Page 6–7

1 a) *magnification = size of image / actual size of the specimen;* size of the image (scale bar) = 20 mm; actual size = 0.2 mm; magnification 20 / 0.2 = 100 ×;

b) width of thiomargarita in the image (image size) = 26 mm; magnification = 100 × actual size = 26/100 = 0.26 mm;

2 a) *magnification = length mitochondrion in the image; (63 mm) / actual size of the specimen (8 μm / 0.008 mm)* = 63 / 0.008 = × 7875;

b) scale bar 5 μm × 7875 = 39 375 μm (approx 40 mm)

c) width on the image 23 mm / magnification 7875 = 0.0029 mm (2.9 μm)

3 a) 20 μm × 2000 (magnification) = 40,000 μm; (or 40mm scale bar)

b) actual size of specimen 34 mm/2000 = 0.017 mm

4 a) hens egg is 7 mm wide in diagram; ostrich egg is 22 mm long in diagram; real hen egg is about 50 mm wide; ostrich egg: $\frac{(50 \times 22)}{7} = 157$ mm approx

b) *magnification = size image / actual size of the specimen;* hens egg : $\frac{7\text{mm}}{50\text{mm}} = 0.14\times$

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Structure	Fonction (pancréas)
Membrane plasmique	Régulateur des échanges entre le cytoplasme et le milieu extracellulaire. Assure les rôles de protection, de compartimentation et d'exposition des marqueurs de l'identité de l'individu
Mitochondrie	Produit de l'ATP lors de la respiration cellulaire aérobie
Noyau	Stocker l'information génétique, gère la réplication des chromosomes et permet l'expression de l'information contenue dans les gènes.
RE granuleux	Lieu de la synthèse des protéines
Appareil de Golgi	Lieu de maturation et de sécrétion des protéines élaborées dans le réticulum.
Vésicules	Stocker et transporter des produits et des déchets cellulaires
lysosome	La digestion des déchets intracellulaires

Structure	Fonction (parenchyme)
Paroi cellulaire	Offre un soutien structurel, une protection contre les facteurs biotiques (agents pathogènes) et les facteurs abiotiques (stress mécanique, osmotique) et agit comme un mécanisme de filtrage.
Membrane cellulaire	Régulateur des échanges entre le cytoplasme et le milieu extracellulaire.
chloroplaste	Il absorbe l'énergie lumineuse et la transforme en énergie chimique sous forme d'adénosine triphosphate (ATP) NADPH et $FADH_2$.
Mitochondrie	Produit de l'ATP lors de la respiration cellulaire aérobie
Vacuole	L'isolement de composants nocifs, la gestion des déchets, le maintien de l'équilibre hydrique, Le stockage de l'eau, la pression et la turgescence cellulaire.
Noyau	Stocker l'information génétique, gère la réplication des chromosomes et permet l'expression de l'information contenue dans les gènes.

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Figure 6 :

- Réticulum endoplasmique
- Noyau
- Vésicules
- **Cellule de la moelle osseuse**

Figure 7 :

- Globule rouges
- Globules blanc
- Noyau dans la membrane
- **Capillaire pulmonaire**

Figure 8 :

- Cils sur la paroi des cellules
- **Cellules ciliées. Ex : paroi des trompes utérines.**

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1. a central white/light area; sandwiched between two darker layers;
2. proteins appear dark in electron micrographs (page 27 of the text); phospholipids appear light; reasonable support for the Gorter and Grendel model;
3. proteins stain darkly; the dark pattern is the distribution of proteins; possible explanation is that they are enzymes/cytoskeleton elements/protein bound vesicles;
4. *magnification = size image / actual size of the specimen* 1 mm/10 nm = $1 \times \underline{10}^{-3}$ m/$(10 \times 10^{-9}$ m) = $0.1 \times 10^{6} = 100\,000 \times$ magnification

Page 29 (Membranes in freeze-etched electron micrographs)

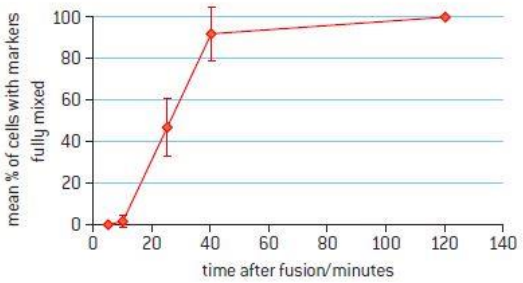
1. **a)** proteins that are transmembrane;

   b) the Gorter and Grendal model had proteins on the outside; provided evidence that the centre contained protein as well; perhaps inaccessible to protein stain;
2. inner membrane; outer membrame visible to the right / outer membrane would not be as regular in appearance;
4. evidence that proteins are being processed is the presence of Golgi apparatus;

Page 29–30 (Diffusion of proteins in membranes)

1.

Time (min)	Mean
5	0
10	1.5
25	47
40	92
120	100

2. 

3. as time progresses, an increasing number of cells have markers fully mixed
4. it supports the Singer -Nicholson model; membrane proteins can move; suggesting membrane is fluid;
5. range bars are a measure of variability of data; the more variable, the less reliable the conclusions based on the data;
6. human body temperature (normal temperature for human cells);
7. the movement of markers increases with temperature, because the molecules move faster with higher temperatures, then it levels off;
8. at lower temperatures the membrane proteins hardly move, therefore the markers are hardly mixed;
9. ATP is required for active transport; the movement of membrane proteins is passive/it does not require ATP/energy;
10. a rise in marker movement can be expected at lower incubation temperatures, since these animals are adapted to a colder environment;

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1. 1 mm = 1000 μm; 400 μm × 1 mm / 1000 μm = 0.4 mm
2. **a)** decreasing with distance; sharply at first but then decreasing more gradually;
   b) used by cornea cells for respiration; no blood vessels to replace consumed oxygen; sudden jump caused by coming in contact with aqueous humor; which does have a blood supply; and can maintain oxygen levels;
3. **a)** higher than the inner cornea; lower than the inner cornea;
   b) concentration is lower in the cornea; there would not be (net) diffusion from the aqueous humour;
4. levels quickly fall off over a distance of 100 μm; making it an ineffective mechanism of transport over larger distances;
5. **a)** increase in the distance O_2 has to move; / decreasing concentration at the inner cornea;
   b) increase moisture / increase O_2 permeability of the lens;
6. an indication of the variability of the data; provides an indication of the reliability of the data;

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1. below 21% to 2.1% O_2 there is a slight reduction in phosphate absorption; there is a significant reduction in phosphate absorption below 0.9% O_2;
2. root cells generate an electronegative charge through the secretion of H^+; root cell accumulate phosphates ions within the cytoplasm of the root cells; phosphates need to be absorbed against an electronegative concentration gradient; Phosphate is absorbed by active transport;
3. phosphate is mainly absorbed by active transport; the graph shows a reduction in phosphate active membrane transport as the concentration of DNP is increased up to 6 mmol dm^{-3}; as the concentration of DNP increase there is a reduction in ATP synthesis; with no or reduced ATP available the active transport mechanism in the membrane stop functioning; there is some phosphate absorption even above 6 mmol dm^{-3} DNP which will be due to the uptake of minerals in the mass flow of water through the apoplastic pathway;

Page 42

1. **a)** it moved in to the tissues

   b) out of the tissues

2. the cactus had the lowest concentration; where the graph crosses the x-axis is isotonic; lowest isotonic value seen for the cactus;
3. cactus tissue might be for water storage; some might have higher quantities of sugars in the cytoplasm; some tissues might have more active metabolisms producing/consuming solutes to a higher degree;
4. the starting masses might have been different in different tissue samples; percentage change is a better measure of relative change;

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1. positive correlation for a range of diseases; does not appear to impact Parkinson's incidence; conclusion is many but not all diseases;
2. for all levels of cigarette smoking; impact is greater for respiratory diseases;
3. even a small number shows a doubling in respiratory diseases; and 1.5 times as much for circulatory diseases; big difference between 1 cigarette a day and 14 cigarettes a day;
4. if a person was a smoker, they might have had other health limiting behaviours; such as drinking (cirrhosis); or inactivity;
5. mouth cancer; lung cancer; esophageal cancer; stomach cancer; throat cancer.