SENIOR SECONDARY IMPROVEMENT PROGRAMME 2013

education
Department: Education
GAUTENG PROVINCE

GRADE 12

LIFE SCIENCES

LEARNER HOMEWORK SOLUTIONS

The SSIP is supported by

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LEARNER HOMEWORK SOLUTIONS

SOLUTIONS TO HOMEWORK: SESSION 3

TOPIC 1: MUTATIONS AND NATURAL SELECTION, GENETIC ENGINEERING

QUESTION 1

1.1. May have fewer side effects ✓
May not be contaminated✓/will be in its natural form
No problem from a religious perspective✓
Can be mass produced✓/produced faster
Avoids killing animals✓ ***(Mark first THREE answers only)*** (3)

1.2. Against:
- risk to human health✓
- risk to the environment ✓
- risk to the health and well-being of other organisms ✓
- interference with nature✓/God's creation
- cultural sensitivity✓e.g. objection to the use of pigs and cows (2)

(Mark first TWO answers only) **[5]**

QUESTION 2

2.1 a sudden/rapid ✓
unexpected/random/unpredictable ✓
change/mistake ✓
in DNA ✓ ***(Mark any 2)*** (2)

2.2 It affects chromosome 1/no indication it is sex-linked or affects gonosomes ✓ (1)

2.3 Genetic counsellor/geneticist ✓ (1)

[4]

QUESTION 3

3.1 May 7 2003 (full date) ✓ (1)

3.2 Futhi means replica/repeat ✓
A replica is an exact ✓copy ✓
The calf is a genetically identical/a clone of/has the same DNA as the parent ✓ (3)

3.3 (a) sexual reproduction (or explanation thereof) ✓ (1)
(b) **Any 2 of** … crossing over random fusion of gametes; ✓ independent assortment/random alignment during meiosis ✓ (2)

3.4 Protective covering of the egg left on in normal cloning ✓ (1)

3.5 Uterus ✓ (1)

3.6 Many (clones) can be made of highly productive livestock ✓ (1)

3.7 Producing the clone, i.e. viable embryo itself ✓
OR
When the egg is inserted into the recipient ✓ (1)

3.8 Isolation phase: **Any 1 of** Remove gene for high yield ✓from high yielding donor ✓
Engineer phase: **Any 1 of** … Genetically engineer a bacterium/plasmid to contain this gene ✓
Insertion phase: **Any 1 of** … Infect the cow with the bacterium ✓ (3)
OR Any other reasonable 3 step process **[14]**

SOLUTIONS TO HOMEWORK: SESSION 3
TOPIC 2: THEORIES OF EVOLUTION PART 1

QUESTION 1

1.1 Natural selection– those organisms with the most beneficial √ traits are more likely to survive and reproduce√. (2)

1.2 Organisms produce more offspring √ than can survive. These organisms compete for limited resources√
There is variation √ in populations. Organisms change over time, those living today are different to those who lived in the past√, i.e.
Change is gradual and slow, taking place over a long time√
The mechanism of evolutionary change was natural selection√
All organisms are derived from common ancestors √ by a process of branching, i.e. organisms pass genetic traits to the next generation√

Any 6 (6)
[8]

QUESTION 2

2.1 93 √% (accept 92 - 95) (1)

2.2 - As the pollution decreased √
- the percentage of the dark-coloured moths also decreased √ (2)

2.3 - The dark-coloured moths are not being camouflaged √/can easily be seen against the light lichen-covered bark
- and have become easier targets/prey for birds√ (2)

2.4 Lamarck believed that structures√ of individuals in a population became better√ or less adapted√ to the environment √ depending on the frequency of their use √ and that these adaptations could be inherited from generation to generation √
He suggested that change was driven by living things themselves √ as they strove to perfect their way of life √
More complex organisms developed from less complex organisms √
He supported the idea of common descent and linked diversity with adaptation to the environment √
He supported the idea of the inheritance of acquired characteristics √

Any (5)
[10]

SOLUTIONS TO HOMEWORK: SESSION 4

TOPIC 1: DIVERSITY: EVOLUTION BY NATURAL SELECTION, FORMATION OF NEW SPECIES AND EVIDENCE OF EVOLUTION

QUESTION 1

1.1 Birds flew into the unaffected areas from the affected areas ✓. (1)

1.2 Remaining patches may not have had the habitat/food resources needed for some of the bird species ✓/competition
These species may have become extinct ✓ in that area/left the area. (2)

1.3 Bird species that would have been made extinct ✓ in that area are preserved ✓ .
The larger the area, the more useful the preservation ✓. (3)

[6]

QUESTION 2

2.1.

	Sympatric speciation	Allopatric speciation
The most common type of speciation in animals	**X**	√
Hybrids may result	**X**	**X**
Occurs in populations living in the same geographical area	√	**X**
Breeding is between members of the same species	√	√

(4)

2.2. 1. Disruptive ✓ 2. Stabilising ✓ 3. Directional ✓ (3)

[7]

QUESTION 3

3.1 Equal✓ number of light and dark-banded snails✓ will be eaten✓

OR

More✓light-banded snails✓ will be eaten✓

OR

Less✓light-banded snails✓ will be eaten✓

OR

More✓dark-banded snails✓ will be eaten✓

OR

Less✓ dark-banded snails✓ will be eaten✓ (3)

3.2 Natural selection✓/camouflage/predation/survival of the fittest/ micro-evolution (1)

3.3

Light-banded✓	Dark-banded✓
Lower number✓ of light-banded shells found, indicating that they are not easily detected ✓ by the birds	Higher number✓ of dark-banded shells found, indicating that they are not easily detected ✓/camouflaged by the birds

(1)

3.4 (2)

3.5 Started with equal numbers✓ of light and dark-banded snails in the environment (1)

[8]

QUESTION 4

4.1 - Random assortment ✓/segregation/recombination of chromosomes during meiosis in the formation of gametes
- Crossing over ✓
- Chance/random fertilisation of gametes ✓/sexual reproduction
- Mutation ✓
- Outbreeding ✓/Gene flow ***(Mark first FOUR answers only)*** (4)

4.2. - Within each of the two groups there is variation ✓
- Each group undergoes natural selection ✓
- as a result of varying environmental conditions ✓
- and develops differently ✓
- genotypically ✓ and phenotypically ✓
- since the geographical barrier prevents gene flow ✓/reproduction between the two populations
- The differences that develop between the two populations prevent them from inter-breeding ✓even if they were to mix
- such that one or both of the groups becomes a new species ✓ **(Any 6)** (6)

[10]

QUESTION 5

5.1 Evolutionists believe that this is biological evidence ✓ for evolution ✓
OR
All evolved ✓from a common ancestor ✓ (2)

5.2 A ✓ (1)

5.3 Vertebrates thought to develop from aquatic form ✓ which breathes by means of gills ✓ (2)

[5]

QUESTION 6

6.1. B
6.2. D
6.3. B
6.4. C
6.5. B (5x1) **[5]**

SOLUTIONS TO HOMEWORK: SESSION 4

TOPIC 2: DIVERSITY: HUMAN EVOLUTION, EVOLUTION IN PRESENT TIMES AND ALTERNATIVE EXPLANATIONS

QUESTION 1

1.1

HUMAN	CHIMPANZEE
Foramen magnum more central / in the middle/ Spinal cord exits underneath skull √	Foramen magnum at back of skull /Spinal cord exits at the back of skull √
Rounded / bigger skull √	Narrower / smaller skull √
Small canines √	Large canines √
No gap between teeth √	Gaps between teeth √
Dental arch /teeth arrangement more rounded √	Dental arch / teeth arrangement more rectangular √
Pelvis wide/ bowl shaped √	Pelvis tall / narrow √
Sacrum bigger / shorter √	Sacrum longer / narrow √

(Any 4 x 2) Tabulate ✓ +1 (9)

1.2 Human ✓ and *Australopithecus* ✓ (2)

1.3 The foramun magnum of both Human and *Australopithecus* is placed in the middle of the skull ✓ adaptation for upright walking/bipedalism ✓ (2)

1.4 Human has larger skull ✓✓/brain than *Australopithecus* / rounder skulls **(Any 1 x 2)** (2)

1.5.

Anthropology	**Palaeontology**	**Archaeology**
Is the study of the human race, including the different belief systems, customs and social habits. ✓✓	Is the study of the earliest known periods of human existence, for example the Stone Age. ✓✓	Is the study of ancient times by examining the buried remains of buildings, tool and animal and plant fossils. ✓✓

(6)

1.6. - *Australophithecus afarensis* ✓
- *Australophithecus africanus* ✓
- *Australophithecus rubustus* ✓
- *Homo habilis* ✓
- *Homo erectus* ✓
- *Homo sapiens* ✓

The formation and development of the skull varies because the brain capacity increased as the mass of the brain tissue increased. ✓ (7)

1.7.

- the hands became free for carrying food, tools and babies ✓
- a better view of the surroundings in search of food and predators ✓
- movement from place to place becomes more efficient ✓
- faster cooling of the body, as an increased surface area is exposed to the air - which was essential in their original hot tropical environments ✓
- display of the male sex organs as part of courtship behaviour ✓ (5)

[33]

QUESTION 2

2.1. The site contains fossils and evidence of the origin of humankind ✓ (1)

2.2. Taung child - *Australophithecus africanus*✓
Little Foot - *Australophithecus afarensis*✓ (2)

2.3. Evidence proves that humans moved from Africa to Europe at the time of the glacial period. ✓ Some of the people underwent a process of bleaching which resulted in the fair-skinned, light eyed, blonde-haired people of Britain, Scandinavia and Germany. ✓ (Remember that these countries are cold – so the need for melanin in the skin and hair decreased over the years.) (2)

[5]

QUESTION 3

3.1. 580 mm^3 ✓ (1)

3.2. Neanderthal ✓ (1)

3.3. They were larger than modern man because they lived in the Stone Age and competed with other large animals. ✓ They lived a very physical life and needed to be bigger and more powerful. ✓ (2)

3.4. The early form ✓ (1)

3.5. Archaeologist ✓ (1)

[6]

QUESTION 4

4.1 No ✓ tails present ✓/tails ✓ are absent ✓ (2)

4.2 (a) Bipedal ✓ (1)
(b) Quadrupedal ✓ (1)

4.3 Their view of surroundings would have been limited. ✓
They would have been slow in ✓ moving (in their current environment)
(Any reasonable answer) (2)

4.4

MAN	CHIMPANZEES
Straight finger bones	Curved finger bones
Fully opposable thumbs	Longer thumbs
Legs longer than arms	Arms longer than legs
Legs and spine almost straight	Spine rectangular to legs
Reduced snout (nose) - s-shaped	Noticeable snout – c shaped
Smaller teeth	Bigger teeth

(Any) (5x2) (10)

4.5 Makes branchiation (swinging from branches) ✓ more difficult ✓ (2)
(Any reasonable and logical answer)

[18]

SOLUTIONS TO HOMEWORK: SESSION 5
TOPICS 1& 2: PLANT & ANIMAL RESPONSES TO THE ENVIRONMENT

QUESTION 1

- Auxins cause cell division (1)
- Form adventitious roots in cuttings (1)
- Stimulate the development of flowers and fruit (1)
- Stimulate the abscission of leaves (1)

(Mark the first three answers only) **[3]**

QUESTION 2

To place the leaves in a favourable position for photosynthesis **[1]**

QUESTION 3

- Place a pot plant on a **stationary clinostat** (1)
- in a box with a hole on one side (1)
- This is the experiment (1)
- Place another pot plant on a **revolving clinostat** (1)
- In a box with a hole on one side (1)
- This is the control (1)
- Leave both sets of apparatus in the sunlight for a few days (1)

[7]

QUESTION 4

4.1. C (1)

4.2. A (1)

4.3. B (1)

[3]

SOLUTIONS TO HOMEWORK: SESSION 6
TOPICS 1 & 2: THE EYE AND THE EAR

QUESTION 1

1.1.

1. aqueous humor in anterior chamber
2. conjunctiva
3. cornea
4. pupil
5. iris
6. ciliary body
7. viterous humour / viterous body
8. suspensory ligaments
9. lens
10. sclera
11. choroid
12. retina
13. yellow spot in the fovea centralis
14. optical nerve
15. blind spot (15 x 1) (15)

1.2.

- Iris: controls the size of the pupil ✓to regulate the amount of light that passes through into the retina ✓
- Choroid: contains blood vessels ✓to supply oxygen and nutrients to the layers of the eye ✓and remove wastes ✓. It contains dark pigment ✓to prevent internal light reflection and scattering of light within the eye ✓
- Lens: the lens is elastic and able to alter its shape for accommodation. ✓ When the lens is round/more convex ✓the light rays from a nearby object are refracted to focus onto the retina. ✓ When the lens is flatter/less convex ✓ light rays from a distant object are refracted less so that they are focused onto the retina. ✓ (12)

1.3. 2 = conjunctiva ⇒ 3 = cornea ⇒ 1 = anterior chamber with aqueous humour ⇒ 4= pupil ⇒ 9 = lens ⇒ 7 = viterous humour ⇒ 13 = yellow spot ⇒ 14 = optic nerve

(Must be in the correct order. 1 mark each point. Mark only from first point until is included or a point is deleted.) (8)

[35]

QUESTION 2

2.1.

a) H = external auditory canal
b) A = bony ossicles
c) D = auditory nerve
d) C = semicircular canals
e) F = Eustacian tube (5 x 2) (10)

2.2. If the Eustacian tube were blocked:

- The air external to the eardrum will have a different pressure ✓to the air in the middle ear. ✓ This will cause pressure to build on one side of the eardrum ✓and cause it to bulge and possible burst. ✓ (4)

2.3. **Balance and equilibrium:**

- The semi-circular canals: there are three canals which lie at right angles ✓ to each other and are filled with endolymph. ✓
- At the base of each semicircular canal is a swelling called the ampulla, ✓ which contains fine sensory hair cells called crista. ✓
- The crista are embedded in a dome-shaped gelatinous capsule called the Cupula. ✓
- When the head moves, the endolymph in the ampulla moves as well. ✓
- This stimulates the crista and a nerve impulse is discharged ✓, and transmitted via the vestibular branch of the auditory nerve, to the cerebellum. ✓
- Function to maintain balance and equilibrium with regard to the perception of head movements. ✓

The Sacculus and Utriculus: lie below the semicircular canals. They are filled with endolymph ✓and contain sensory hair cells called macula. ✓
The hairs are embedded in the otolithic membrane. ✓
Otoliths are calcium carbonate granules ✓which lie on the hair cells.
When the head position changes, the otoliths move according to the pull of gravity. ✓
This stimulates the maculae, which convert the stimulus into an impulse. ✓
The impulse is transmitted via the vestibular branch of the auditory nerve, to the cerebellum. ✓
Function to maintain balance and equilibrium with regard to perception of the position of the head in relation to gravity. ✓ (17)

2.4.

- Sound waves move from the **vibrating source** (e.g. a person talking, a car driving past, etc.) in horizontal waves. ✓
- Humans hear sounds with a vibration **frequency of between 16 and 20 000Hz.** ✓
- Sound waves are **collected by the pinna** and passed down the **external auditory canal.** ✓
- We become conscious of sound when the vibrations reach our **ear-drums** (tympanic membrane). ✓
- The **ear-drum vibrates** according to the frequency of the sound waves. ✓
- These vibrations are transmitted to the **three ossicles (the hammer, anvil and stirrup)** in the middle ear, which **amplify** the vibrations. ✓
- The stirrup passes the vibration through the **oval window**, into the inner ear. ✓
- The oval window vibrates and causes vibrations of the **perilymph** in the form of wave movements. ✓
- The wave movements are transferred to the **endolymph of the scala media** (inside the cochlea). ✓
- This causes the **Reissner's membrane** and the **basilar membrane** to vibrate. ✓
- The **hair cells of the Organs of Corti** (the mechanoreceptors) brush or bend against the **tectorial membrane** ("tickle it"). ✓
- The **mechanical stimulus** of the sound wave is converted into an **impulse** by the hair cells. ✓
- The impulse is passed via the **cochlear branch** of the auditory nerve to the **auditory centre** in the cerebral cortex, where the sensation of sound is perceived. ✓
- **Excess vibrations** are passed out through the **round window**, to prevent sound pressure and echoes. ✓ [14]

2.5. **Middle ear infection:**

- An inflammation of the middle ear. ✓
- When the middle ear becomes infected by bacteria, there is **extreme pain** as pressure builds up behind the eardrum. ✓
- The pressure is caused by pus, which collects in the middle ear cavity. ✓
- The **Eustachian tube** becomes blocked so there is a lack of the ability to **equalise the pressure** on both sides of the eardrum. ✓
- In some cases, the eardrum may burst and pus drains out of the ear. ✓
- Antibiotics are generally prescribed. ✓
- Severe scarring of the eardrum can affect the person's hearing. ✓
- When a person gets middle ear infections often, an Ear Nose and Throat specialist (ENT) ✓will insert grommets ✓into the eardrum to assist to drain excess fluid out of the middle ear. ✓ [10]

[55]

SOLUTIONS TO HOMEWORK: SESSION 7
TOPIC 1: CONSOLIDATION - EXAMINATION PAPER 1

QUESTION 1

1.1 B
1.2. A
1.3. D
1.4. A
1.5. C
1.6. B
1.7. D
1.8. B
1.9. C
1.10 C
1.11 C
1.12 C
1.13 C
1.14 A **[14]**

QUESTION 2

2.1 M – DNA ✓R – Ribosome ✓ (2)
2.2 AGT ✓✓ (2)
2.3 Transcription ✓ (1)
2.4 (a) Threonine ✓✓ (2)
(b) CCG ✓✓ (2)
(c) Anticodon ✓ (1)
(d) A different protein may form because it has cysteine ✓instead of serine ✓/have different amino acids (2)
[12]

SOLUTIONS TO HOMEWORK: SESSION 7
TOPIC 2: CONSOLIDATION – EXAMINATION PAPER 1

QUESTION 1: max 20 marks

The process of protein synthesis occurs in two steps, namely transcription and translation.

Transcription
• Double stranded DNA unzips
• When the hydrogen bonds break
• One strand is used as a template
• To form mRNA
• Using free RNA nucleotides from the nucleoplasm
• The coded message for protein synthesis is thus copied onto mRNA
• mRNA moves from the nucleus to the cytoplasm and attaches to the ribosome **Max (6)**

Translation
• tRNA collects amino acids
• tRNAs, with amino acids attached, become arranged on the mRNA
• The anticodons on the tRNAs match complementary bases on the codons of mRNA
• Amino acids become attached by peptide bonds to form the required protein
• Each tRNA is released to pick up more amino acids **Max (6)**

Impact of gene mutations on protein synthesis
- Errors/mistakes/changes may occur during DNA replication
- Point mutation: replacing one base of a codon with another
- Small change that may possibly result in one amino acid changing in a protein
- Frameshift mutation: addition/deletion of one or more bases of a codon
- Resulting in changing the order/sequence of all the bases of the codons
- Resulting in forming a different protein with different functions **Max (5)**

ASSESSING THE PRESENTATION OF THE ESSAY

Marks	Description
3	Explained all three of transcription, translation or mutation fully without irrelevant information
2	Explained 2 of transcription, translation or mutation fully with little/no irrelevant information
1	Explained 1 of transcription, translation or mutation fully with little/no irrelevant information
0	Not attempted/nothing written other than question number/no correct information

Synthesis (3)

[20]

QUESTION 2

2.1 Haemophilia occurred in males ✓only ✓ (2)

2.2 (a) X^hY ✓✓ (2)

(b) X^HX^h ✓✓ (2)

(c) X^HY ✓✓ (2)

[8]

QUESTION 3

3.1 7 ✓ (1)

3.2 14 ✓ (1)

3.3 Non-disjunction ✓

During meiosis in the wild wheat plant the 7 homologous pairs ✓ did not separate ✓

The gamete was 2n ✓ / had 14 chromosomes

The same process happened with the natural goat grass ✓

Fusion of the two diploid gametes formed a polyploidy ✓/ tetraploid Emmer **(max 5)**

(5)

3.4 (a) Polyploidy ✓ (1)

(b) The size ✓of the seeds increased and the number ✓of seeds increased from the wild wheat plant to Emmer to the present day wheat (2)

3.5 Wind cannot disperse the seeds ✓since the seeds are firmly attached to the husk ✓ (2)

3.6 Sympatric ✓speciation (1)

3.7 Allopatric ✓speciation (1)

3.8 Allopatric speciation: geographical barrier present ✓

Sympatric speciation: no geographical barriers present ✓ (2)

[16]

SOLUTIONS TO HOMEWORK: SESSION 8
TOPIC 1: CONSOLIDATION – EXAMINATION PAPER 2

QUESTION 1

1.1. None
1.2. None
1.3. A and B
1.4. B only
1.5. B only
1.6. None
1.7. A and B
1.8. A only

(8 x 1) **[8]**

QUESTION 2

2.1. a) 2 ✓– iris ✓ (2)
b) 9 ✓– choroid ✓ (2)
c) 10 ✓– retina ✓ (structure and function must BOTH be correct for 2 marks) (2)
2.2. a) 6 ✓– cornea ✓ (2)
b) 12 ✓- yellow spot / fovea centralis ✓ (2)
2.3. 6 – cornea
5 – aqueous humour
3 – lens
7 – vitreous humour
(Answer must be in the **correct order** with correct number AND structure) (4)
2.4. 10 ✓– retina ✓ (2)
2.5. 2 ✓- iris ✓ (2)
2.6. Bright light:

- circular muscles contract ✓
- causing pupil to constrict (get smaller) ✓
- radial muscles relax ✓
- less light is allowed into the eye ✓ (4)

2.7. Near vision:

- ciliary muscles **contract** ✓ causing the ciliary body to move closer to the lens ✓
- suspensory ligaments **slacken** ✓
- tension on the lens is released ✓
- lens becomes more convex and **rounded** ✓ increasing the **refractive power** of the lens ✓
- focal length **decreases**, ✓bringing the object into focus onto the yellow spot of the retina ✓ (8)

[30]

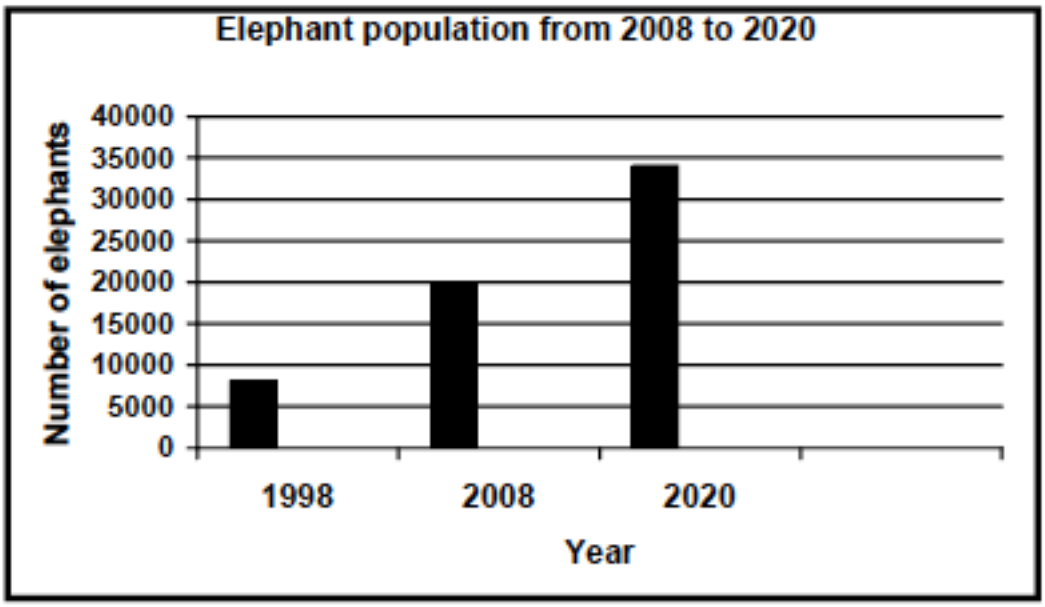
SOLUTIONS TO HOMEWORK: SESSION 8
TOPIC 2: CONSOLIDATION – EXAMINATION PAPER 2

QUESTION 1: 10 minutes

1.1 Damage to the environment ✓ (1)

1.2 Contraception ✓
Relocation of elephant families ✓
Removing fences to allow migration ✓ **(Mark first TWO only)** (Any 2) (2)

1.3



Mark allocation for the graph:

Caption for graph	1
Correct label for X-axis	1
Correct label for Y-axis	1
Appropriate scale for Y-axis	1
Drawing of bars (D)	1 mark if 1 to 2 bars are drawn correctly 2 marks if all 3 bars are drawn correctly

(6)
[9]

QUESTION 2

1.1 Binocular vision /stereoscopic vision
1.2 Emigration
1.3 Choroid
1.4 Ecological succession
1.5 Census
1.6 Niche
1.7 Amniotic
1.8 Vas deferens
1.9 Autonomic nervous system
1.10 Altricial development

(10 x 1) **[10]**