



## Topic 11 – data-based questions

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1. endemic: native to the area;
2. Afghanistan, Pakistan and Nigeria;
3. WPV1;
4. Pakistan is the only country where year to date comparison shows a total decline;
5. eradication programme appears to have led to a significant reduction in the total number of cases; only  $650/350000 = 0.2\%$  of the number of cases have been reported; worsening in two countries; disease is persistent / eradication has not been achieved;
6. lack of access to populations in remote areas; lack of trust between affected individuals and epidemiologists; lack of recognition of mild cases; mis-diagnosis; language barriers; death before identification;

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1. 26 flaps;
2. vigorous contractions during take off and landing, less vigorous contractions during fast flight; decreasingly vigorous contractions during take off and fast flight / increasingly during landing; fewer contractions per unit time in (later stages of) fast flight than other phases; most vigorous contractions during landing;
3. TB is used (mainly) for landing;
4. the upstroke of the wing;
5. similar frequency to the SB muscles / same number of contractions; the peaks of activity would be out of phase / alternate with those of the SB and TB;

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1. a longitudinal section is one that is cut along the long axis of a structure; a cross section would be one that is perpendicular to the long axis;
2. the light band, as it contains only actin;
3. the first and second have the same pattern of large dots; the first and the third have the same pattern of small dots; the first is heterogeneous while the second and the third are homogenous; the first is a combination of the second and the third;
4. the first diagram shows the region of the sarcomere where actin and myosin are both found (the dark band), the second diagram shows myosin only (central part of dark band – sometimes called the H zone); the last diagram shows actin only (light band);

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1. 1.5 delta;
2. 0.7–1.2 delta;
3. it would have a similar shape to the line of isosmoticity over all concentrations;
4. below 0.7 and above 1.2 it is an osmoconformer, but between 0.7 and 1.2 it is an osmoregulator; likely that the natural habitat variation is between 0.7 and 1.2, it can be considered to an osmoregulator;

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1. the kidney has the highest blood flow rate of the tissues shown – five times more than the heart muscle and nearly 200 times resting skeletal muscle;
2. the kidney receives 420 mL per minute; in 2.38 minutes, 1 litre is delivered to 100 mg of tissue; in this time  $(84.0 \times 2.38) = 200$  mL of oxygen is delivered;



3. skin 14.6%  
skeletal muscle 36%  
heart muscle 41.4%  
kidney 8%
4. blood flows to different organs for different reasons; all blood needs toxic waste products removed so must flow to kidney; some oxygen demand is variable depending on activity; such as by skeletal muscle during activity; some blood flow is variable such as thermoregulation and the skin;
5. selective re-absorption/active transport;
6. blood flow to the skin would change; to support thermoregulation;

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1. the larger the particle size, the lower the permeability to them of the filter unit;
2. a) all show a decline in permeability with an increase in size; neutral dextran shows the most direct relationship; dextran sulfate permeability declines most rapidly with an increase in size; DEAE permeability declines most slowly with an increase in particle size;  
b) large particles of any type cannot pass easily through the membrane; electric charge has an impact on ultrafiltration with negatively charged particles decreasing ultrafiltration and positively charged particles increasing the rate of ultrafiltration;
3. regardless of charge, particles as large as 4.4 nm do not end up in the filtrate; the presence of such particles in the urine indicates kidney function disability because it has been able to pass through the glomerulus when it normally would not pass through;

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1. the drier the habitat, the more concentrated the urine; some variation evident;
3. a) the higher the RMT, the higher the MSC produced;  
b) the length of the loop of Henle determines the solute concentration established in the medulla; the higher the RMT, the longer the loops of Henle;

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- a)  $5.3 (\pm 0.3) \text{ pmol dm}^{-3}$  (unit needed);
- b) a positive correlation; no data below  $280 \text{ mOsmol kg}^{-1}$ ;
- c) after drinking water, blood plasma / solute concentration decreases; plasma ADH concentration decreases; osmoreceptors in the hypothalamus monitor blood solute / blood plasma concentration; impulses passed to ADH neurosecretory cells to reduce / limit release of ADH; drop in ADH decreases the effect of this hormone on the kidneys; blood solute concentration returns to normal;
- d) vomiting / diarrhea / blood loss; increased salt intake; drinking alcohol / coffee; taking certain drugs / morphine / nicotine / barbiturates; excess sweating / lack of water intake; diabetes as it increases glucose in blood;

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2. pattern is not clear; longer sperm tend to have higher cross sectional area;
3. scaling of all dimensions related to overall size of sperm; shearing stress in longer sperm; needs thicker cross-sectional area to support;
4. data is not supplied about relative sizes of rodents but in general no as humans and bulls are larger organisms with relatively small sperm;

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1. a) microvilli, coming in and out of the plane of the section;  
b) active transport of glucose and other foods; osmosis for water absorption; facilitated diffusion of mineral ions or other substances; increased surface area; gas exchange;



2. progesterone is a steroid hormone; so the sER produces the hormones;
3. nucleus because it is adjacent to the ER; nucleus because it is a large organelle;

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- a) the higher the concentration, the greater the number of oocytes in testes;
- b) 31%;

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1. a) hCG is present throughout pregnancy; highest levels are at about 2 months declining sharply after that;  
b) estrogen levels increase throughout pregnancy; estrogen falls sharply before parturition;  
c) progesterone rises throughout pregnancy, falling sharply just before parturition;
2. hCG maintains the ovary's hormone production capacity; once the placenta takes over production, then the ovary's production does not have to be maintained;
3. miscarriage; endometrium would not be maintained;

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1. open dots are altricial species; as these have smaller body mass and shorter gestation;
2. the higher the adult body mass, the longer the gestation period;
3. large body mass organisms are more likely to be precocial; time taken for structures for more rapid independence are developing in utero; meeting nutrition requirements of large body mass offspring difficult for parent, so better if it can be independent earlier;
4. (i) top left quadrant of graph;  
(ii) gestation period is longer than other organisms of similar adult body mass; longer period for neural development; human infants relatively helpless for longer compared to organisms of similar adult body mass.