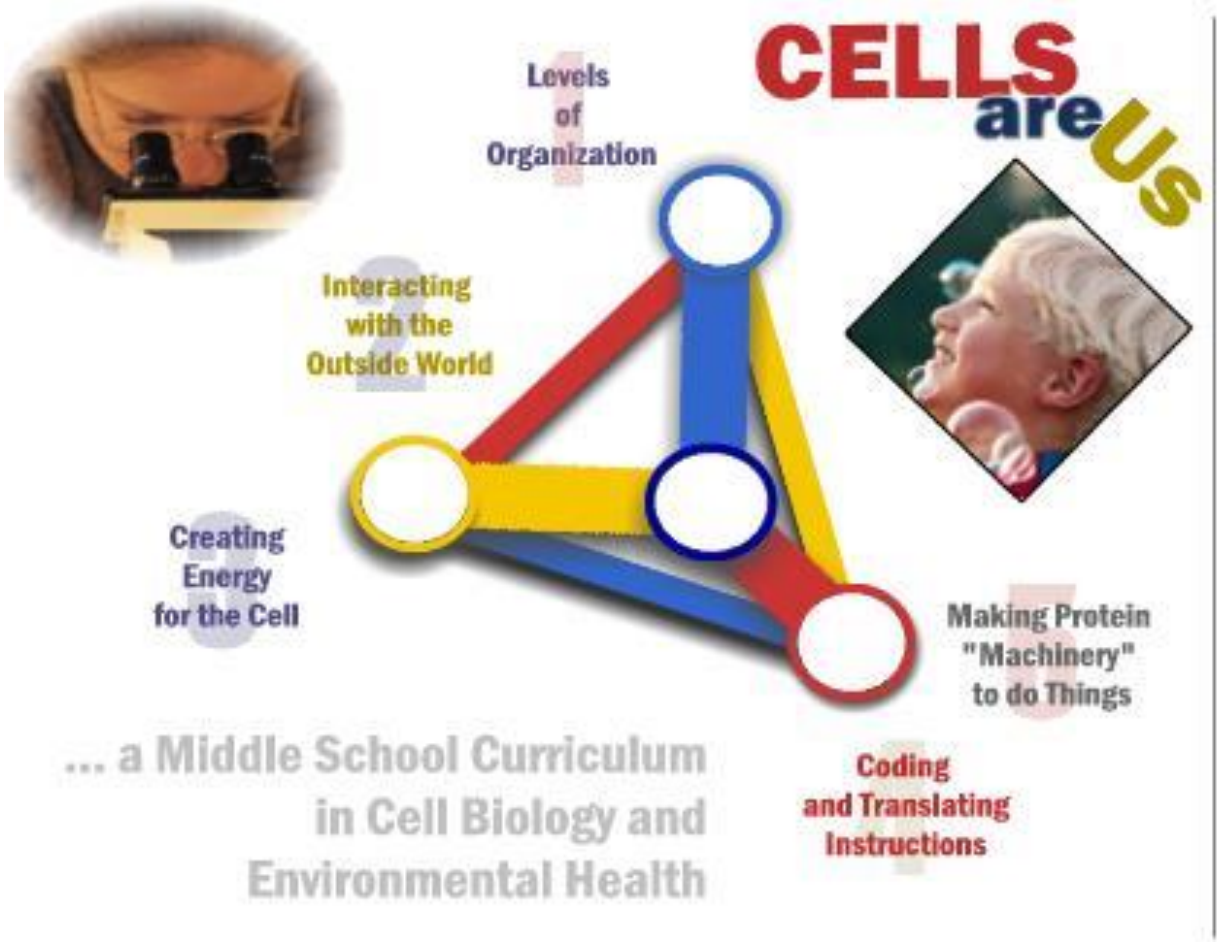
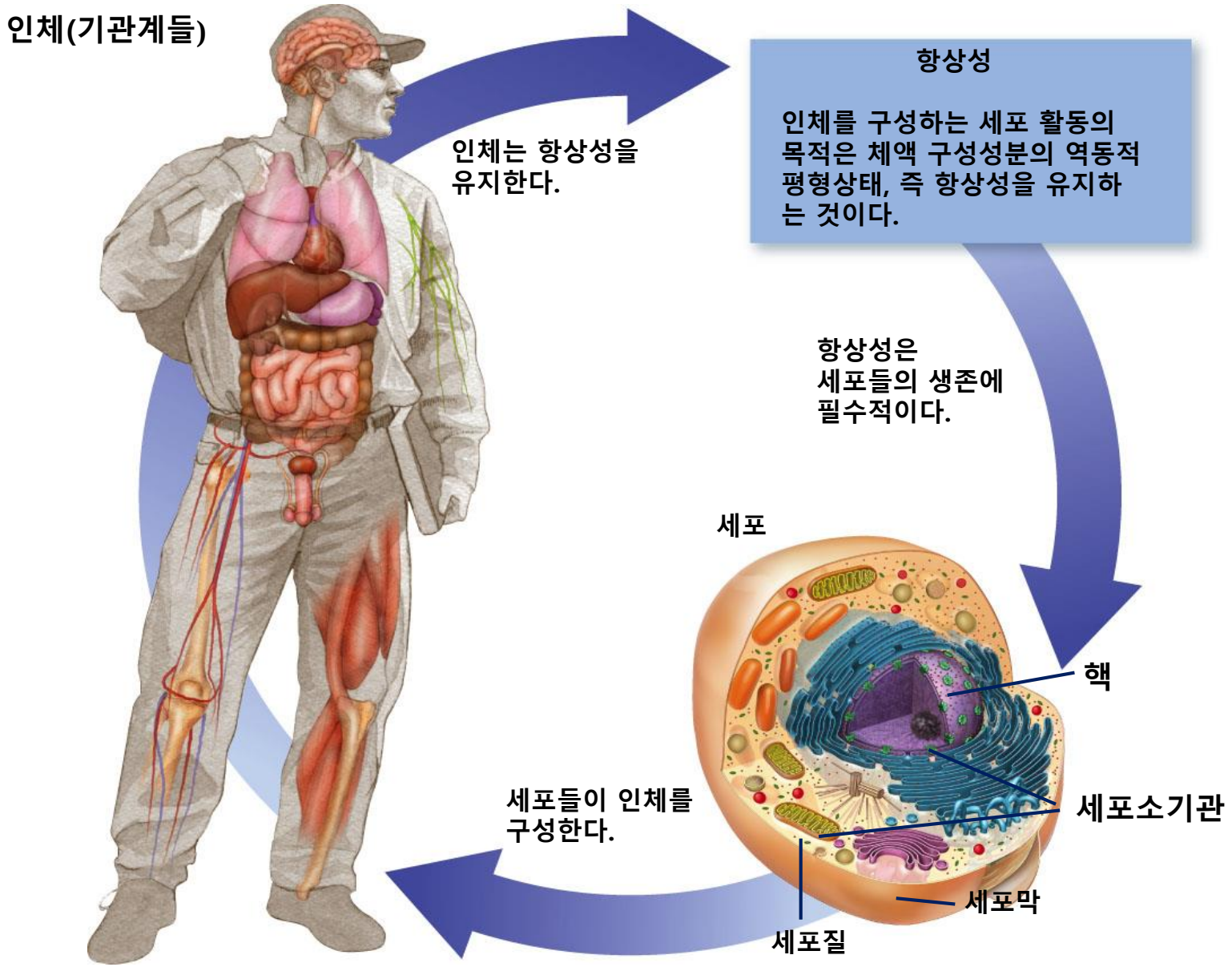
Cell physiology
(세포생리)




인체(기관계들)
인체는 항상성을 유지한다.
항상성
인체를 구성하는 세포 활동의 목적은 체액 구성성분의 역동적 평형상태, 즉 항상성을 유지하는 것이다.
항상성은 세포들의 생존에 필수적이다.
세포
핵
세포소기관
세포막
세포질
세포들이 인체를 구성한다.

세포 (Cell)

- Cells are the microscopic fundamental units of all living things.
- Every living thing has cells: bacteria, protozoans, fungi, plants, and animals are the main groups of living things.
- Some organisms are made up of just one cell : (e.g. bacteria and protozoans)
- Animals, including human beings: multicellular.
- An adult human body is composed of about 100,000,000,000,000 cells!

- Each cell has basic requirements to sustain it, and
- the body's organ systems are largely built around providing the many trillions of cells with those basic needs (such as oxygen, food, and waste removal).

생물체를 구성하는 구조적 기능적
유전적 최소단위 자기조절과 보존성

✓세포설 **(cell theory)**

1. 모든 생물은 세포와 그 부산물로 구성

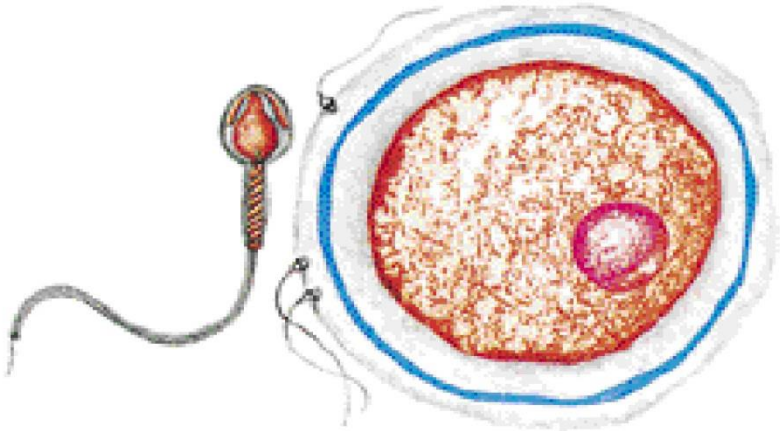
2. 세포는 반드시 그 이전에 존재했던 세포로 부터 생성

✓모양

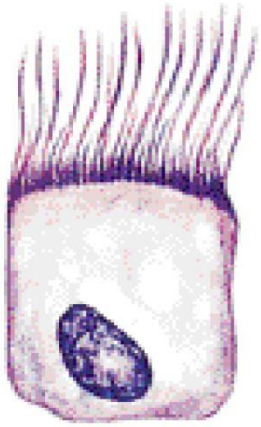
1. 일반적으로 구형, 종류 부위 기능에 따라 다양

2. 난자, 신경세포, 백혈구, 세균, 식물세포 등..

A



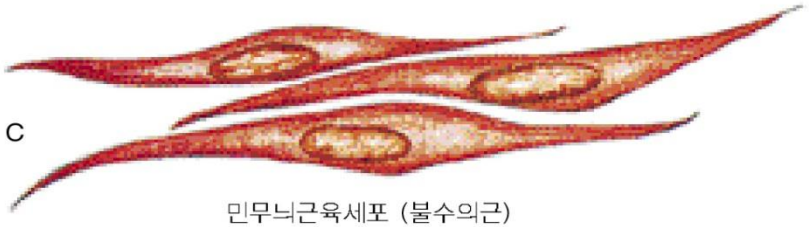
정자와 난자
[Sperm and ovum (egg)]



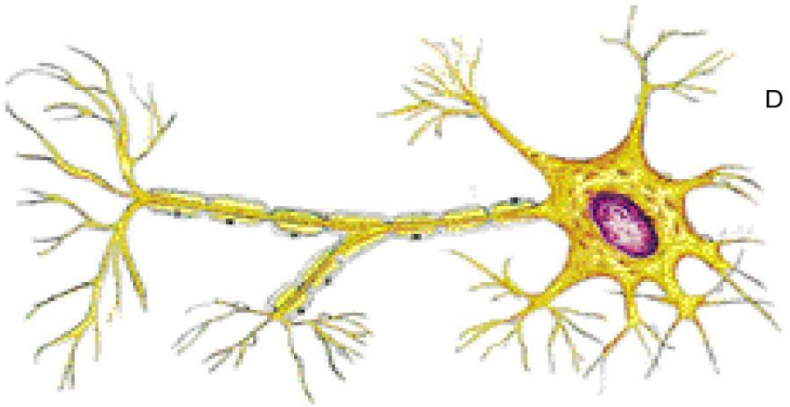
B

상피세포
(Epithelial cell)

C



민무늬근육세포 (불수의근)
[Smooth (involuntary) muscle cells]

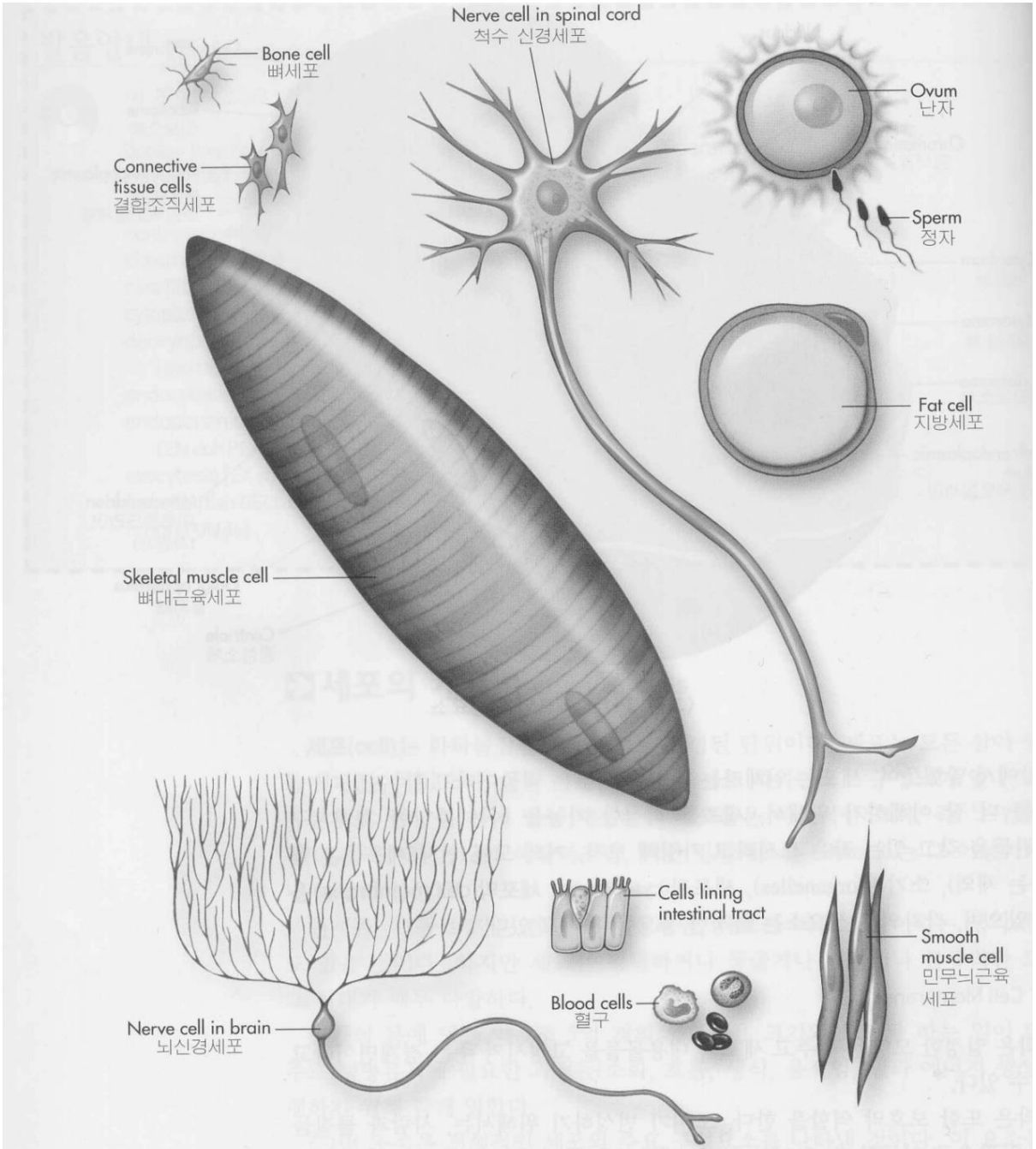


D

신경세포[Nerve cell (neuron)]

E

림프구(Lymphocyte)



〈그림 3-2〉 인체 내에 있는 세포의 여러 형태들

세포의 구성 (Cellular Organization)

1. 세포막(cell membrane)

- 세포내외 물질 이동 담당
- 그 주위와 세포 성분들을 격리
  세포내액(intercellular fluid; ICF)과
  세포외액(extracellular fluid; ECF)

세포의 구성 (Cellular Organization)

2. 세포질 (cytoplasm)

- 핵을 제외한 세포 내부 전체
- 세포소기관들(organelles)과 세포골격(cytoskeleton)으로 구성
  - ✓ **세포골격**: **세포기질(cytosol)**이라 불리는 겔 같은 액체에 존재하며, 서로 연결된 단백질 섬유와 관으로 구성된 복잡한 구조물

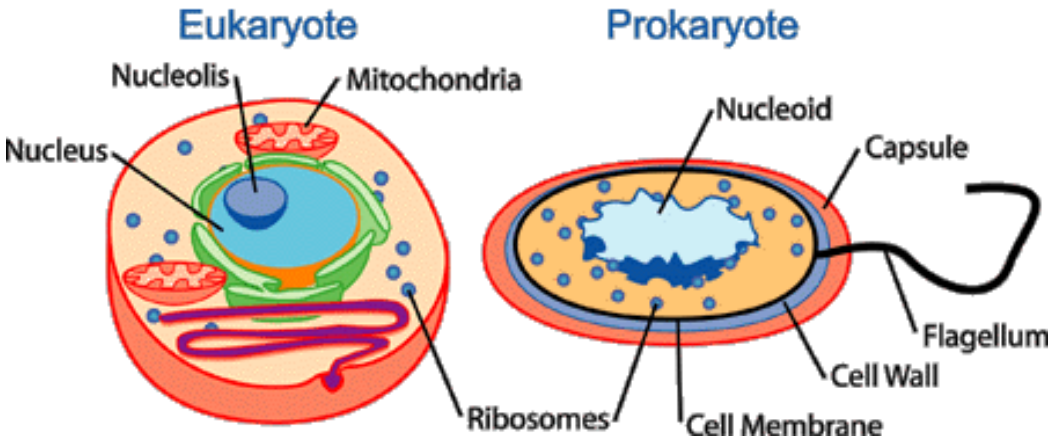
세포의 구성 (Cellular Organization)

3. 핵 (nucleus)

- **핵막, 핵소체, 염색질, 핵형질로 구성**
  유전인자의 정보센터, 단백질 합성 등..
- 세포의 다른 부분과 핵을 구별하는 이중막으로 된 **핵막**(nuclear envelope)으로 둘러싸임
- 세포의 유전물 질인 **데옥시리보핵산**(DNA)을 함유
  - DNA의 기능들
    - 단백 질 합성 지시
    - 세포 복제 과정에서 유전자 청사진으로의 역할

세포 및 조직

- 세포외 기질(extracellular matrix)이 둘러싸고 있음.
- 인체 세포 : 3~30㎛ 크기, 진핵세포(eukaryote)
  (혈구, 혈소판 등 제외)
- 체중의 40% 세포내액(intracellular fluid),
  20% 세포외액(extracellular fluid)



체액의 조성 :체중의 약 60%

세포내액 (40%)
ICF

- 단백질 (20%)
- 핵산 (1.1%)
- 유지방 (5%)
- 탄수화물 (3~5%)
- 무기질 (1.5%)
- 비타민, 호르몬 기타 (1.0%)

세포외액 (20%)
ECF

- 혈액 (5%)
- 사이질액(간질액) (15%)

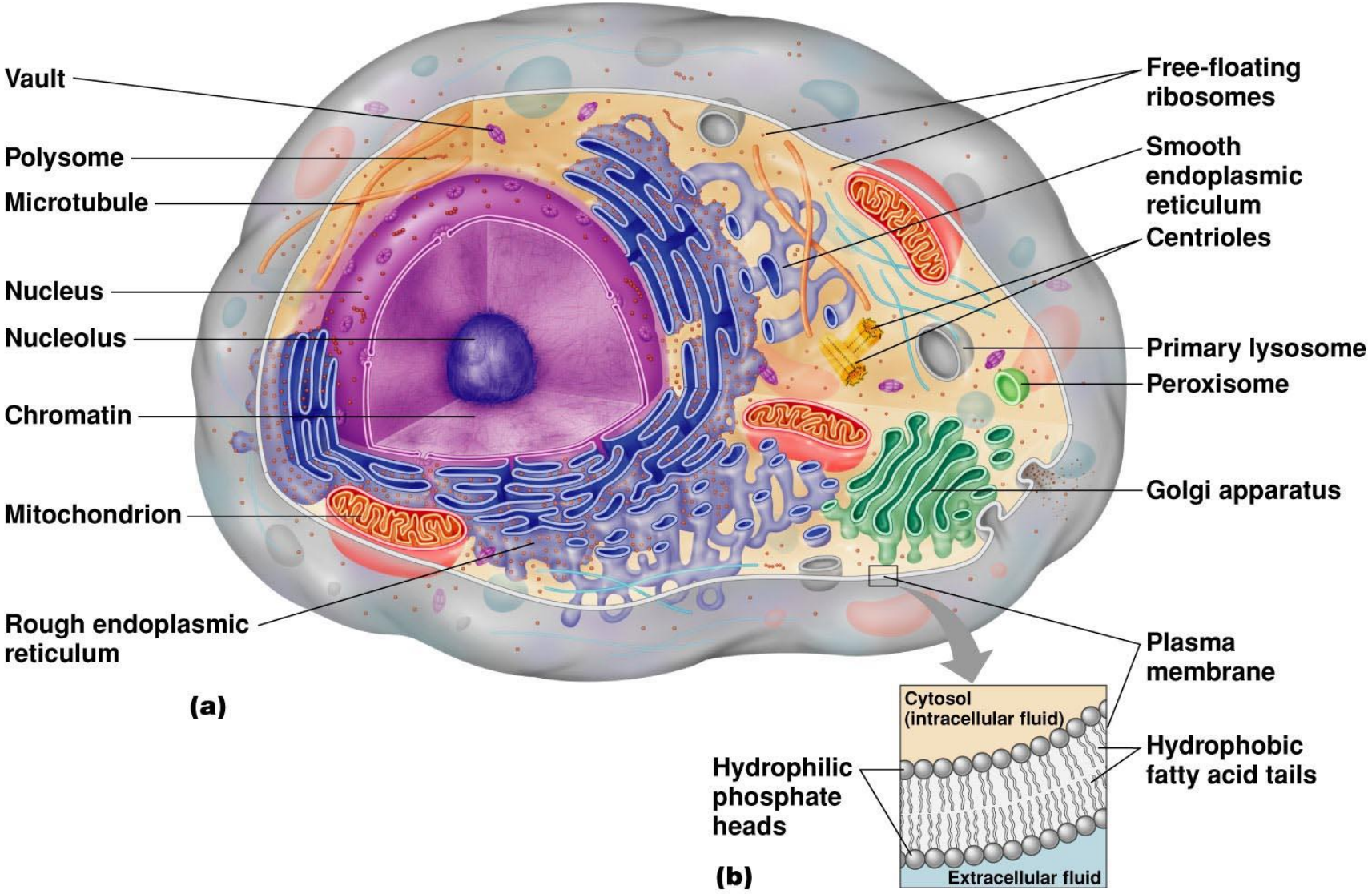
세포내액 [intracellular fluid, 細胞內液]

- 체중의 약 40%
- 체액(body fluid) 중 세포 내에 포함되어 있는 것. 체액의 약 65%를 차지한다. 세포외액에 비해
  - 단백질, K^+, Mg^{2+}, PO_4^{3-}, SO_4^{2-}가 많으며,
  - Na^+, Ca^{2+}, Cl^-, HCO_3^-가 적다.
- 전기적 음성
- 구성: 전해질, 포도당(glucose), 당원(glycogen), 지질(중성지방, 인지질, cholesterol), 아미노산(amino acid), 산소, 이산화탄소
- 기능: 수분평형조절, 능동적 운반, 삼투작용, 산 염기평형

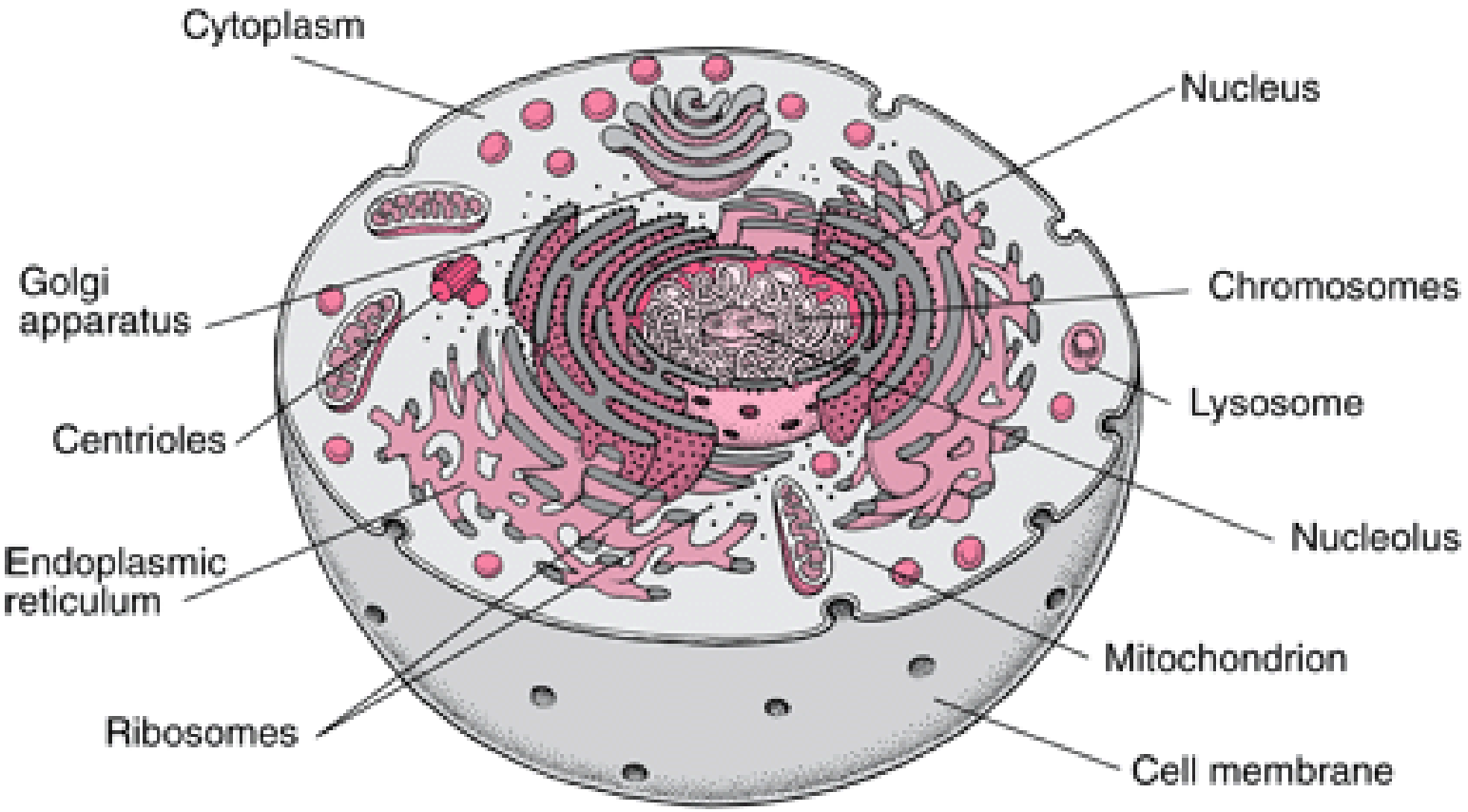
세포외액 [extracellular fluid, 細胞外液]

- 체중의 약 20%
- 체액(body fluid) 중 세포의 외부에 있는 조직액(interstitial fluid), 림프액(lymph) 및 혈장(plasma)의 총칭. 3종의 세포외액의 무기이온 조성은 거의 공통적이며,
- 세포내액에 비교해
  - Na^+, Ca^{2+}, Cl^-, HCO_3^-가 많고
  - K^+, Mg^{2+}, PO_4^{3-}, SO_4^{2-}가 적다.
- 전기적 양성
- 전해질 농도차의 기능: 세포막 투과성 차이와 능동적 운반기전의 힘으로 근육, 신경세포막 내외의 막전위 발생

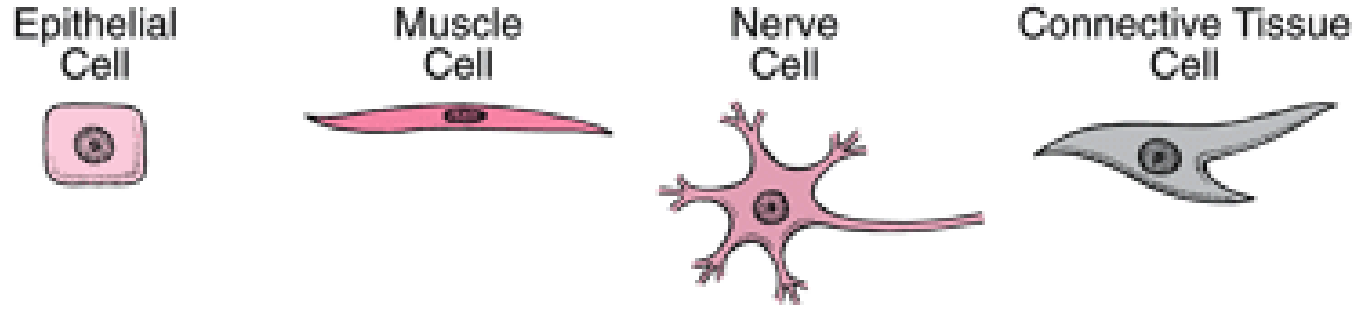
Cell organization



http://www.youtube.com/embed/a6boqEbcJWI?feature=player_embedded



Examples of Different Cells



Cytoplasm; cytosol(세포질)

세포 내 젤 형태의 물질, 세포의 생존을 위한 환경구현

- The gel-like material within the cell membrane.
- It is a fluid matrix, the cytosol, which consists of 80% to 90% water, salts, organic molecules and many enzymes that catalyze reactions, along with dissolved substances such as proteins and nutrients.
- Surrounds the nuclear envelope, the cytoplasmic organelles.
- A storage space for chemical substances indispensable to life, which are involved in vital metabolic reactions, such as anaerobic glycolysis and protein synthesis

Cytoplasm (cont'd)

- Cytoplasm is the region between the nucleus and the membrane bounding the cell
- The cytoplasm is made of a semifluid called cytosol
- Organelles are located in the cytoplasm
- Cytosol uses enzymes to break down larger molecules
- The products are used by organelles
  Ex) Glucose cannot be used by mitochondria unless it is broken down into pyruvate molecules

The cell organelles are suspended in the cytosol. You learned that the microfilaments and microtubules set up a "skeleton" of the cell and the cytosol fills the spaces. The cytoplasm has many different molecules **dissolved in solution**. You'll find enzymes, fatty acids, sugars, and amino acids that are used to keep the cell working. Waste products are also dissolved before they are taken in by vacuoles or sent out of the cell.

Functions of cytosol (fluid of the cell)

- Location of specific chemical reactions
- Storage of fat, carbohydrates as inclusions
- Storage of secretory vesicles

Cytoskeleton (세포골격)

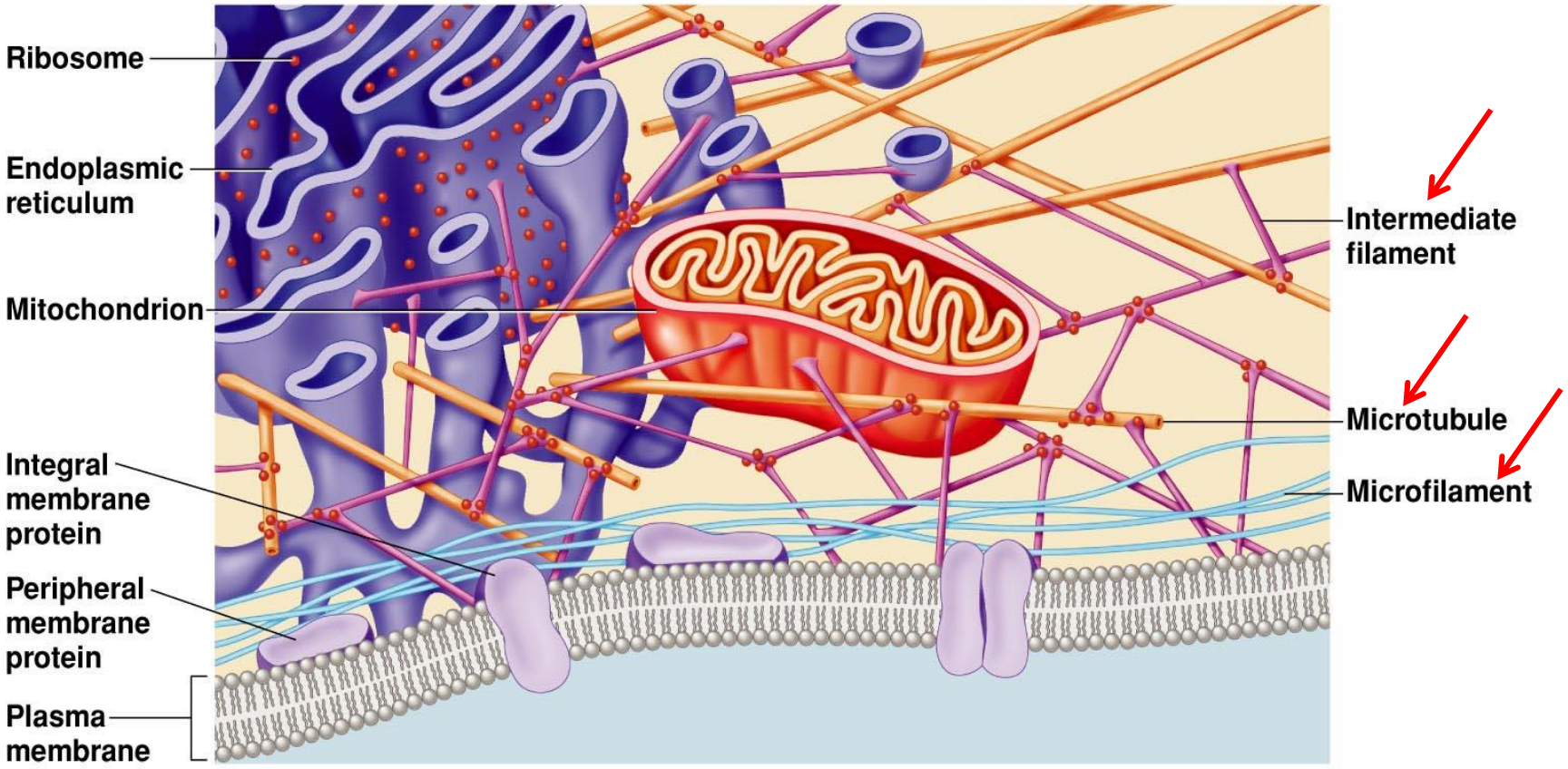
- The Cytoskeleton is the internal network of protein filaments

  Ex) microtubules in eukaryotic cells that are responsible for controlling the cell's movement, providing mechanical strength, establishing the shape of the cell, chromosome transportation during cell division, and the intracellular transport of organelles.

- The cytoskeleton is made up of three protein filaments:

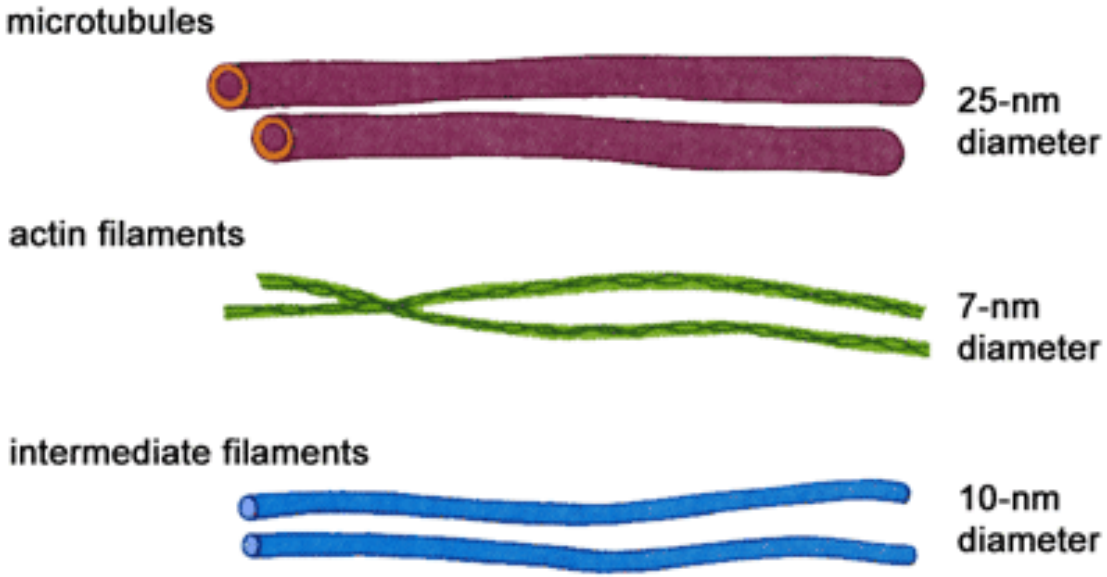
  ✓actin filaments (also known as microfilaments),
  ✓intermediate filaments,
  ✓microtubules.

- Microtubules, microfilaments, intermediate filaments
  (미세소관, 미세소섬유, 중간소섬유)
  : 세포 형태 결정, 세포 운동 주관



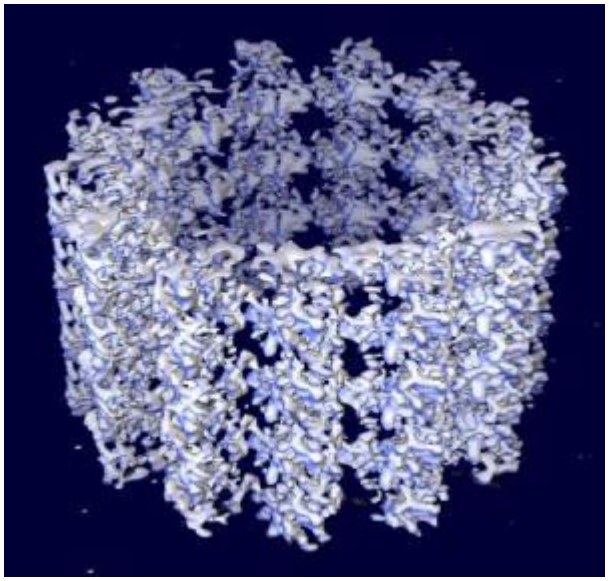
Functions of cytoskeleton

- Mechanical support and structure
- Intracellular transport of materials
- Suspension of organelles
- Formation of adhesions with other cells
- Contraction
- Movement



Microtubules (미세소관)

- Microtubules function as the framework along which organelles and vesicles move within a cell.
- They are the thickest of the cytoskeleton structures.
- They are long hollow cylinders, composed of protein subunits, called tubulin.



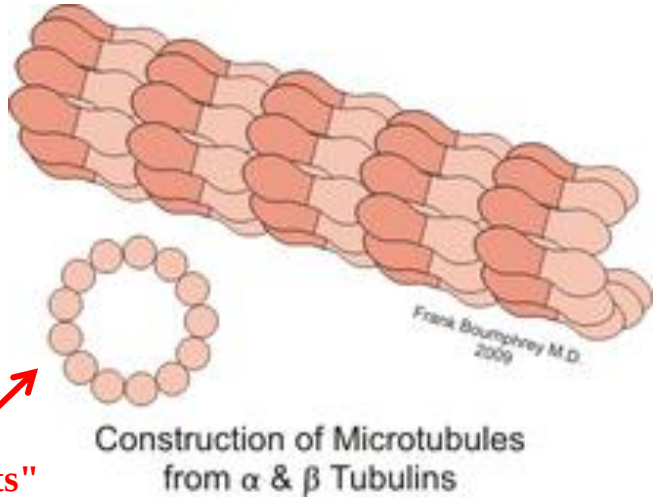
A 3-D reconstruction of intact microtubules

Microtubules (미세소관)

- 20-25nm in diameter
- straight, hollow cylinders made up of a ring of 13 "protofilaments";
- composed of subunits of the protein tubulin termed alpha and beta
- determine cell shape and are responsible for most cell functions involving motion
- are found in both animal and plant cells.
- motion is driven by microtubule "motors" that run on ATP

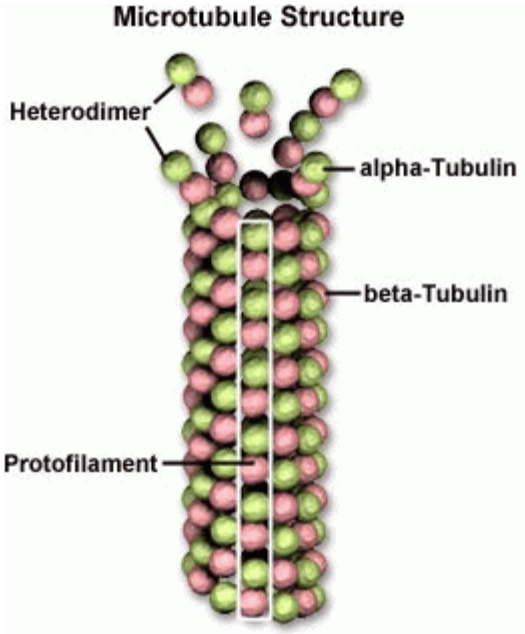
Microtubules (미세소관)

- 진핵세포의 세포골격을 구성하는 세포 구조의 하나
- 세포에 있는 속이 빈 관 모양의 구조물
- 튜불린 단백질의 이합체가 지름 25 나노미터의 원통 모양으로 이루어진 구조
- 세포 내 구조물을 **지지**, 물질 수송에 관여
- 편모와 섬모에서도 규칙적인 배열, **방추사**
  - 세포에 운동성을 제공



Construction of Microtubules
from α & β Tubulins

13 "protofilaments"

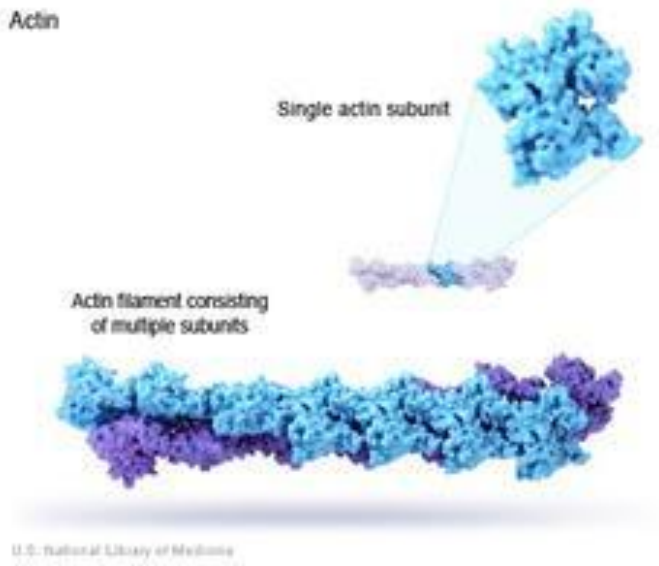


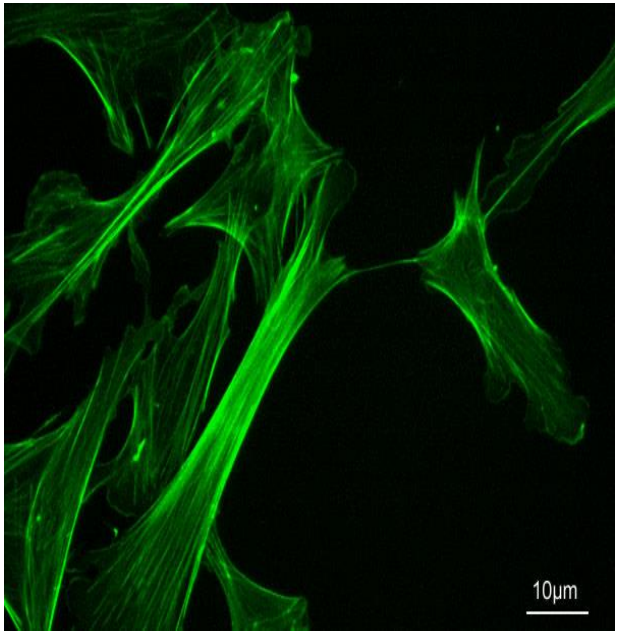
Microfilaments (미세소섬유) Actin filament

- 8 nm in diameter
- composed of a contractile protein called actin
- interact with myosin filaments
  →muscle contraction
- generate locomotion in cells such as white blood cells and the amoeba
- carry out cellular movements including gliding, contraction, and cytokinesis
- generates cytoplasmic streaming in some cells.
- provide mechanical support for the cell, determine the cell shape, and in some cases enable cell movements.
- They are made of the protein actin and are involved in cell motility.

Microfilaments (미세소섬유)

- predominant in muscle cells
- in the cells that move by changing shape, such as phagocytes (white blood cells that scour the body for bacteria and other foreign invaders).





A photograph of microfilaments

Microfilament (미세소섬유)

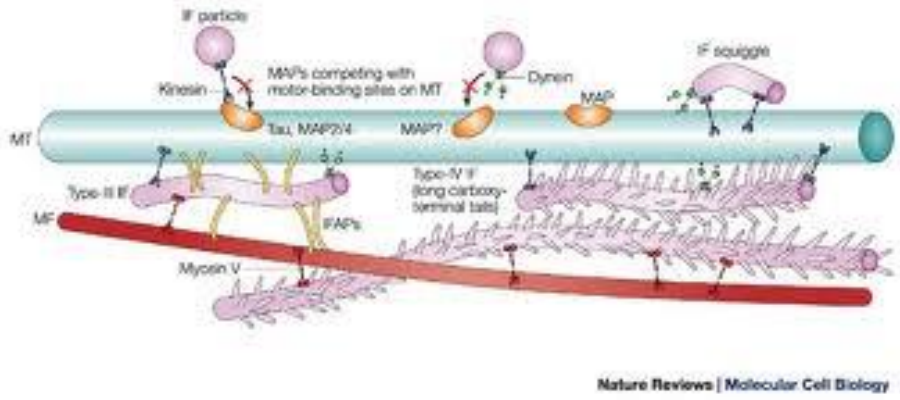
- 직경 약 5~7㎚, 가늘고 긴 섬유
- actin이 주성분
- 미소섬유, 미소사, 미세사 라고 명칭
- 세포막 기저부 형성(치밀한 망상구조체)
- 세포 형태 유지, 기계적 강도 부여, 세포 자체 운동 및 세포 내 세포질의 운동 담당

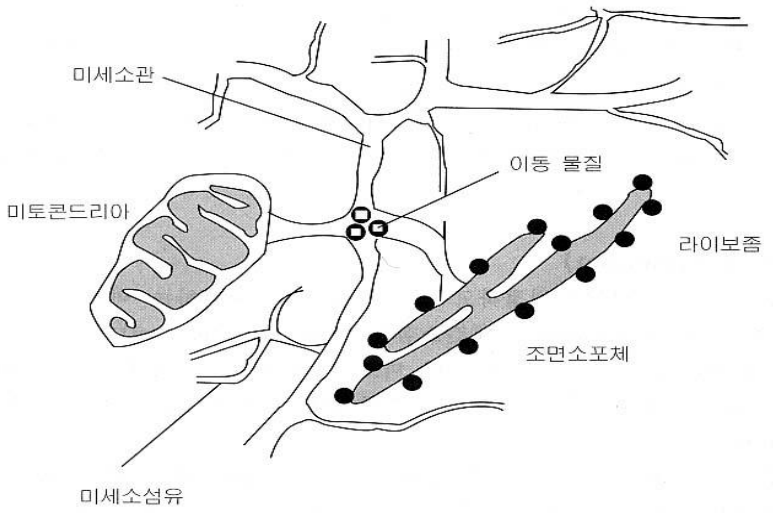
Intermediate filament (중간소섬유)

- different cell types, different intermediate filaments (all eukaryotes nuclear cytoskeleton the same)
- resist stresses applied externally to the cell
- cytoplasmic network or meshwork
- flexible intracellular scaffolding 10-nanometer diameter
- cross-linking proteins allow interactions with other cytoskeletal networks
- intermediate filament associated proteins (IFAPs) - coordinate interactions between intermediate filaments and other cytoskeletal elements and organelles,
- human disorders- mutations weaken structural framework, increase the risk of cell rupture

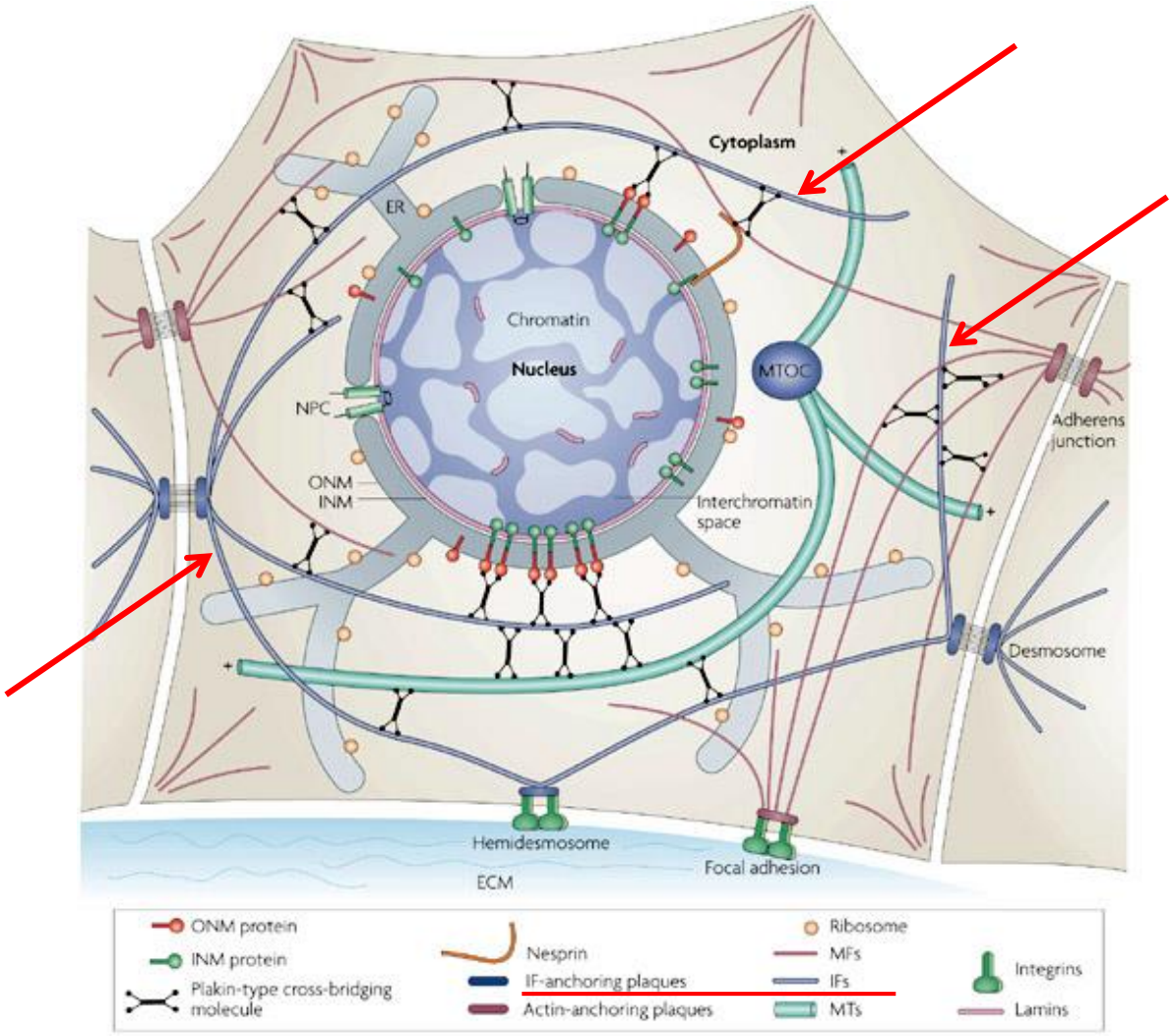
Intermediate filament (중간소섬유)

- 세포질 내 3차원적으로 분포
- 세포형태 유지, 세포 내 물질이동, 세포간의 접착 등 관계
- 직경 약 10㎚ 섬유
- 단백질 조직 특성에 따라 구성이 다름





Intermediate filament



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중심체 (Centrosomes)

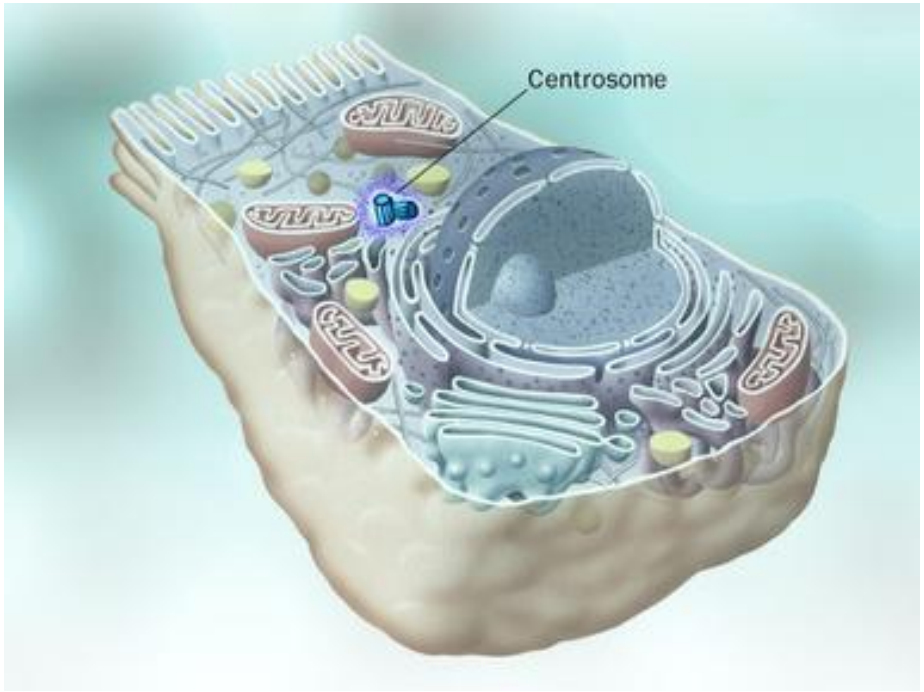
- 세포질 및 소포체에 존재
- 세포분열 시 가장 활발
- RNA로 구성
- 효소와 세포복구 및 생식에 필요한 단백질 생성에 관여

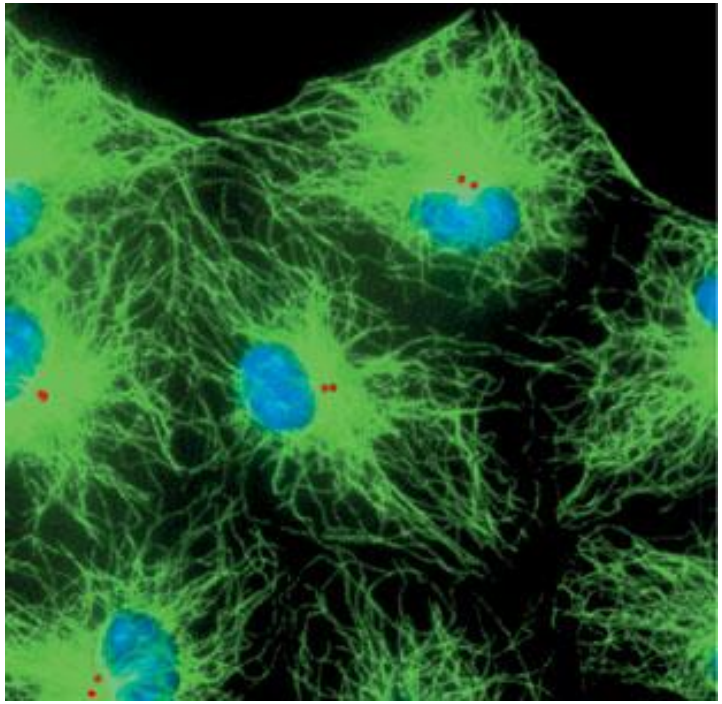
cf. 신경세포 식물세포?에서는 볼 수 없다

(신경세포는 일생 동안 분열되지 않음)

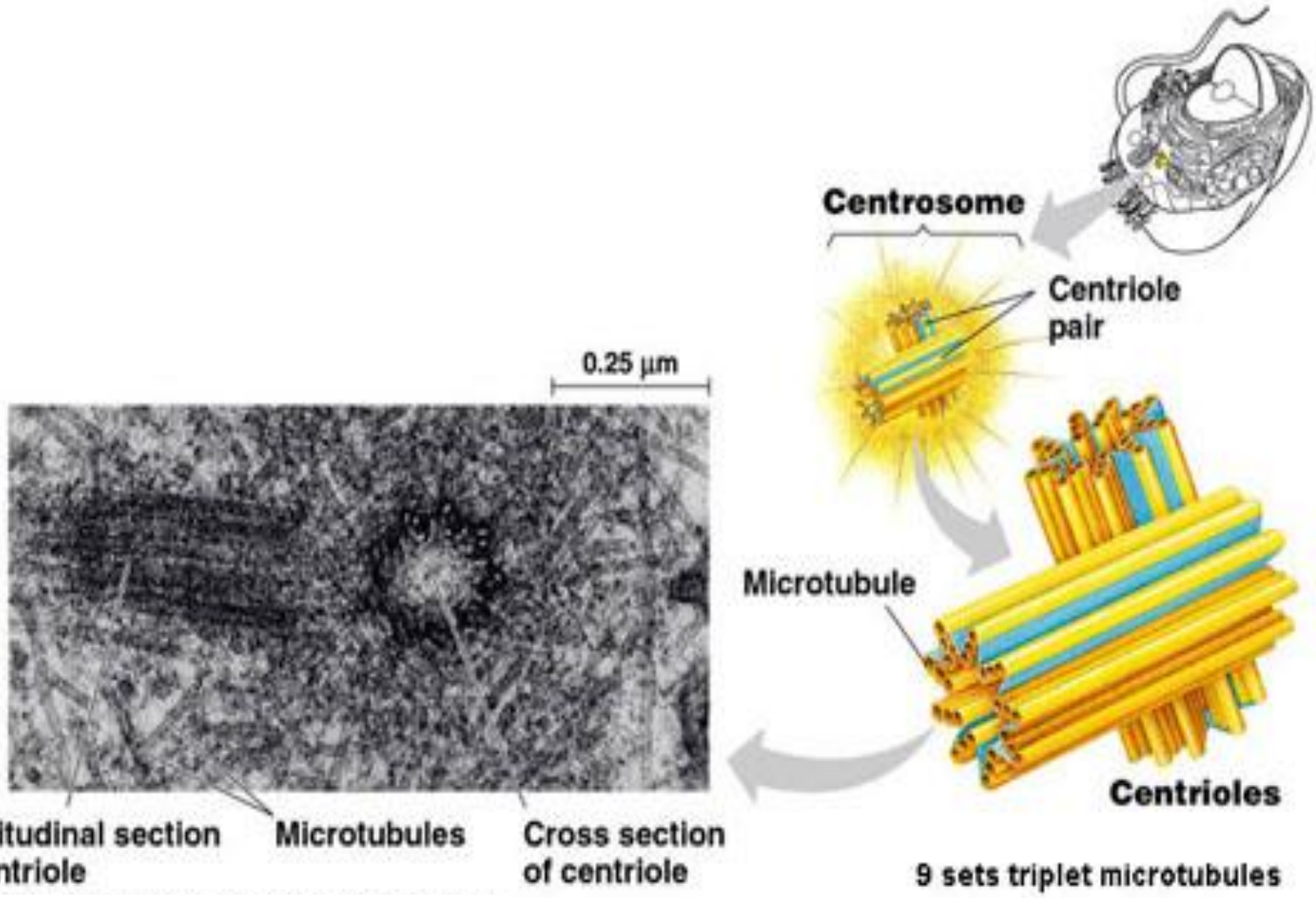
Centrosome

- a region near the nucleus that microtubules grow out of
  - the microtubules are the compression resistant grinders of the cytoskeleton
  - found in both plant and animal cells

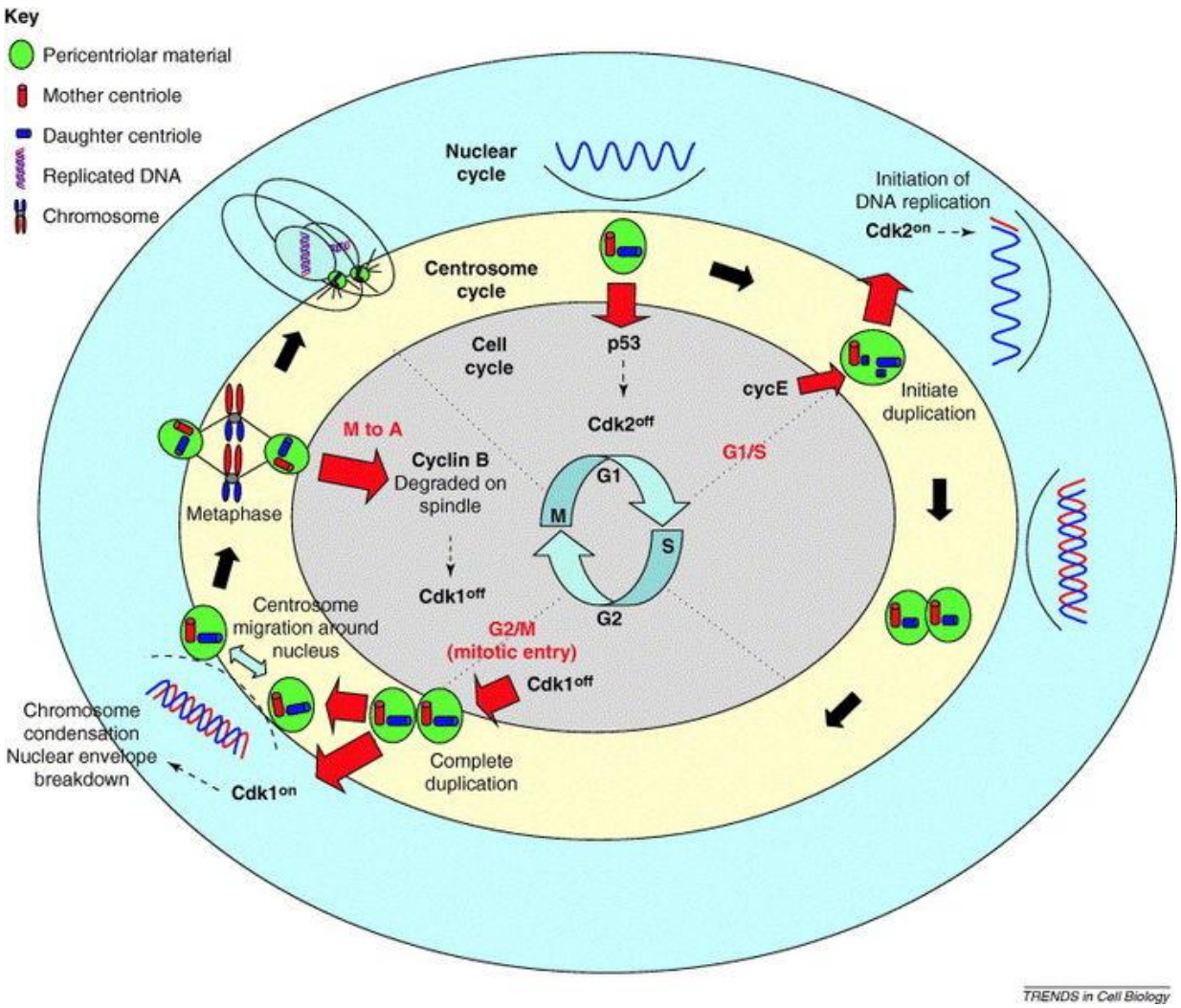




For many years, there have been scientists interested in the mysterious entity called the ***centrosome***. Often refered to as the black hole of the eukaryotic cell, these intracellular structures (**see red dots**) are often located next to the nucleus (**blue**), where the microtubule cytoskeleton (**green**) converges (called the microtubule organizing center).


Centrosome
Centriole pair
0.25 µm
Microtubule
Centrioles
Longitudinal section of centriole
Microtubules
Cross section of centriole
9 sets triplet microtubules

중심체 (Centrosomes)

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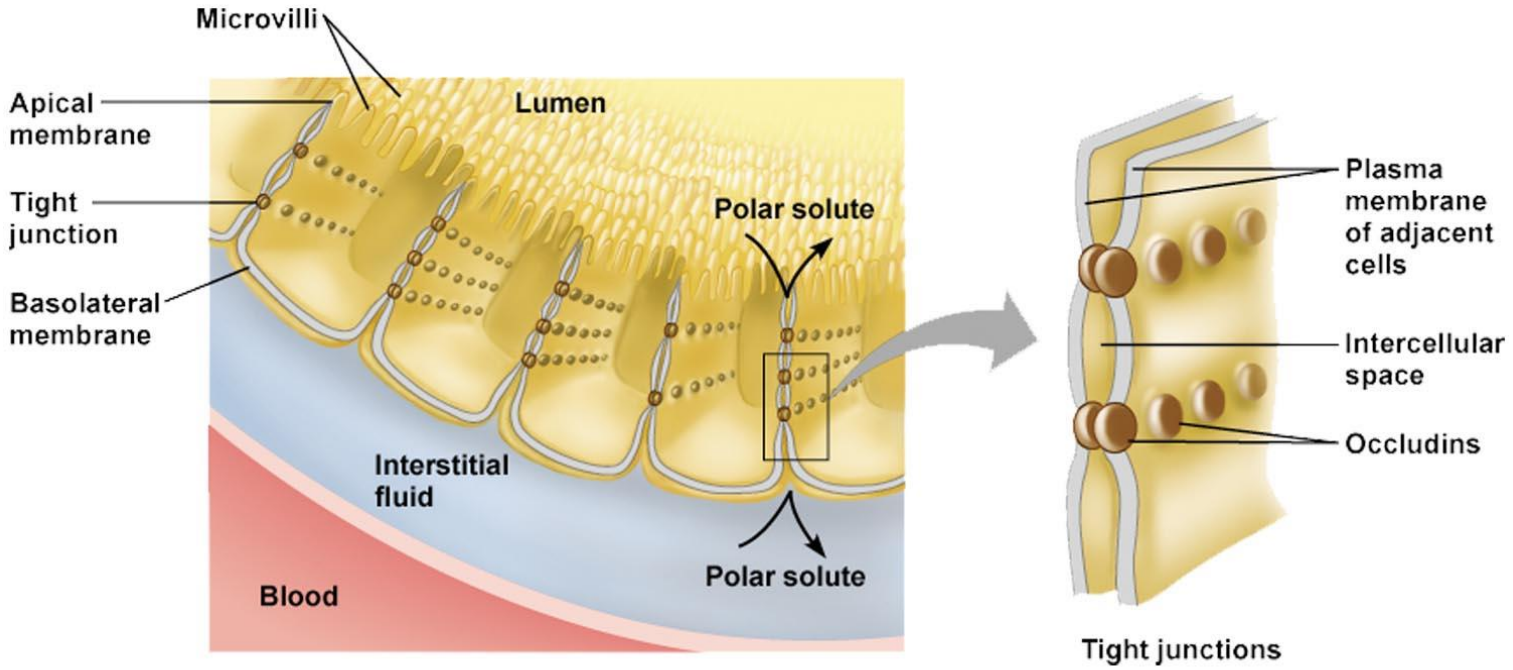
1st Quiz

다음 뜻을 적으시오

1. blasto
2. carcino
3. chondro
4. cyto
5. necro
6. pseudo
7. scolio
8. somato
9. anti
10. clast

Cell-to-cell adhesions



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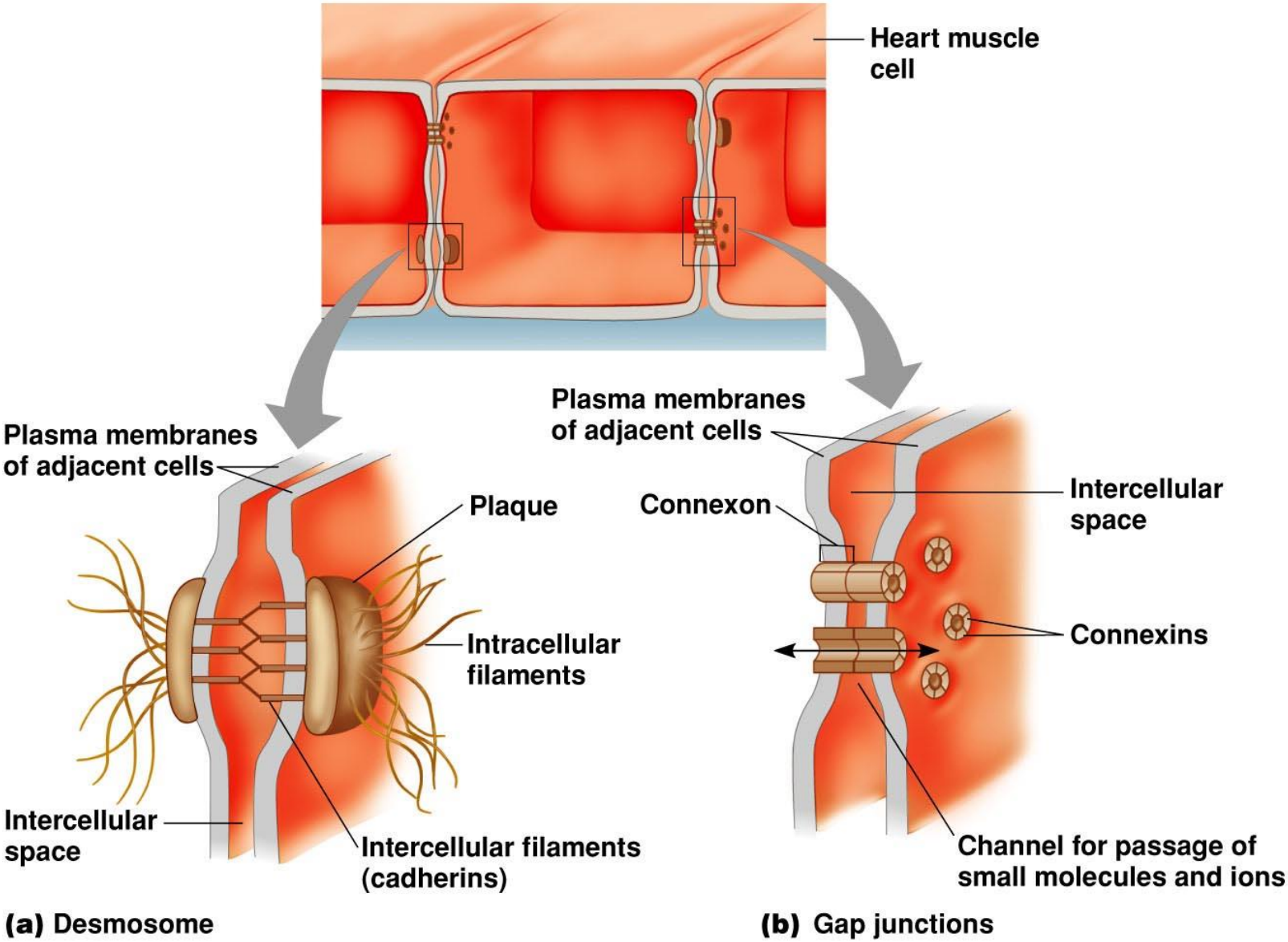
Tight Junctions



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