

# Answers and feedback for practice questions on Yr1 Sem1 Wk2

## 1-1 (describing the reason for sexual reproduction)

*The correct answer is B.*

Feedback if you made an incorrect choice:

This question is not quite straight recall but requires you to think and evaluate a little.

- Answer A – that one sex is specialized for nurturing young – happens to be a true statement for some parts of the animal kingdom, although in most organisms (remember that mammals are a tiny minority) the young are left to themselves once eggs have been laid. In any case, nurturing does not depend on sexual reproduction. This is therefore an example of a part-true statement that is not the answer to the question (which was to choose a statement that best describes the *reason* for sexual reproduction).
- Answer B is factually correct because sex shuffles alleles: this makes it more likely that there are some offspring that can cope well with the environment they meet (and also many that die because they cope very badly: Nature is not sentimental).
- Answer C is plain wrong: sexual reproduction involves more resources, for example those required to find a mate.
- Answer D is also plain wrong: if an organism made spores asexually, each of which could produce a new organism, it could produce far more than if it makes sexual gametes that can only produce a new organism if they happen to meet another gamete of the opposite sex of the same species.

Points to take away if you did not get this right:

- If you answered A, the most likely error you are making concerns exam technique more than biology, because you were probably happy to choose the first correct statement you found. Read the stem of questions carefully – if a stem asks for a reason, then an answer will only be the one to choose if it is both correct and logically provides a reason.
- If you answered C or D, you probably have a misconception about asexual reproduction. This is not of course clinically dangerous, but being able to compare and contrast sexual with asexual reproduction tells you a lot about why we have the kinds of bodies, and critically the kinds of behaviour, that we humans have.

## 1-2 (Leydig cell function)

*The correct answer is B*

Feedback if you made an incorrect choice:

This is a very simple recall question, requiring memory but not much thought.

- Answer A is outrageously wrong since Leydig cells are in the testis not the ovary: a student who wrote this is probably confusing Leydig cells (testis) with Granulosa and Thecal cells (ovary).
- Answer B is correct: the only possibly tricky thing here is the requirement for a student who knows that Leydig cells make testosterone, to realize that testosterone is an androgenic hormone.
- Answer C is a correct description for a myoid cell (not Leydig)
- Answer D is a correct description for a Sertoli cell (not Leydig)
- Answer E is outrageously wrong (wrong organ).

Points to take away if you did not get this right:

- Unless you were tripped up by not knowing 'androgenic', then the remedy is a simple one: go and learn the cell types. There is a great deal of this kind of rote learning in medicine and we do need you to absorb a great deal of information, 'absorption' being an active process requiring revision.

## 1-3 (What do sperm reach when they leave the epididymis)

*The correct answer is B*

Feedback if you made an incorrect choice:

This question is recall, but it is constructed so that you have to remember essentially all of the anatomy involved to get it right, since all of the distractors are places that sperm reach or at least pass near at some time.

- Answer A should be obviously silly because sperm originate in the testis so they are not going to go there after being somewhere else.
- Answer B is correct: you may care to remember the terrible joke I probably told you in the lectures about epididymis and prostate not being the same because there's a vas deferens between them.
- Answer C is where they end up after the vas deferens
- Answer D is where they pass through (not really in the prostate, but along the prostatic urethra)
- Answer E is an accessory gland of the urethra.

Points to take away if you did not get this right;

- There is nothing subtle here: you just have to learn the anatomy. Or, if you got it wrong because you misread the question, you need to learn to read stems very carefully.

## 2-1 (Calculation)

*The correct answer is B*

Feedback if you made an incorrect choice:

This question is not really about reproductive biology. We have become concerned that so many medical students, who must have done well with maths at school, seem to become innumerate during their medical studies. We therefore scatter simple calculations throughout our exams.

Total number of sperm = total volume in mls x conc of sperm/ml

So (rearranging) : conc of sperm/ml = Total number / total volume

As with all of these sorts of questions, the distractors are not random numbers but are the numbers you get by doing something silly.

- Answer A is obtained by multiplying instead of dividing
- Answer B is obtained by getting it right!
- Answer C is obtained by having the division sum the wrong way up and paying no attention to the sign of the index
- Answer D is obtained by thinking that the total number is the number per ml.
- Answer E is obtained by thinking that the number of mls just needs to be multiplied by  $10^8$

Points to take away if you did not get this right;

- You need to remind yourself about basic maths. And you do really need to – one day, these will not belittle MCQs but dose calculations made in haste to save a patient dying in front of you.

## 2-2 (Cleavage)

*The correct answer is A*

Feedback if you made an incorrect choice:

This question simply tests whether you understand 'cleavage' in its embryological sense: the division of cells without intervening growth.

- Answer A is the only one that equates to no growth
- Answers B-E correspond to what would happen after 1,2,3,4 divisions if the cells were undergoing the normal mitosis-growth-mitosis... type of division that is generally seen in the body at post-cleavage stages. They are not.

Points to take away if you did not get this right;

- You need to understand the specific technical meaning of 'cleavage' divisions.

## 3-1: which type of twin?

*Correct answer: d*

Feedback if you chose the wrong answer:

Broadly, if you got this wrong you need to get straight the time and place of the formation of the

amnion and chorion.

- a) – dizygotic twins are independent and each forms their own trophoblast, placenta etc – they cannot therefore share a chorionic cavity (or an amniotic one)
- b) – this answer is outrageously wrong – entry of two sperm would create a triploid embryo, which would die very soon.
- c) – this option has the right basic type of twin – monozygotic – but if the separation happened before each embryo divided itself into trophoblast and ICM, then each would make their own amnion and chorion and no sharing would be possible
- d) is correct (remember, this is how fetal transfusion syndrome can happen)
- e) this very rare type of twinning happens in the epiblast, and therefore after the amnion has formed, so twins made this way would share an amniotic cavity (and be at risk from conjoining).

### 3-2: gastrulation

*Correct answer; b*

Feedback if you chose the wrong answer:

Really, you just need to learn what gastrulation is – if it helps, remember that GASTrulation comes from GASTER, Latin for stomach (ie endothelium).

- a) This process is the formation of the blastocyst
- b) correct
- c) this is neurulation
- d) this is a later process (with no special name)

### 3-3; notochord

False answer: c

Feedback if you made an incorrect choice:

- a) is a correct statement – in humans the notochord does come from the endothelium. The people most likely to have got this wrong are those who know about the embryology of other vertebrates such as fish (who make notochord from a different layer, which I am not going to name here because I do not want to reinforce the memory). The question did specify human.
- b) is a correct statement - we covered SHH from the notochord being used to pattern the neural tube and the somites
- c) is a false statement (and therefore the one you should have chosen): the neural tube is the precursor to the spinal cord. The notochord all but disappears, lingering on in parts of intervertebral discs. It is very important in embryonic life, but not in adults.
- d) is a true statement.

### 3-4: migration

False answer: c

Feedback if you made an incorrect choice:

This was a very simple recall question. I have told you of only 2 migratory cell types, and they

occupy 2 of the 3 choices, so the third one (notochord cell) must be the odd one out.

#### 4-1: thalidomide

Correct answer: a

Feedback if you chose wrongly, or guessed.

- a) thalidomide does indeed poison new blood vessel growth, so that the blood supply cannot enter the limb at the speed it needs to in order to support rapid limb elongation. The result is failure of elongation, and phocomelia (seal-limbs)
- b) simple logic should have warned you off this – if that were the case, the phenotype would be a small body, properly proportioned.
- c) if you did not know the answer, this was a rational guess – indeed it is what people used to think at the time of the thalidomide disaster – but we have known for a long time it is not so.
- d) this answer is very wrong and should be obviously so: it is here to trap wild guessers who vaguely remember some connection with blood and can't be bothered to think things through. If this is you, please take this warning. Foetal transfusion syndrome is a risk of monochorionic monozygotic twins, and affects growth of the whole body of an effected twin so could not result in phocomelia.

#### 4-2: human growth

False statement: c

Feedback if you chose wrongly or just guessed:

Growth hormone is released by the pituitary and controls how much the limbs grow – having it produced by the limbs is having the whole story the wrong way round. The other statements are correct.

#### 5-1: PGCs

False statement = c

Feedback if you chose wrongly or guessed:

PGCs are of the germ line (it's in the name). Somatic cells of the gonad are the only ones to try to express SRY, so statement c is wrong. The other statements are correct. If you chose (d), you are forgetting that meiosis happens much later in development of the germ line.

#### 5-2: complete androgen insensitivity

Correct answer = c

Feedback if you chose wrongly or guessed:

First, note that the question specifies an XY human, and that it says **complete** androgen insensitivity. That means that the extragonadal part of the body cannot detect masculinizing

hormones from the testis (testosterone and its derivatives) and therefore do not 'know' they are in a male body. To get this question right, you first have to remember that the somatic cells of the gonad choose a sex depending on whether they carry a Y chromosome, but the rest of the body just listens out for androgenic hormones and becomes male only if they are detected.

a) this describes a normal man: the extragonadal parts of the body would not have produced external anatomy characteristic of a man (eg penis, scrotum, male pelvis, male figure, beard) if they could not detect testosterone

b) this describes a man with failure of testicular descent. See above about why the basically male body in the statement would not arise in complete androgen insensitivity

c) Correct: the person is XY, so the gonads will form as testes. Deaf to androgens, the body forms a basically female anatomy externally (internally, lack of a Mullerian duct caused by the testes still making AMH means that the uterus is not present). Lack of androgens means that there is no reason for testes to descend. (Sometimes one or both do anyway, to the labia, but you were asked to choose the best description and this is the only one, of the ones available, that can possibly fit).

d) Not ovaries – see above

e) You are getting confused between androgen insensitivity (a receptor problem) and lack of testosterone-processing enzyme activity resulting in the Guevedoces phenotype.

### **Questions that span the week:**

#### **Wk2-1: endoderm derivatives**

Correct answer: d

Feedback if you made an incorrect choice, or guessed:

This question is a bit more tricky than the ones immediately above and below it, because it does not ask you simply to recall exactly what I told you, but to use it. In lecture 3, you knew endoderm was the precursor of the gut, and you ought to know that oesophagus and intestine are part of that. In lecture 4, I used lungs, liver and pancreas to illustrate how organs can grow by out-branching of existing tubes, in this case gut. You therefore know that the epithelia of these must derive from endoderm. Even if you did not remember that testis comes from mesoderm, you could have settled on the correct answer by a process of elimination.

#### **Wk2-2: ovary**

False statement: b

Feedback if you made an incorrect choice or guessed:

Ideally, you could answer this by recall. You may remember the problem that chemotherapeutic agents can damage follicles, and this being a problem because girls and women have no germ line stem cells in their ovaries from which to build more.

#### **Wk 2-3: embryonic development**

False statement = a

Feedback if you made an incorrect choice or guessed:

These are all just facts to know, but if (a) were correct then I would not have spent so long explaining the problems the embryo faced getting axis information 'from nowhere' and having to use geometrical tricks to do so.

#### **Wk 2-4: little and large**

False hypothesis: b

Feedback if you made an incorrect choice or guessed:

This is a question that required some reasoning.

a) monozygotic twins who share a chorion can show fetal transfusion syndrome, which results in one twin growing at the expense of another due to cross-connections of blood. This is therefore a possible explanation.

b) Laron syndrome is genetic. Monozygotic twins have the same genotype so either both would have it or neither. This cannot be a correct answer, therefore.

c) dizygotic twins have different genotypes, so it is possible that one grows at a different speed from the other for genetic reasons.