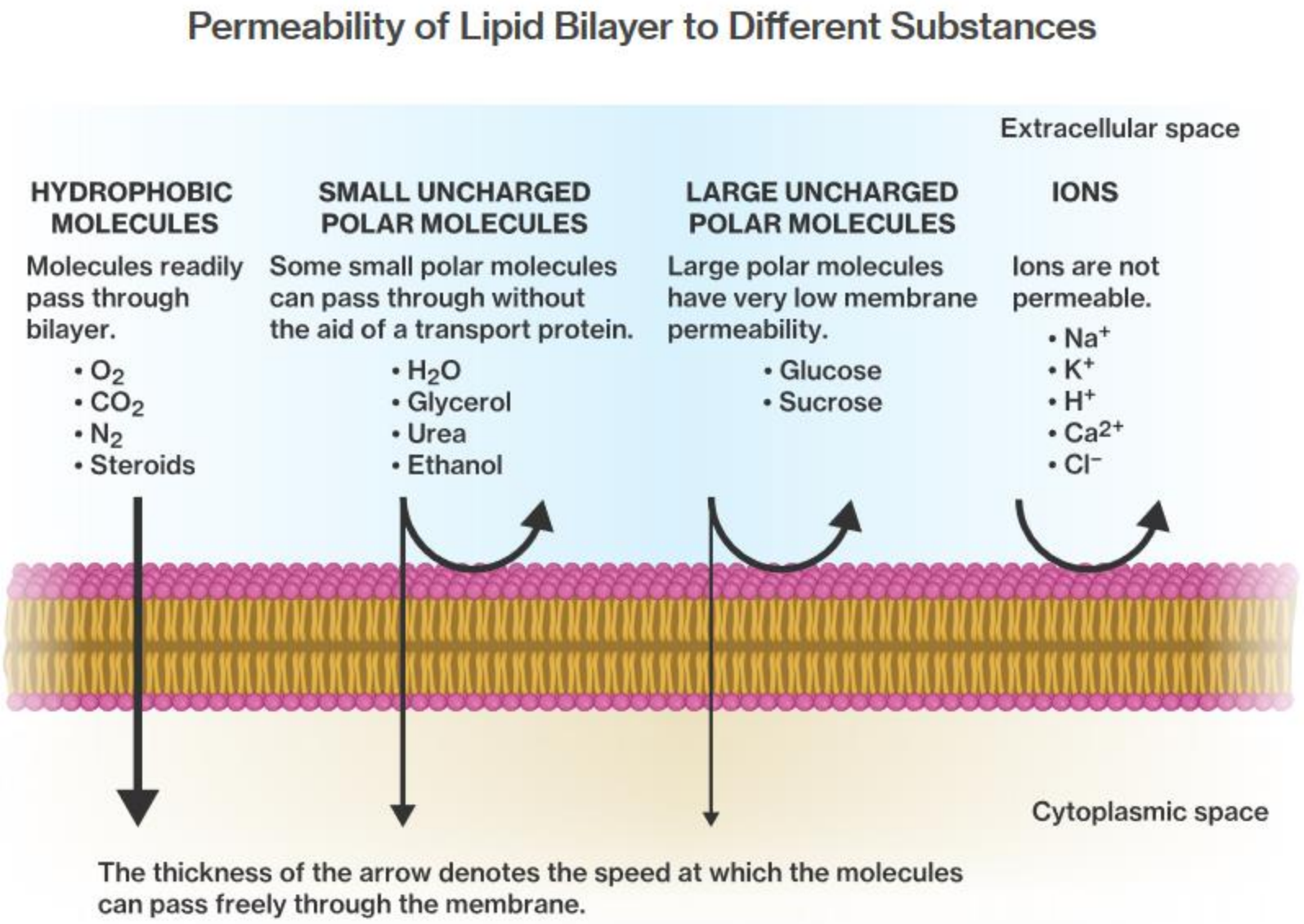




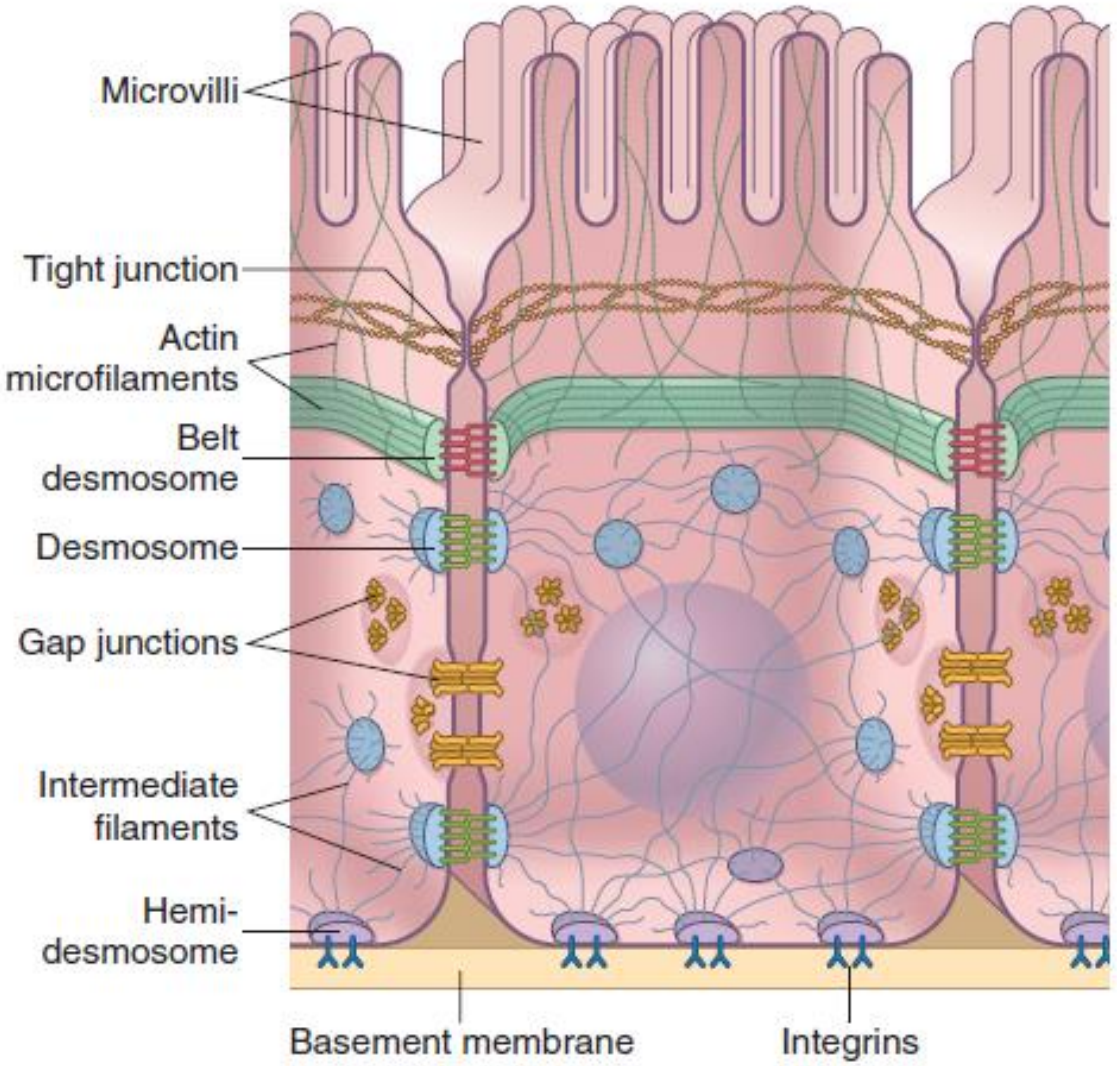
Cellular Membrane

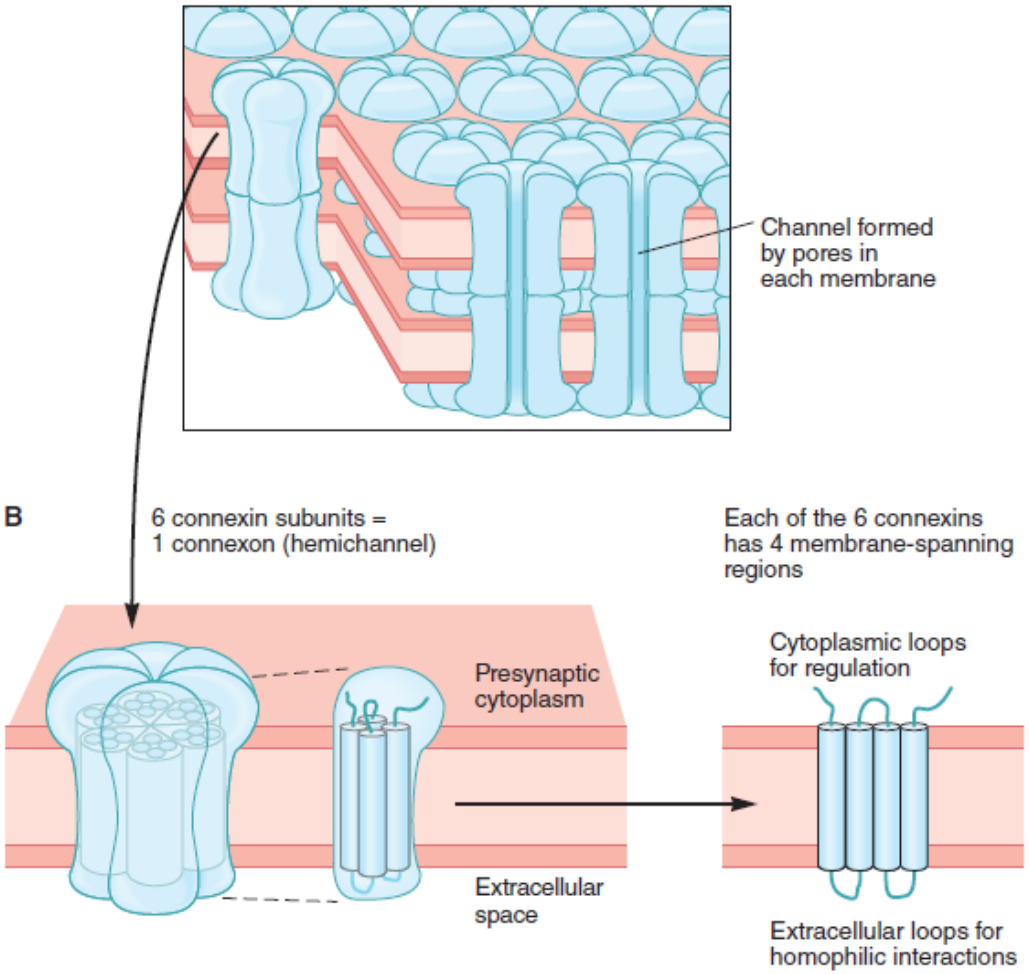


Cellular Membrane

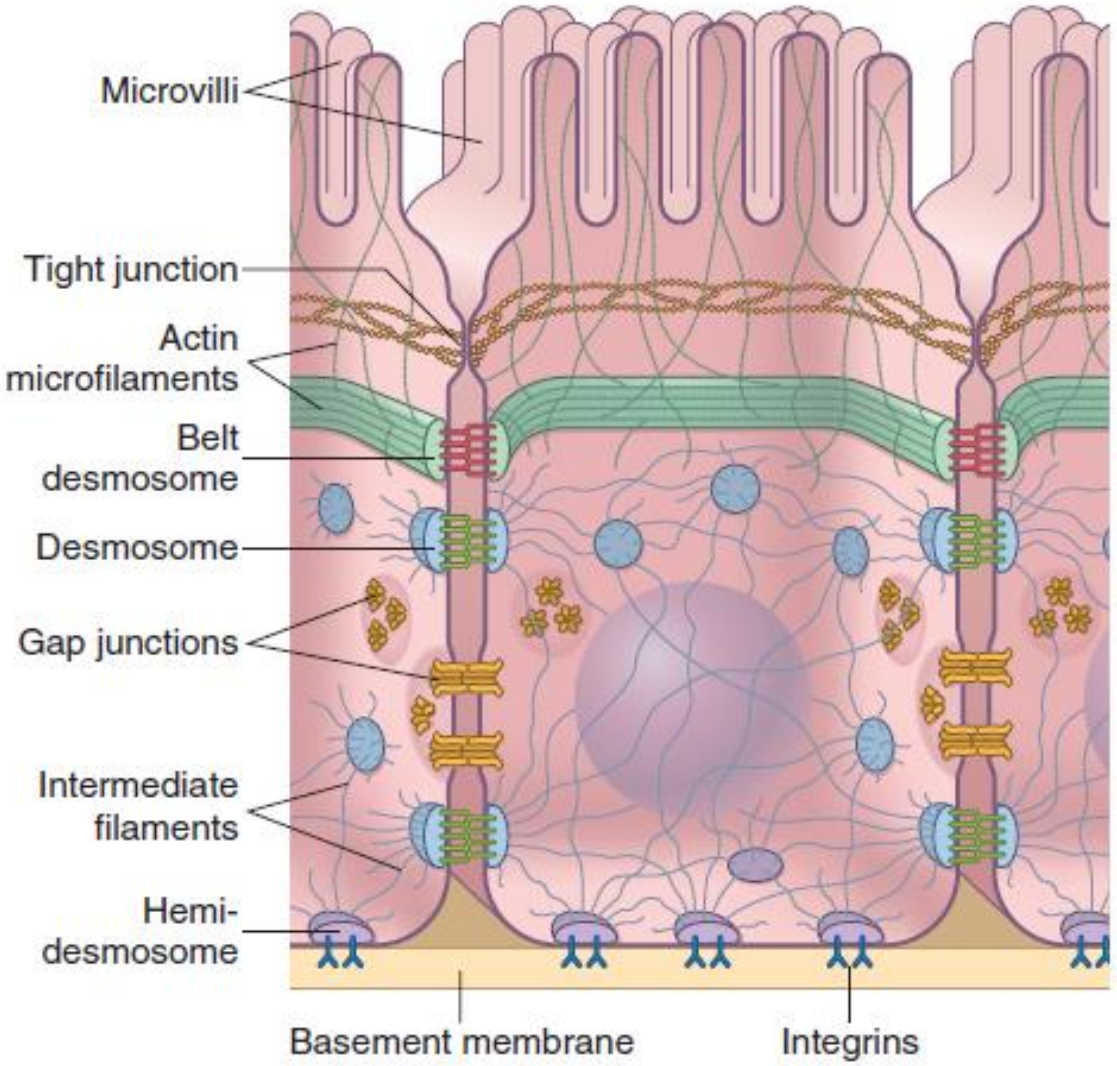


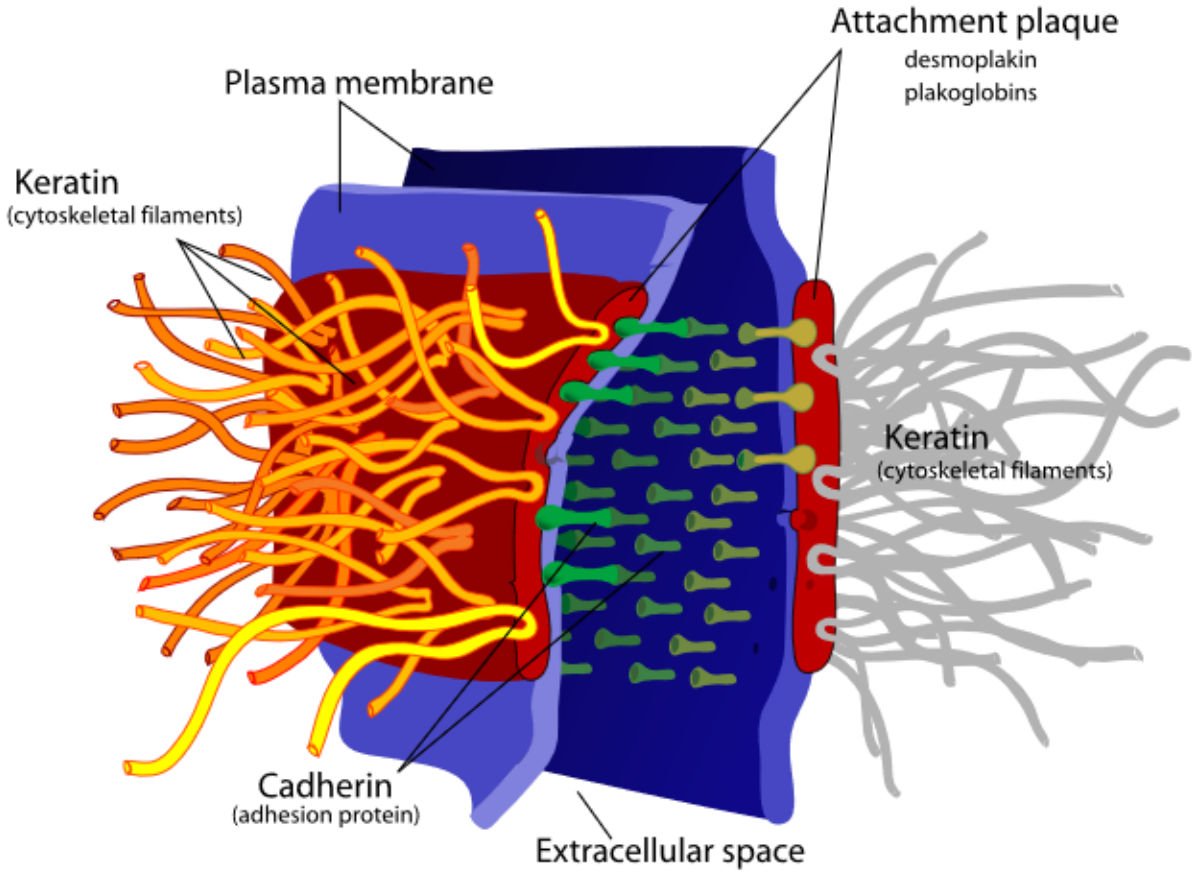
Cytoskeleton and Intercellular Connections



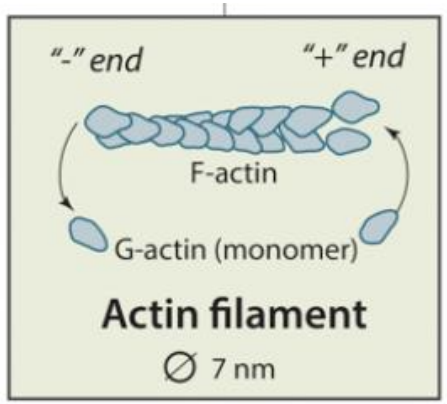


Cytoskeleton and Intercellular Connections

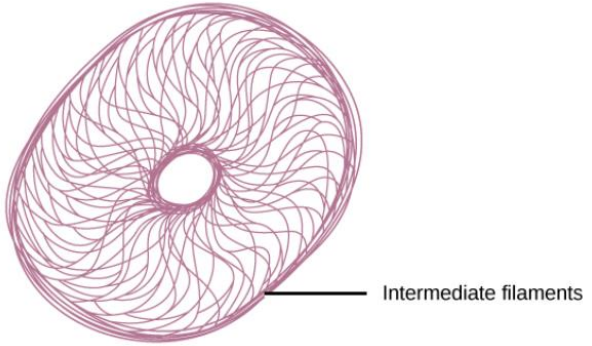


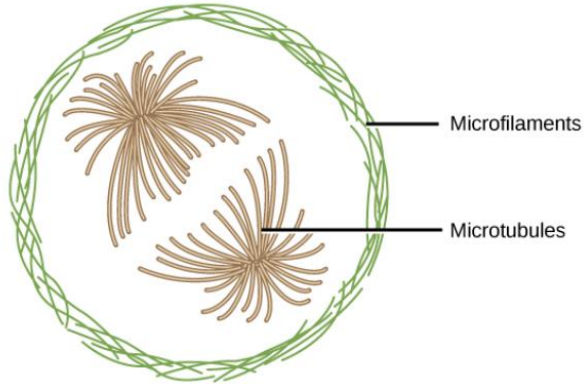


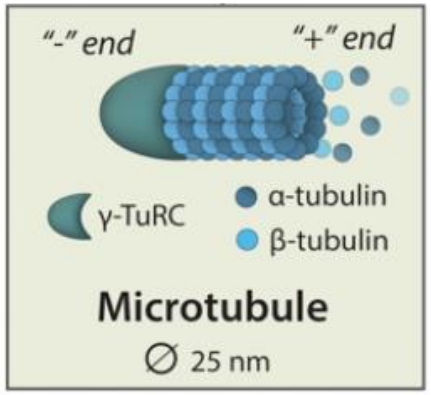
Cytoskeleton and Intercellular Connections



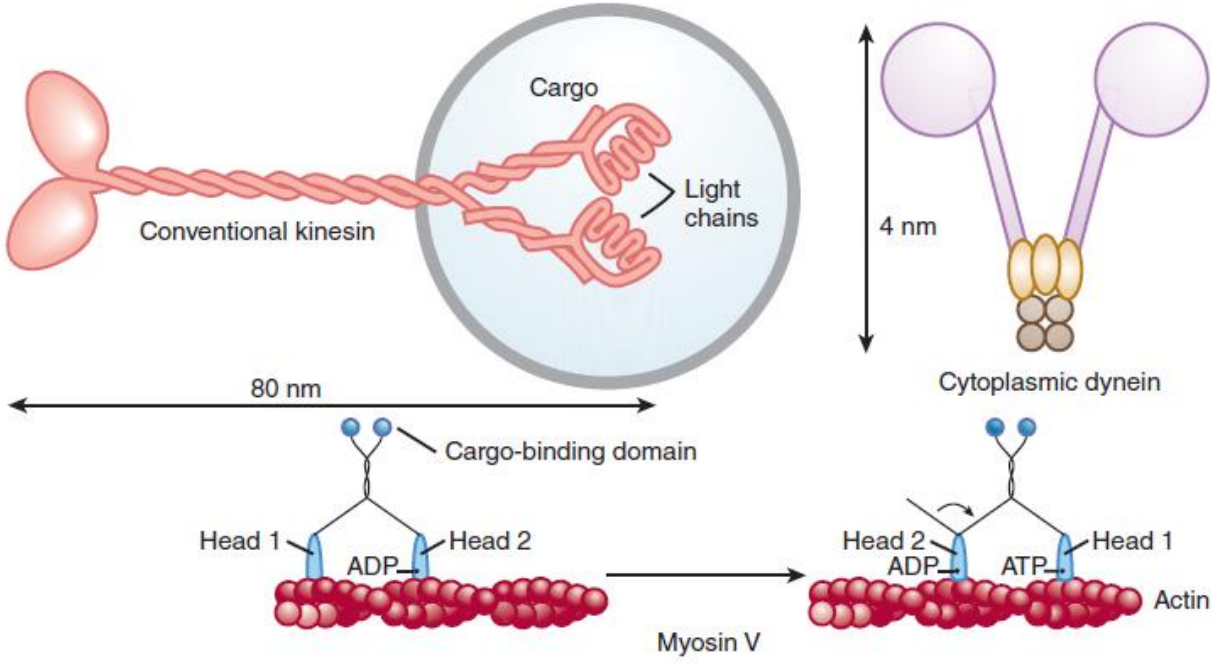
Actin (i.e. microfilaments): most abundant intracellular protein, cellular motility, muscle contraction, transmission of extracellular forces

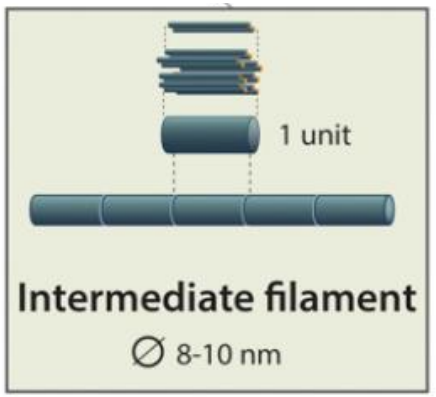






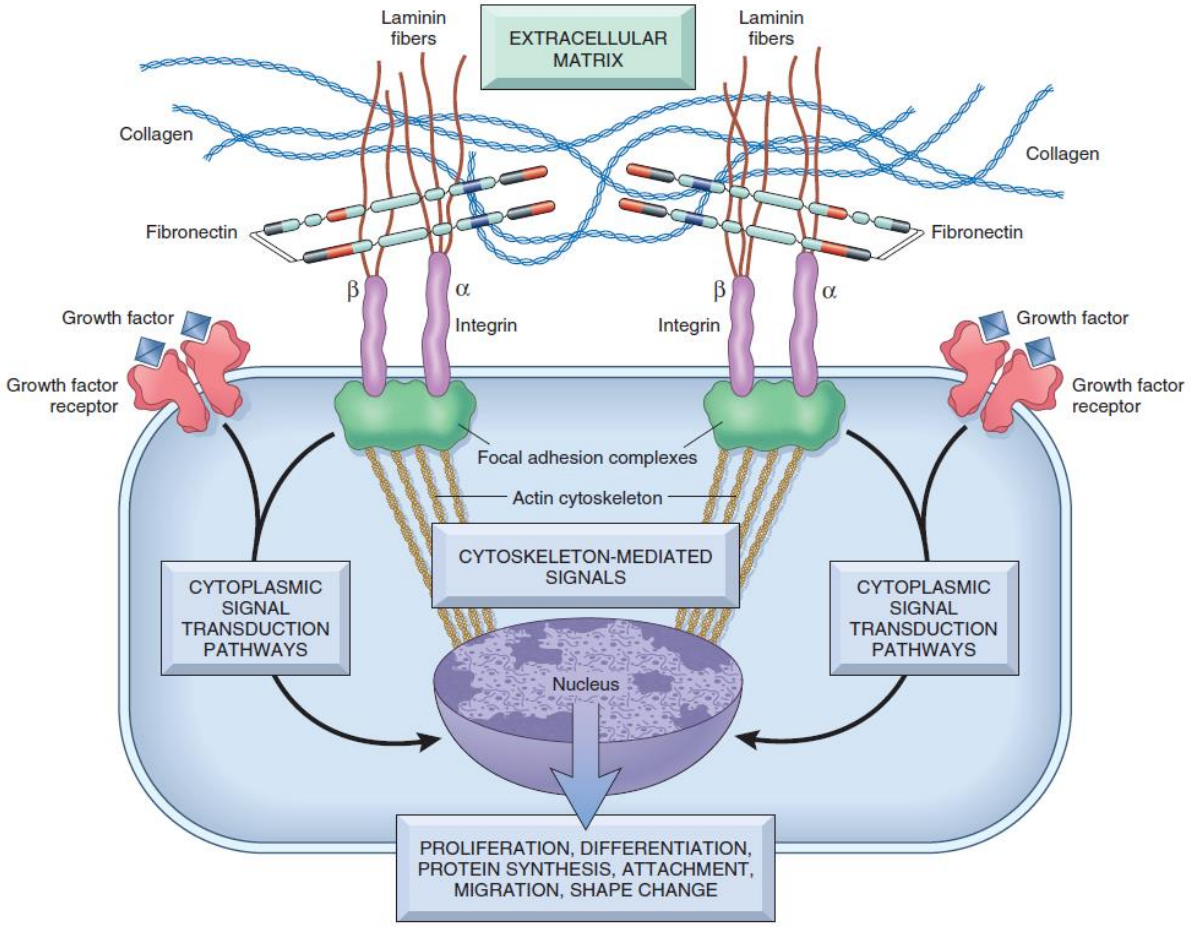
Microtubule: maintain cellular polarity, tracks for molecular motors, formation of spindles in mitosis

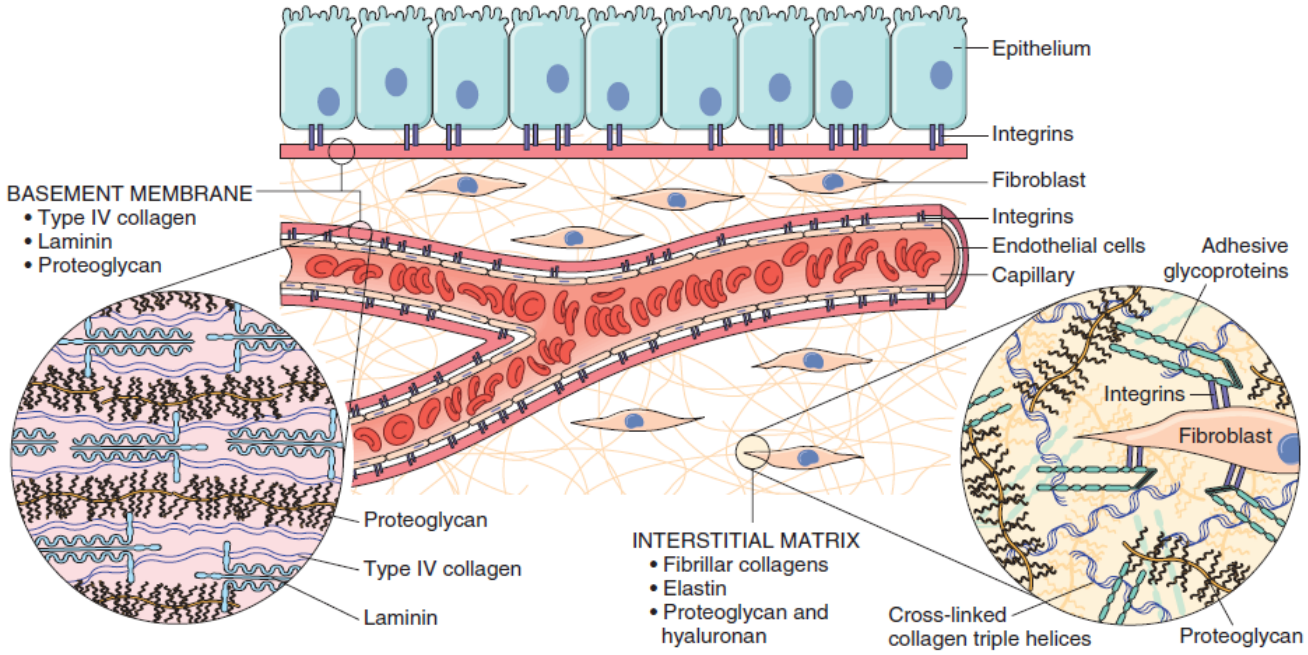




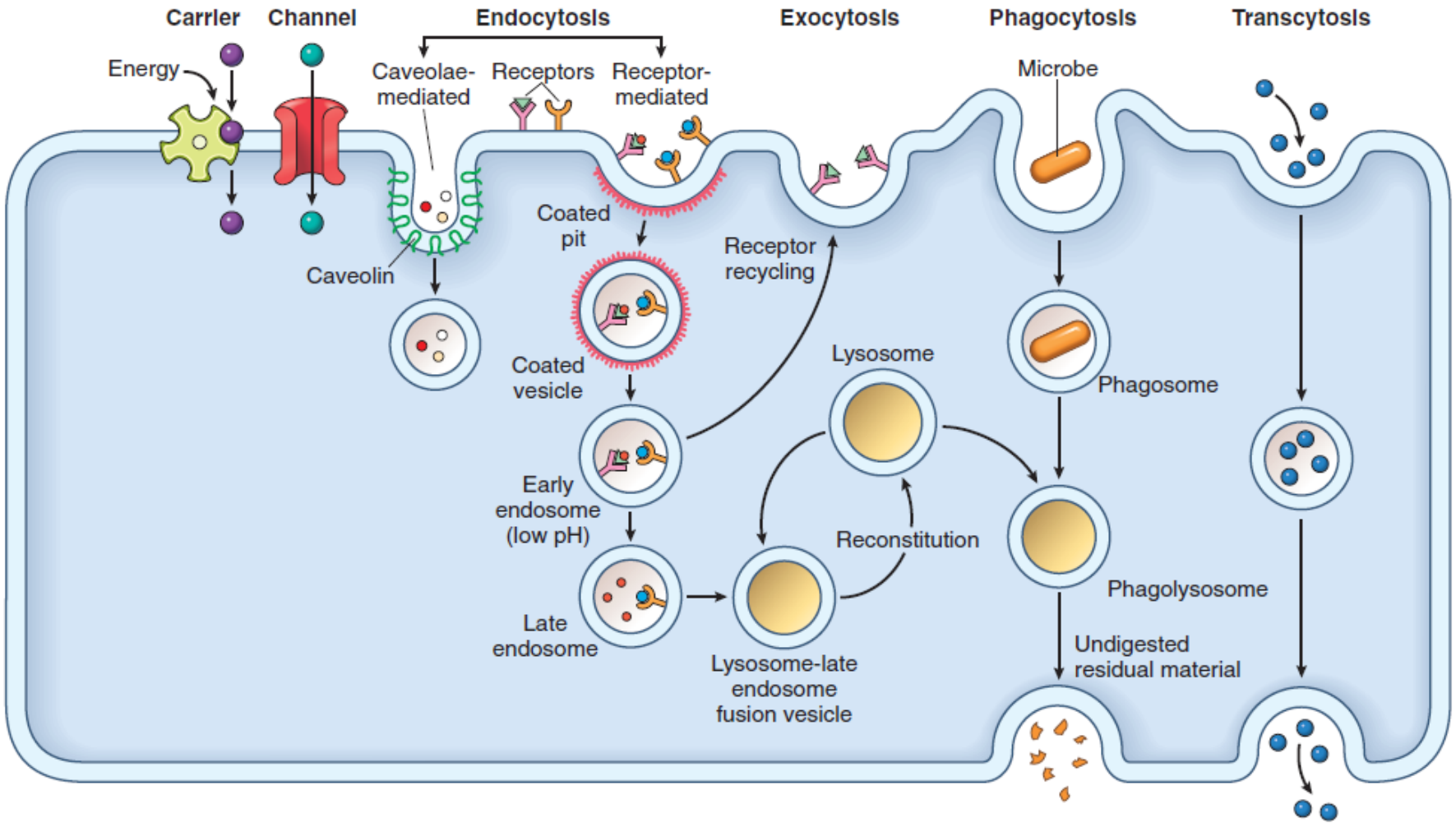
Intermediate filaments (e.g. cytokeratins): connect the nuclear and cellular membranes, resist cellular compression (rebar)

Cytoskeleton and Intercellular Connections





Transport Across Cellular Membranes



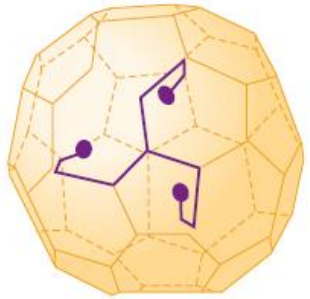
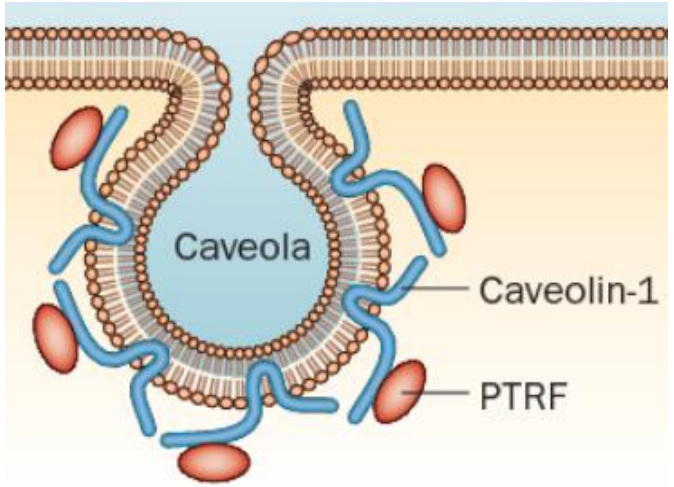
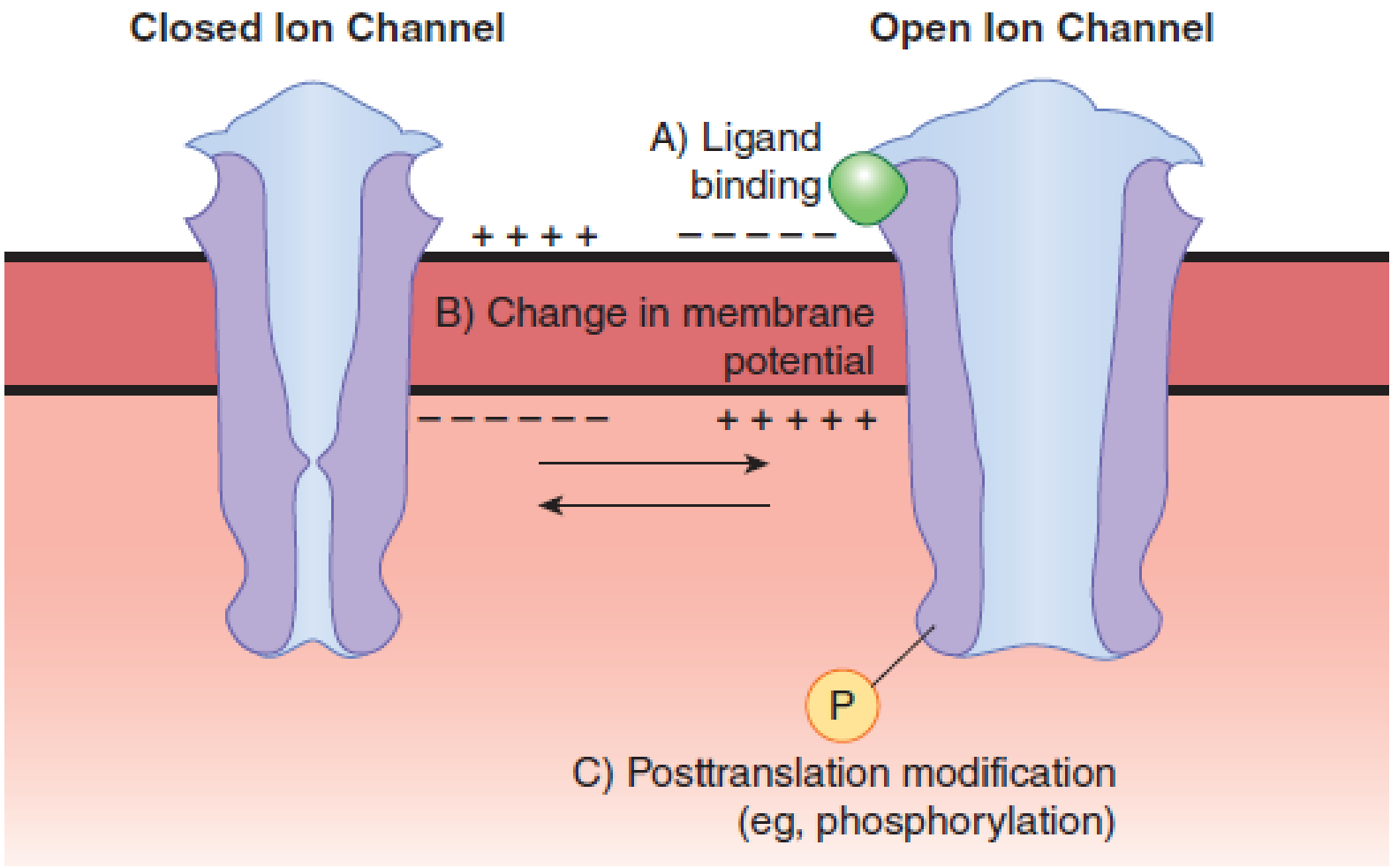


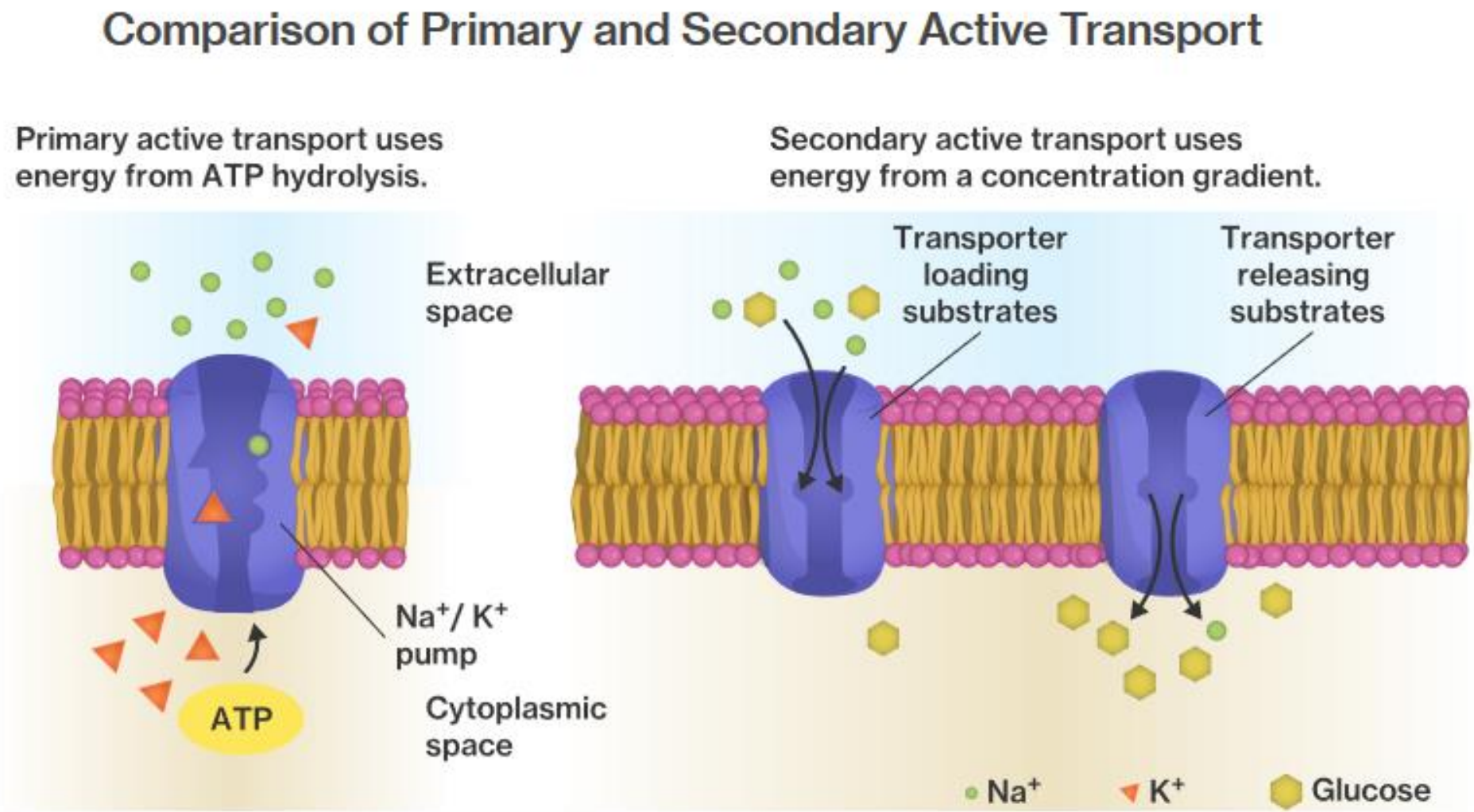
FIGURE 2–13 **Clathrin molecule on the surface of an endocytotic vesicle.** Note the characteristic triskelion shape and the fact that with other clathrin molecules it forms a net supporting the vesicle.



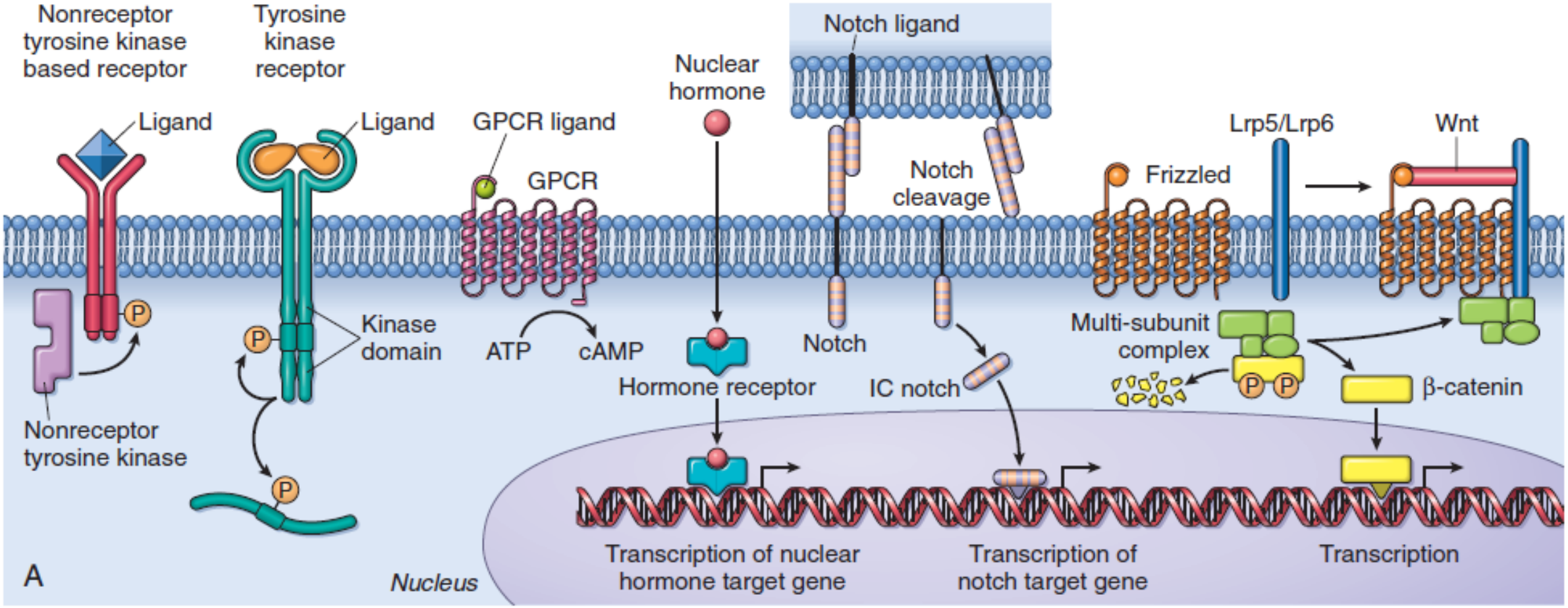
Channel Gating



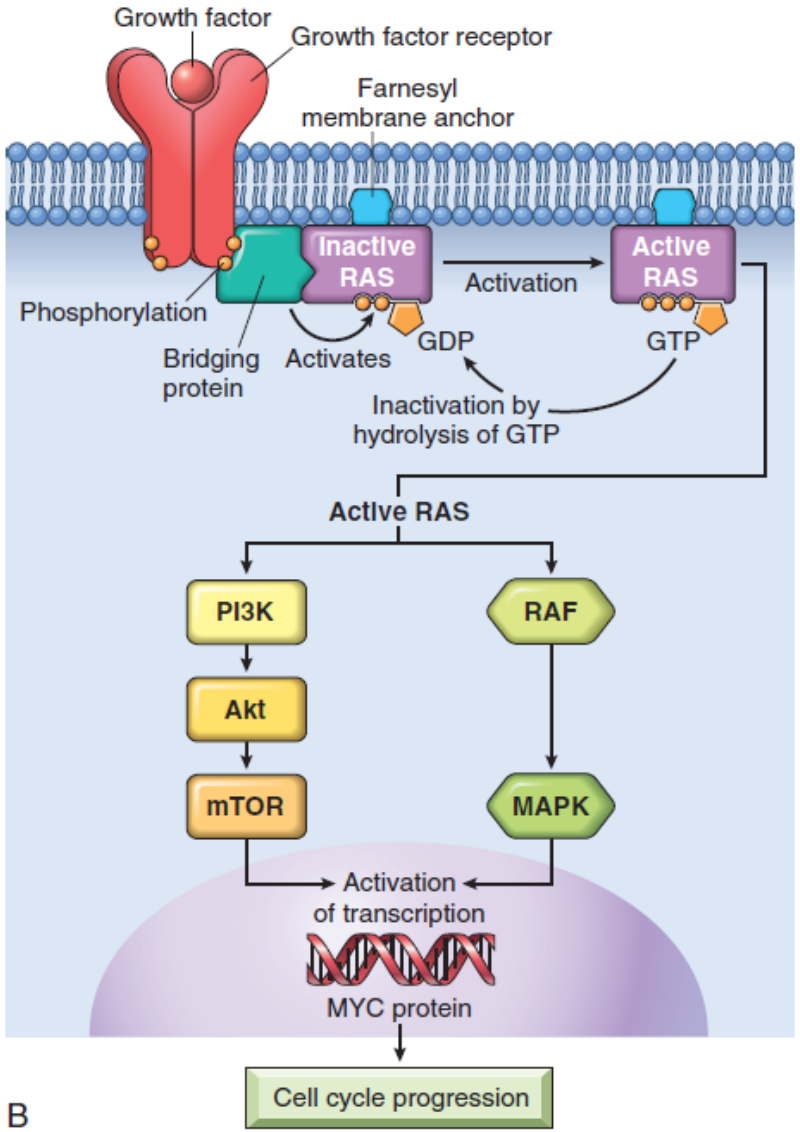
Active Transport

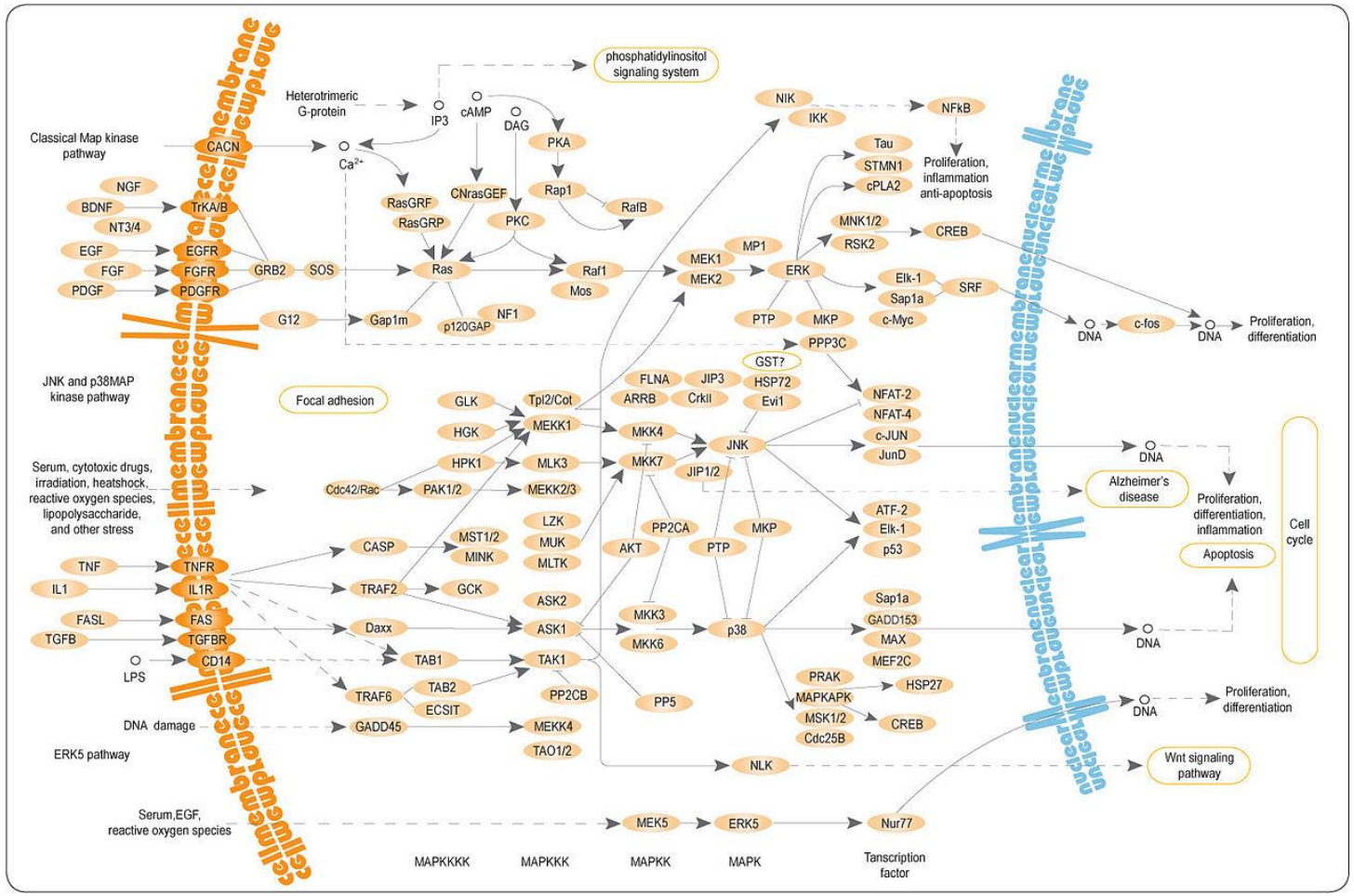


Receptor Physiology

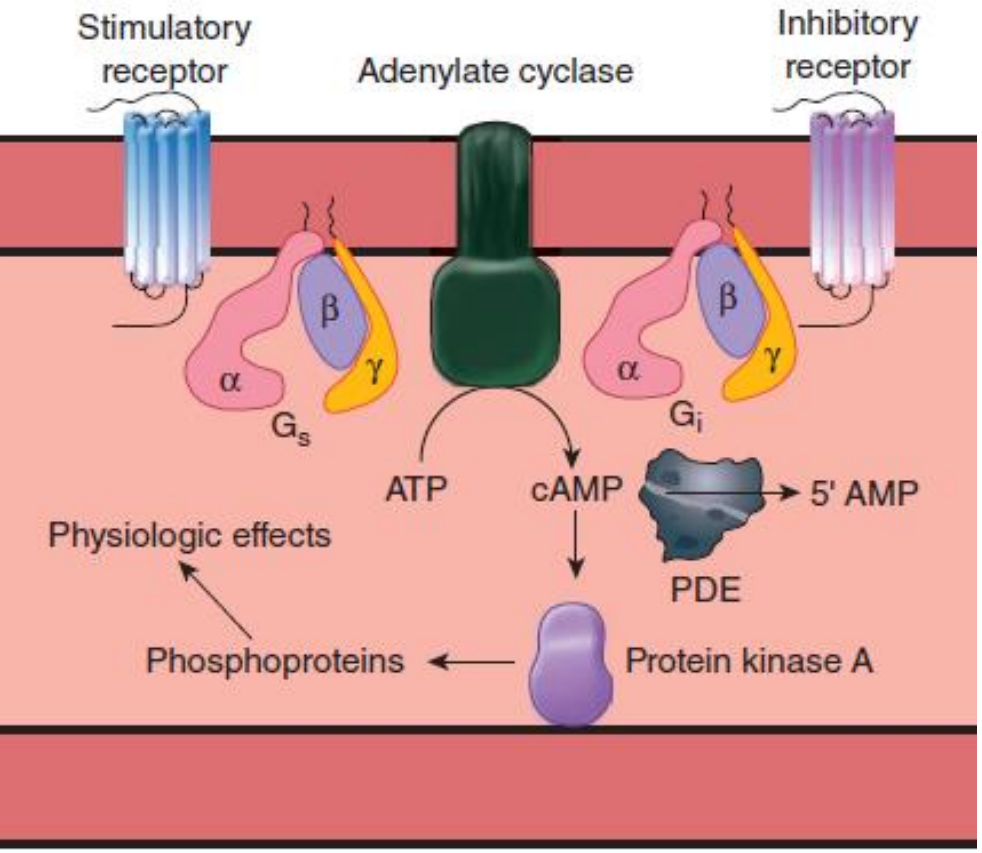


Intracellular Signaling Pathways

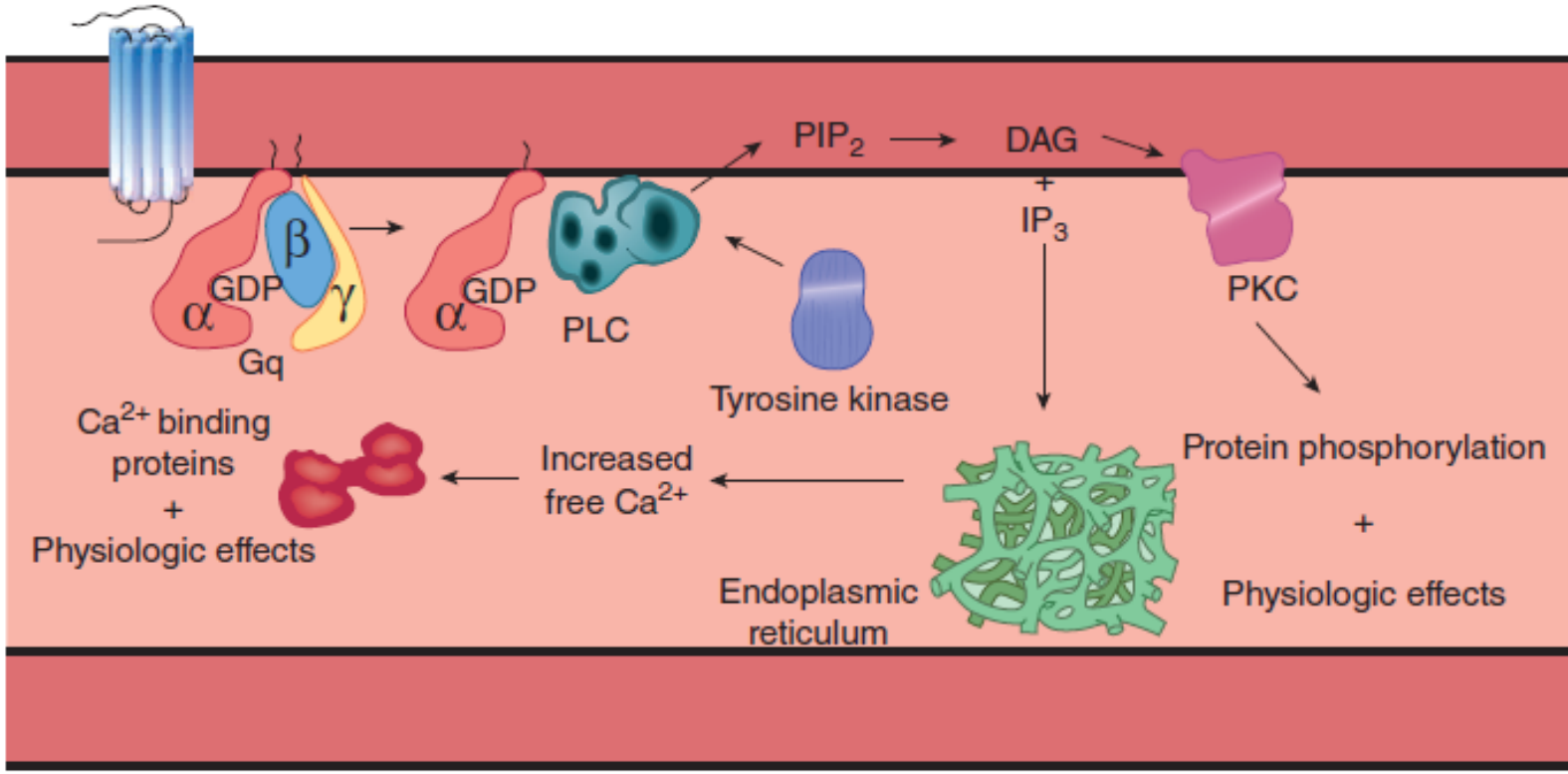




cAMP and IP3/DAG Signaling Pathways

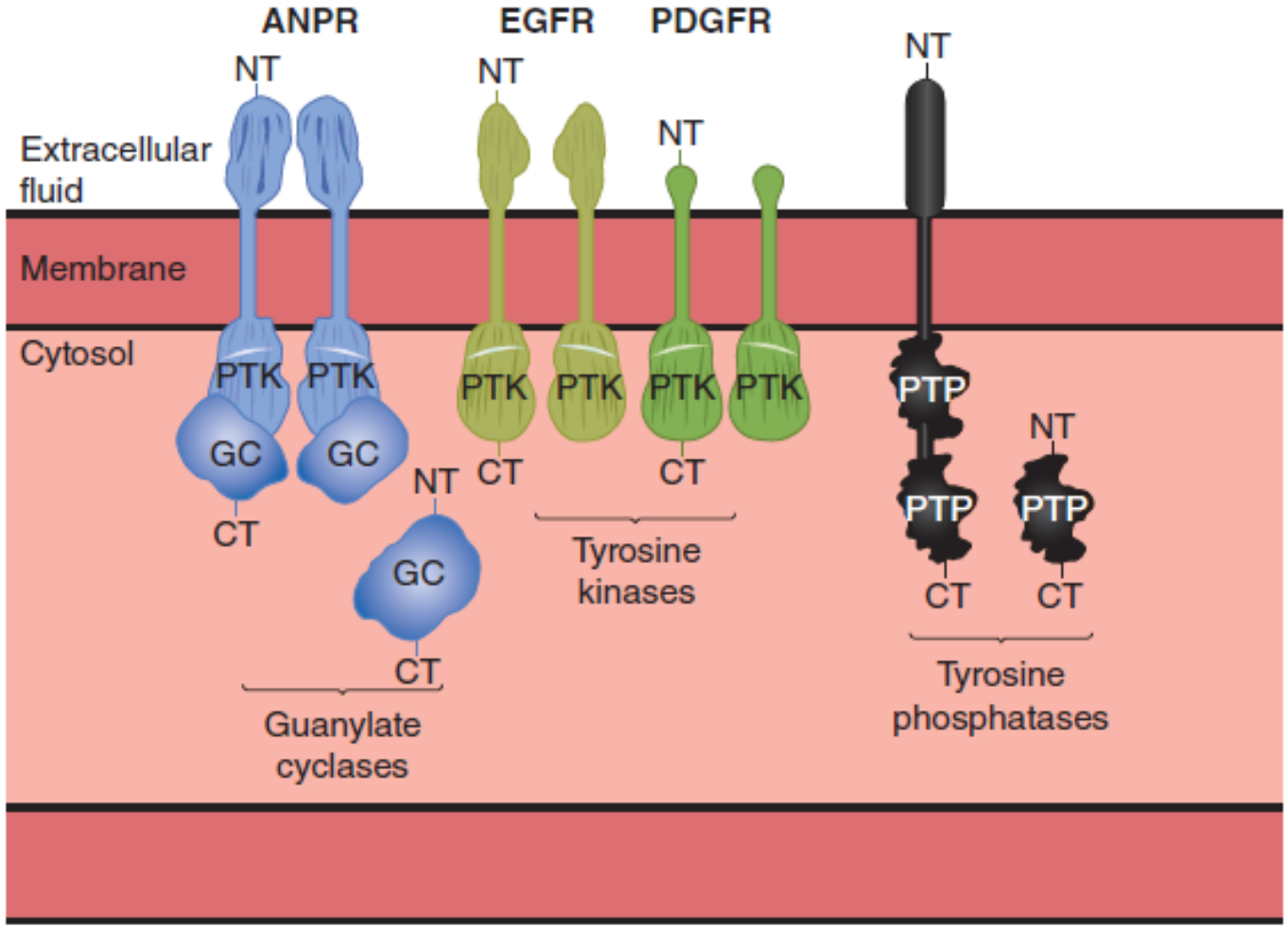


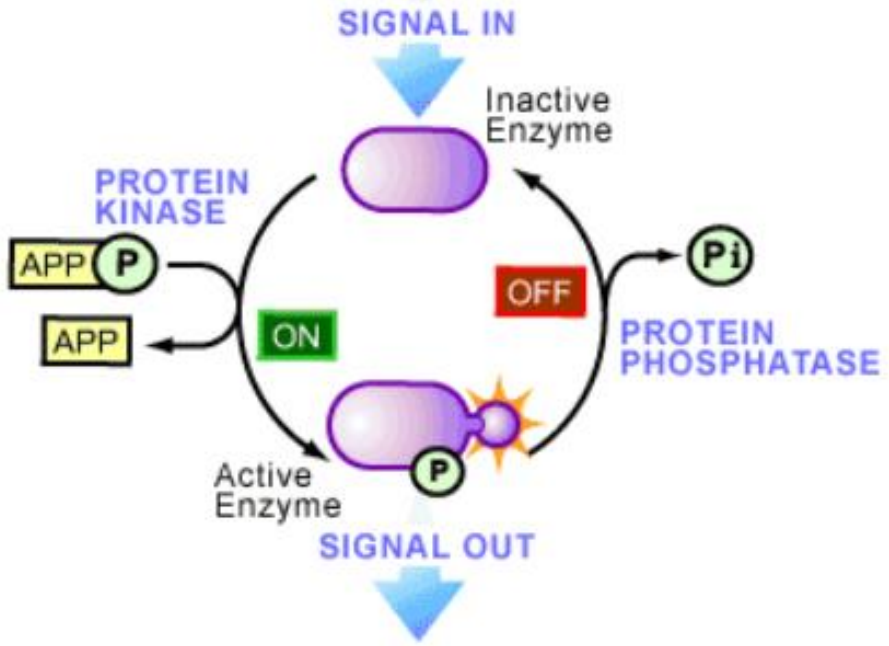
cAMP Signalling



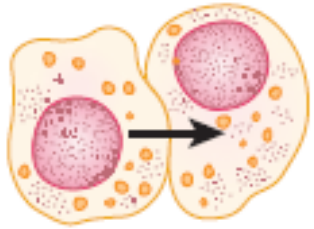
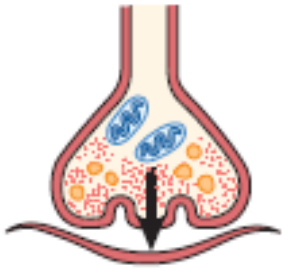
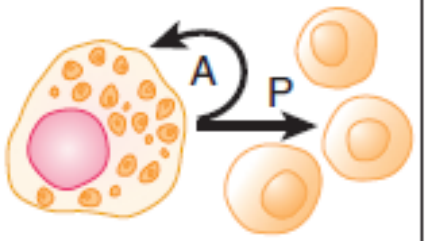
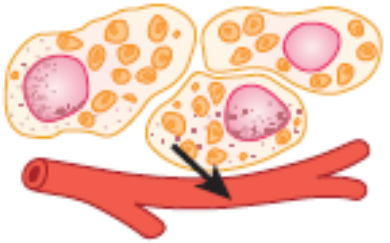
IP3/DAG Signalling

Kinase and Phosphatase Signaling

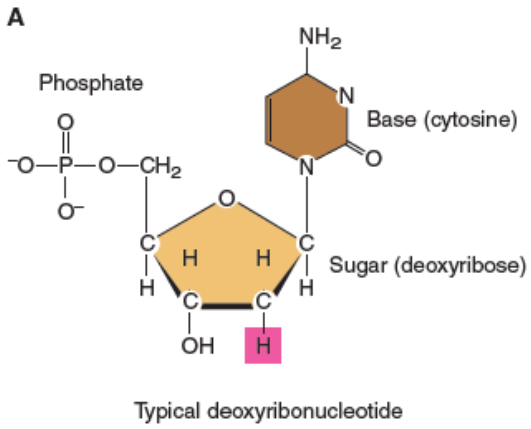


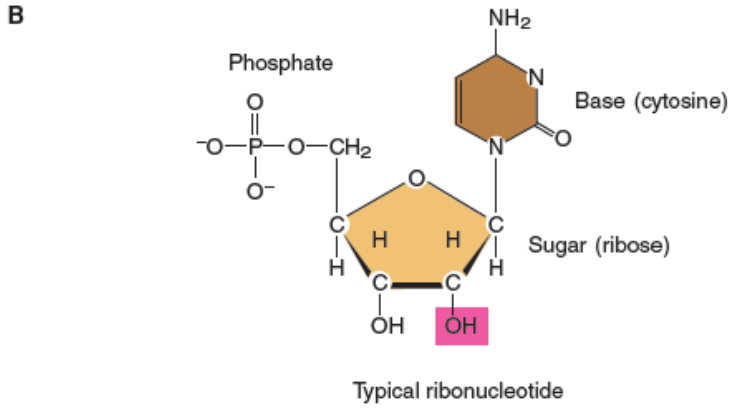


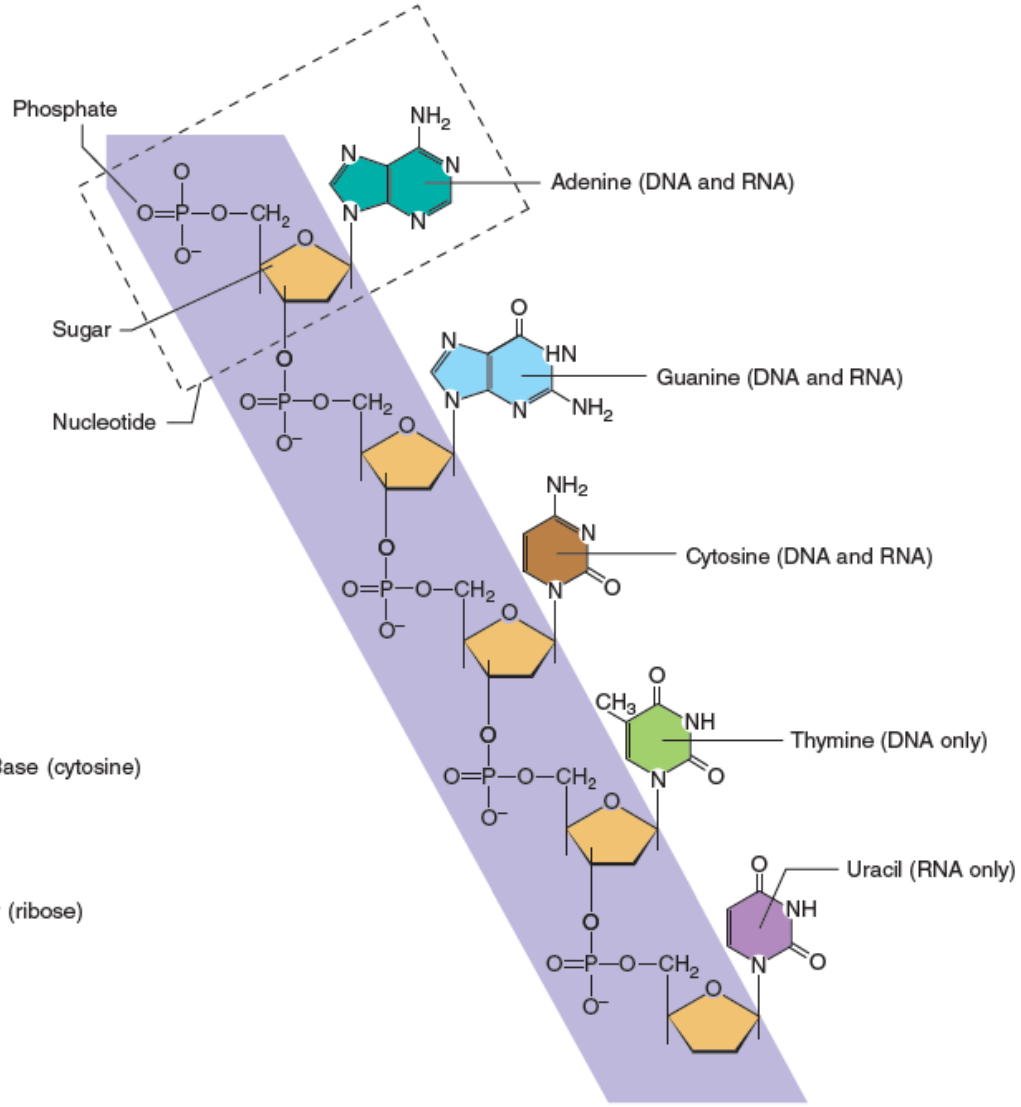
Intercellular messaging pathways

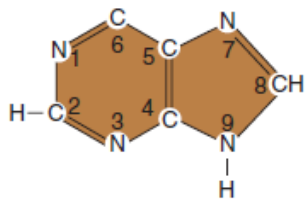
	GAP JUNCTIONS	SYNAPTIC	PARACRINE AND AUTOCRINE	ENDOCRINE
				
Message transmission	Directly from cell to cell	Across synaptic cleft	By diffusion in interstitial fluid	By circulating body fluids
Local or general	Local	Local	Locally diffuse	General
Specificity depends on	Anatomic location	Anatomic location and receptors	Receptors	Receptors

DNA and The Genome



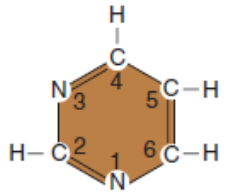






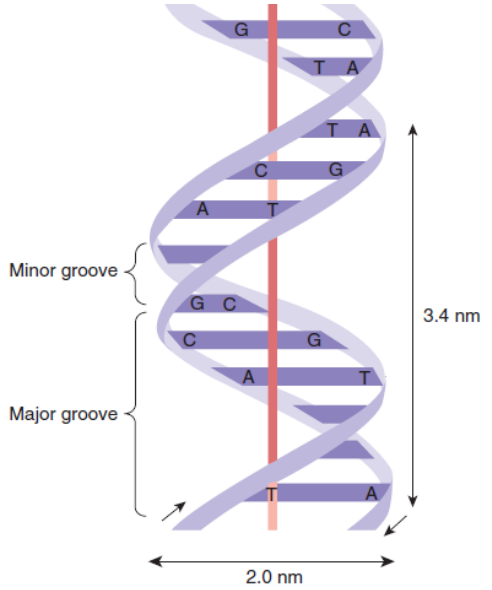
Adenine: 6-Aminopurine
Guanine: 1-Amino-6-oxypurine
Hypoxanthine: 6-Oxypurine
Xanthine: 2,6-Dioxypurine

Purine nucleus

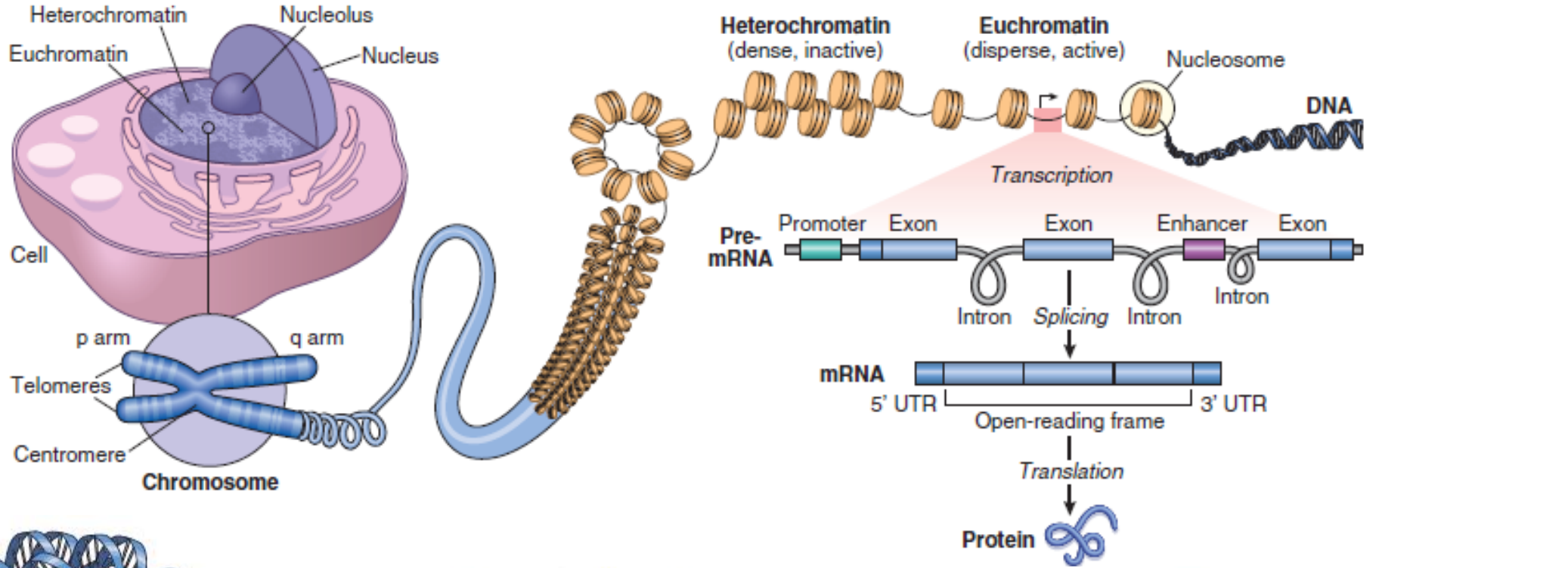


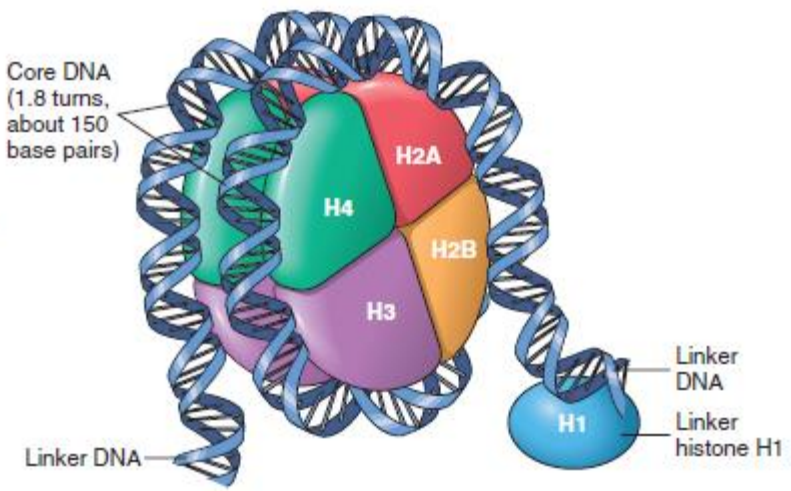
Cytosine: 4-Amino-2-oxypyrimidine
Uracil: 2,4-Dioxypyrimidine
Thymine: 5-Methyl-2,4-dioxypyrimidine

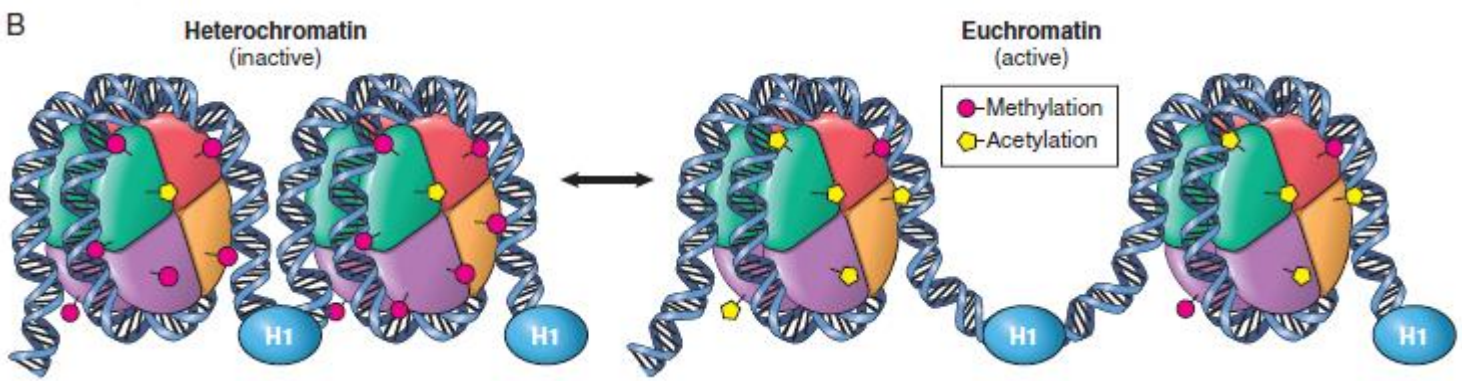
Pyrimidine nucleus



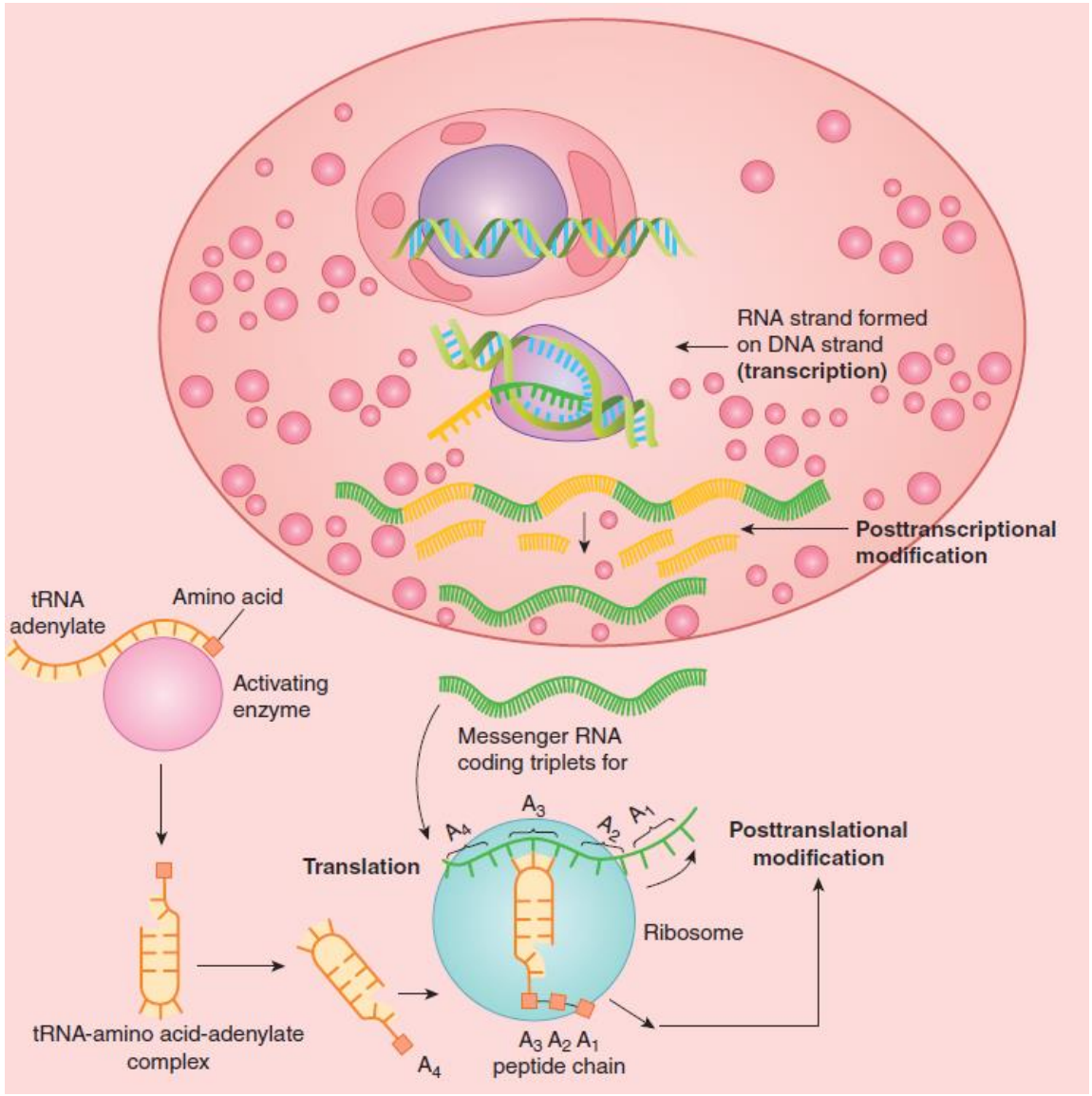
DNA and The Genome

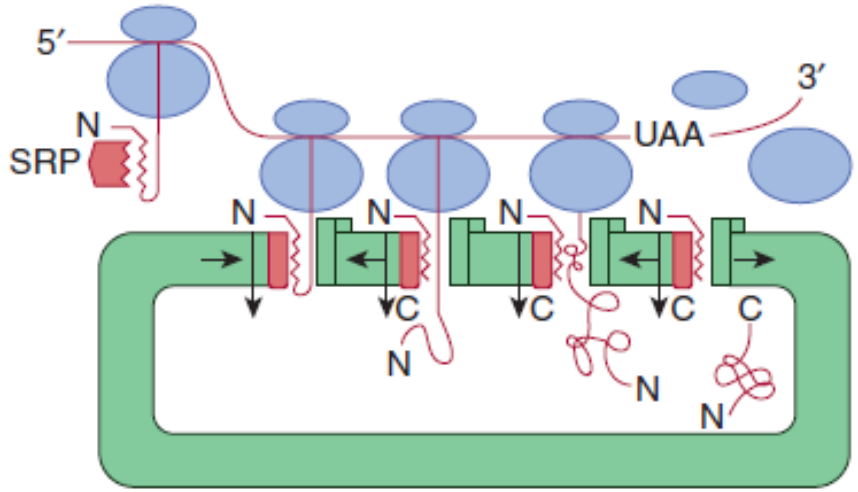




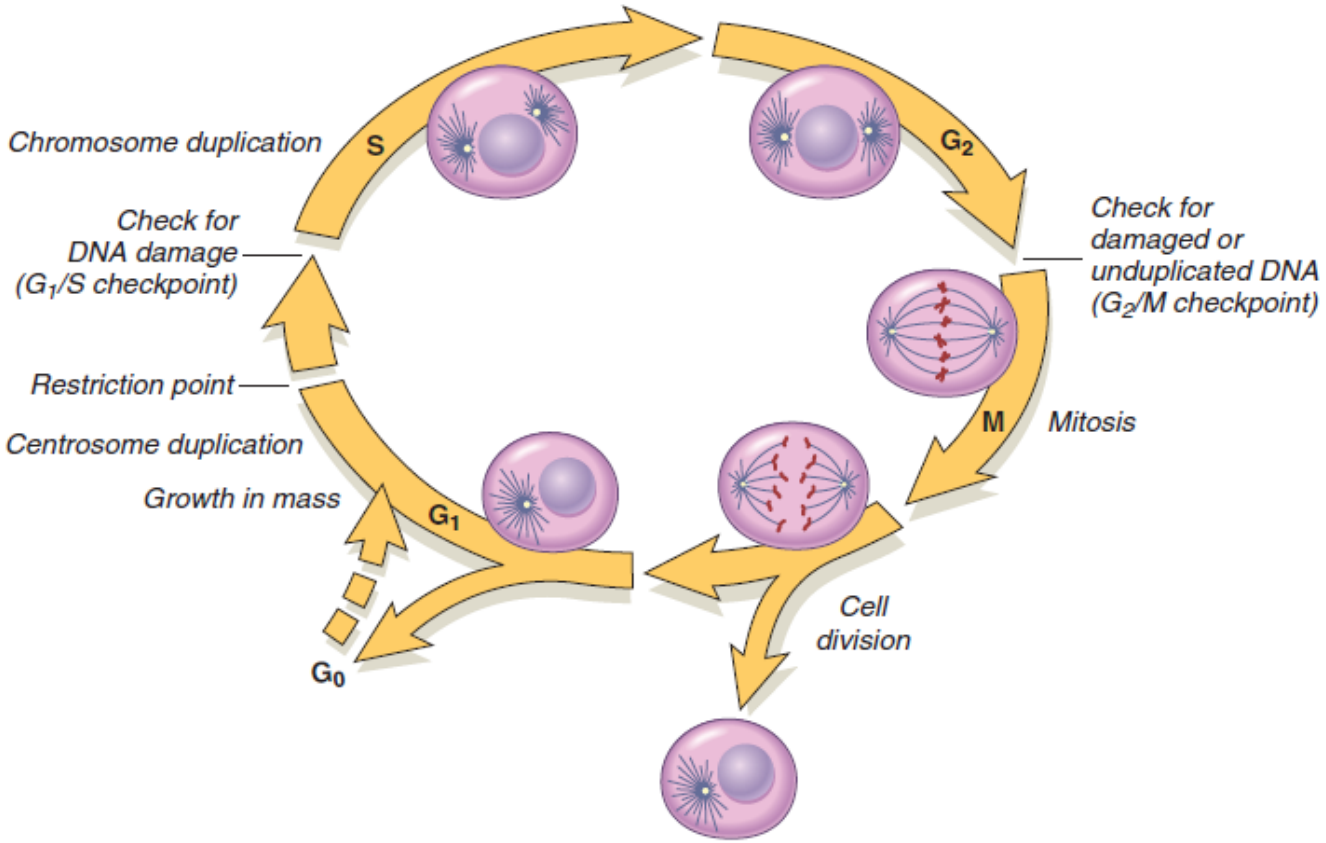


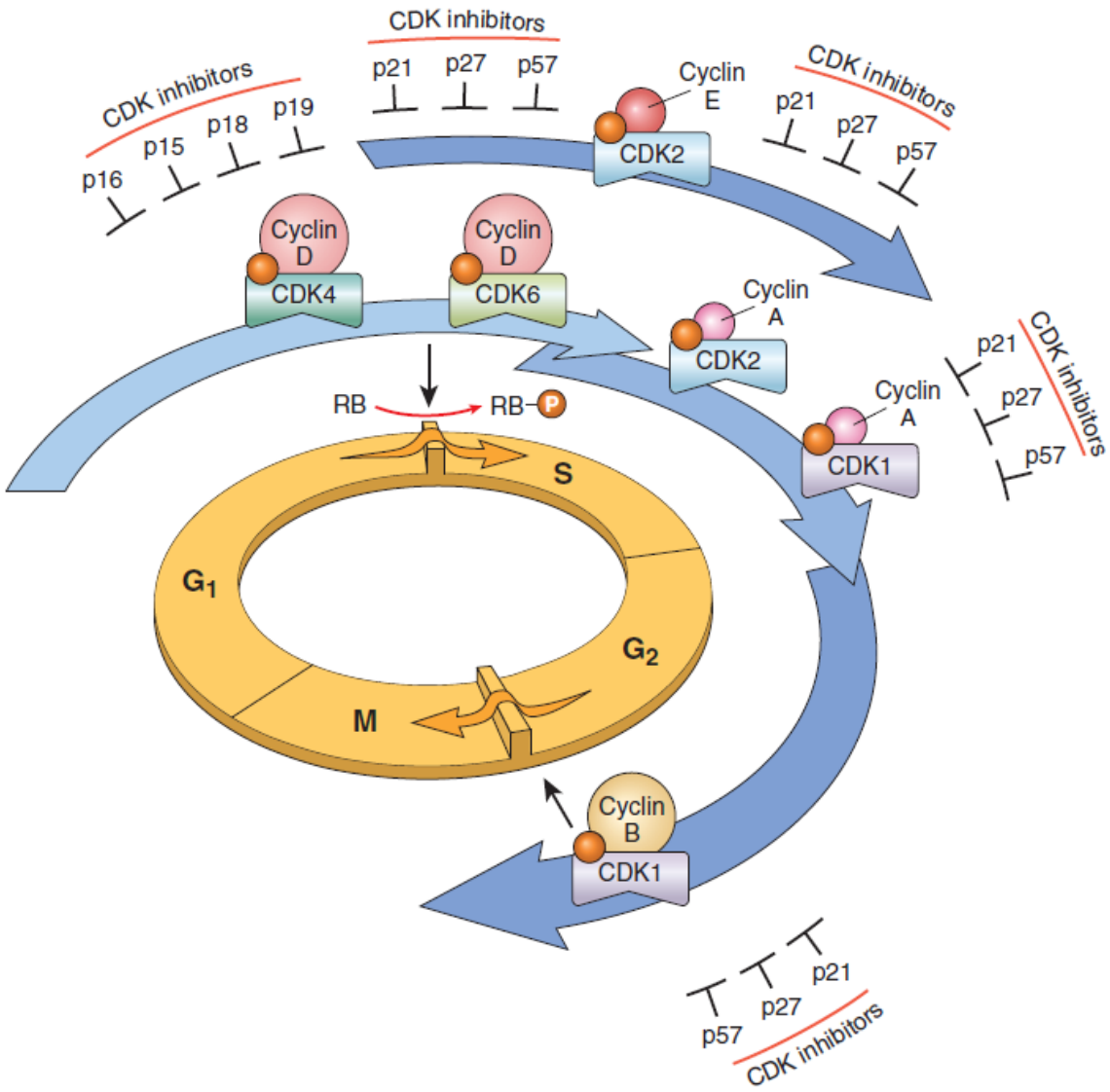
Transcription and Translation



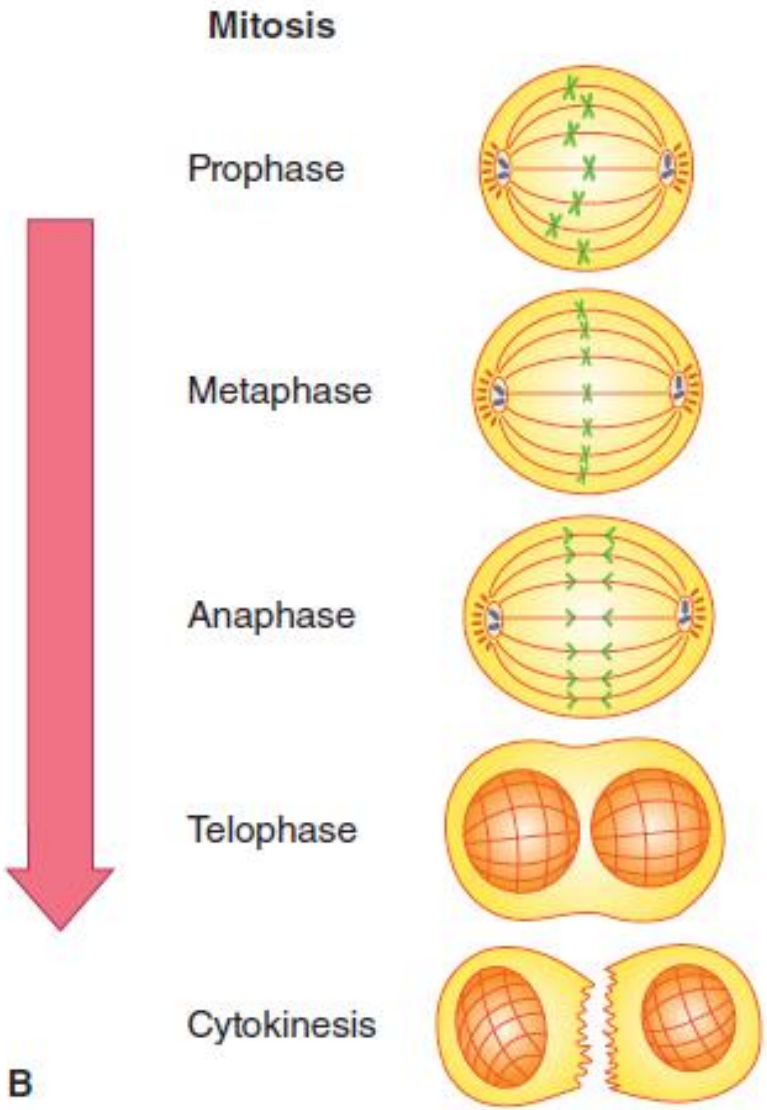


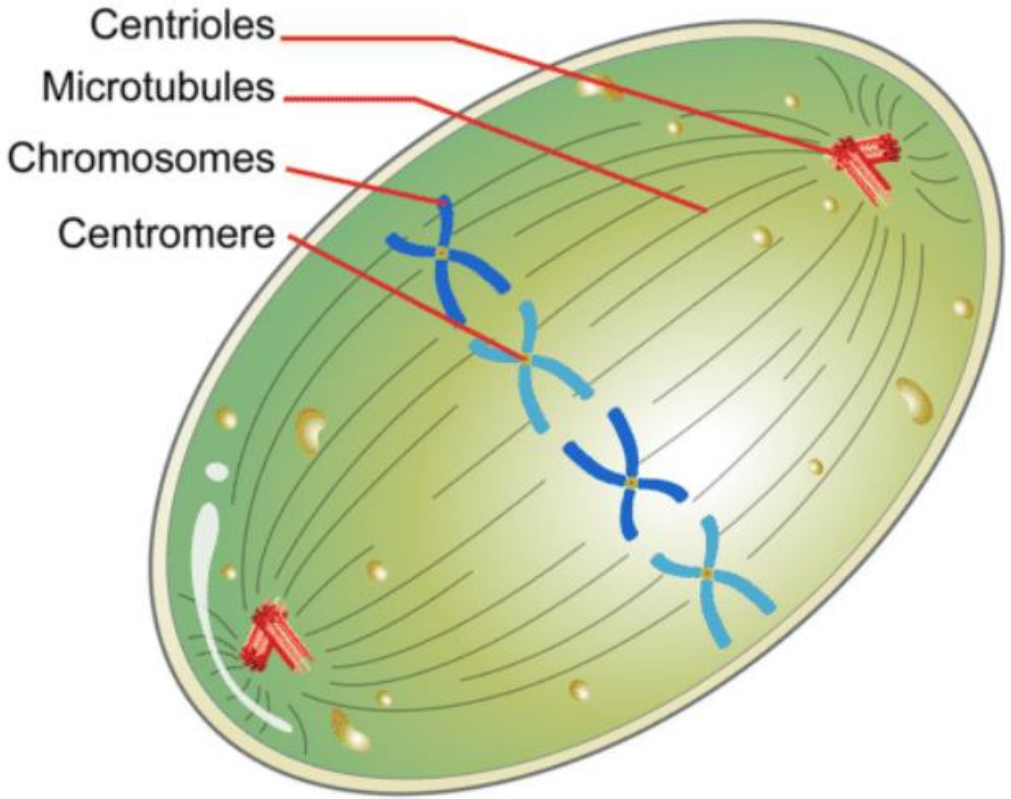
Cellular Cycle and Mitosis



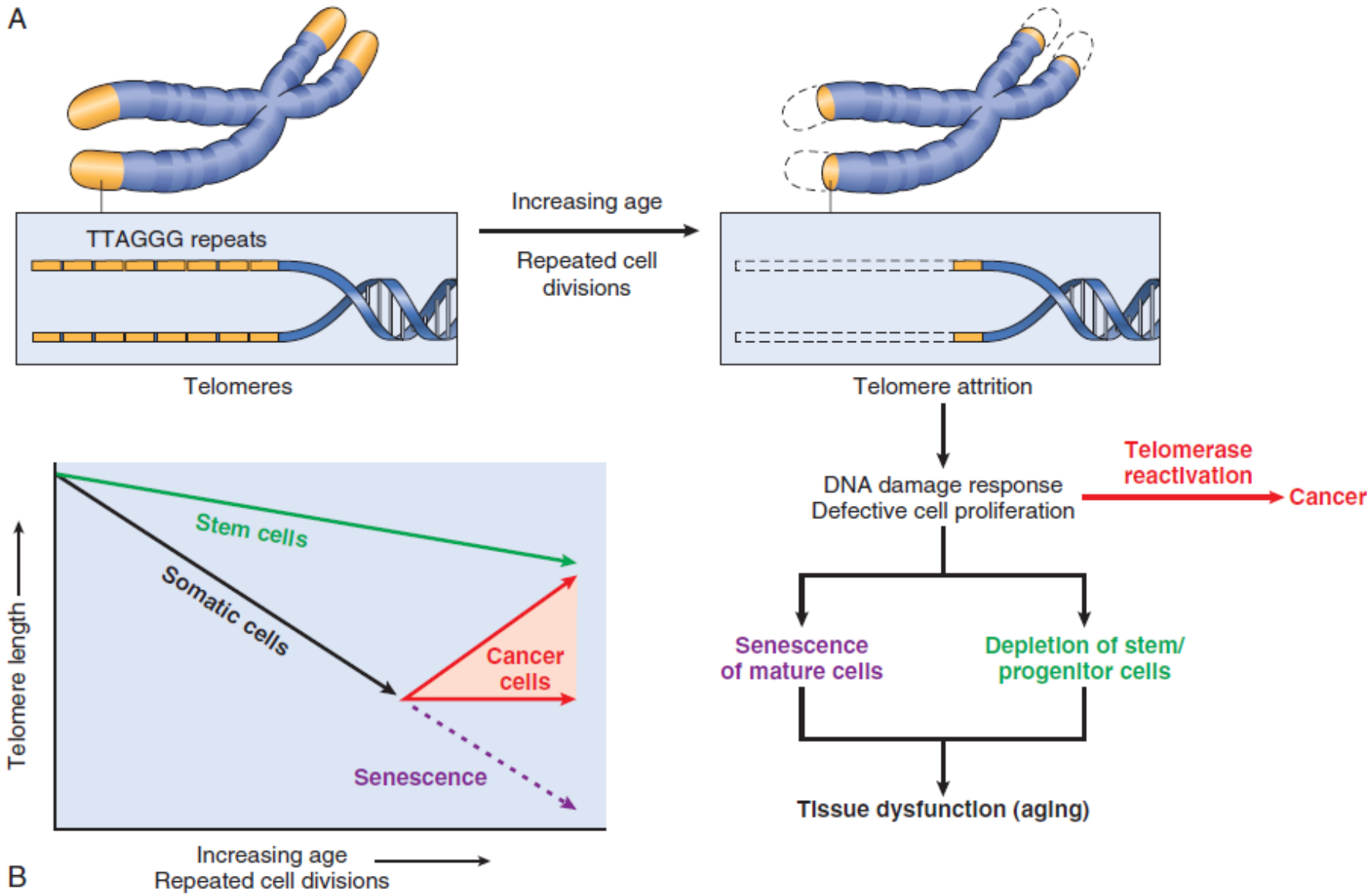


Cellular Cycle and Mitosis





Telomeres


A
TTAGGG repeats
Telomeres
Increasing age
Repeated cell divisions
Telomere attrition
DNA damage response
Defective cell proliferation
Telomerase reactivation
Cancer
Senescence of mature cells
Depletion of stem/ progenitor cells
Tissue dysfunction (aging)
Stem cells
Somatic cells
Cancer cells
Senescence
Telomere length
Increasing age
Repeated cell divisions
B