91. The pollen tube usually enters the embryo sac

(a) between the egg cell and synergid  (b) by directly penetrating the egg
(c) between one synergid and antipodal cell  (d) by knocking off the antipodal cells

92. Plants of which one of the following groups of genera are pollinated by the same agency?

(a) Triticum, Mussanda and Zea mays  (b) Kadam and Cannabis
(c) Salvia and Calotropis  (d) Salvia, Pinus and Ophrys
93. Genes for cytoplasmic male sterility in plants are generally located in

(a) mitochondrial genome  (b) cytosol
(c) chloroplast genome    (d) nuclear genome

The mitochondrial genome is the full genetic complement of a mitochondrion. Mitochondrial DNA is only a small portion of the total DNA of a eukaryotic cell and in most species is solely inherited from the mother. In humans mitochondrial DNA contains approximately 16,600 base pairs encoding 37 genes.

Cytoplasmic male sterility is total or partial male sterility in plants as the result of specific nuclear and mitochondrial interactions. Male sterility is the failure of plants to produce functional anthers, pollen, or male gametes.
94. Women who consumed the drug thalidomide for relief from vomiting during early months of pregnancy gave birth to children with

(a) no spleen  
(b) hare-lip
(c) extra fingers and toes  
(d) under developed limbs

thalidomide: a drug formerly used as a sedative, but withdrawn in the UK in the early 1960s after it was found to cause congenital malformation or absence of limbs in children whose mothers took the drug during early pregnancy. A sedative and hypnotic drug, C13H10N2O4, withdrawn from general use after it was found to cause severe birth defects when taken during pregnancy, especially in the treatment of leprosy.

95. Disease associated with secretion of toxin is

(a) tetanus  
(b) TB  
(c) food poisoning  
(d) AIDS
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Tetanus: An often fatal infectious disease that is caused by the bacterium Clostridium tetani, which usually enters the body through a puncture, a cut, or an open wound. Tetanus leads to profound painful spasms of muscles, including 'locking' of the jaw so that the mouth cannot open, and death.

Microbial toxins are toxins produced by micro-organisms, including bacteria and fungi. Microbial toxins promote infection and disease by directly damaging host.

Clostridium tetani is a rod-shaped, anaerobic species of pathogenic bacteria, of the genus Clostridium. Like other Clostridium genus species, it is Gram-positive, and its appearance on a gram stain resembles tennis rackets or drumsticks. C. tetani is found as spores in soil or in the gastrointestinal tract of animals.

96. The world’s highly prized wool yielding ‘Pashmina’ breed is

(a) sheep   (b) goat   
(c) goat and sheep cross   (d) Kashmir sheep and Afghan sheep cross

PASHMINA

Pashmina is a fine type of cashmere wool. The wool comes from four distinct breeds of the Cashmere goat; namely the Changthangi goat from the Changthang plateau in Ladakh region, the Malra from Kargil area in Kashmir region, the Chegu from Himachal Pradesh in northern India, and Chyangara or Nepalese Pashmina goat from Nepal. They survive on grass in Ladakh, where temperatures drop to as low as −20 °C (~4.00 °F). Shawls made from Pashmina wool are considered very fine, and are exported worldwide. The Changthangi goats have revitalized the poor economy of Changthang, Leh and Ladakh region.

Angora Goat
Directions (7 to 9) In each of the following questions a statement of Asserting is given followed by a corresponding statement of Reason just below it. Of the statement, mark the correct answer as

97. **Assertion** *Flavr savr*, a transgenic tomato remains fresh and retains its flavor for long time.
**Reason** Production of polygalacturonase enzymes, which degrades pectin was blocked in *Flavr savr*.

(a) If both Assertion and Reason are true and Reason is the correct explanation of the Assertion.
(b) If both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.
(c) If Assertion is true, but Reason is false.
(d) If both Assertion and Reason are false.

98. **Assertion** Genetic engineering overcomes the drawbacks of traditional hybridisation.
**Reason** Genetic engineering involves creation of recombinant DNA and introduces the desirable genes into the target organisms.

(a) If both Assertion and Reason are true and Reason is the correct explanation of the Assertion.
(b) If both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.
(c) If Assertion is true, but Reason is false.
(d) If both Assertion and Reason are false.

99. **Assertion** In plant tissue culture, somatic embryos can be induced from any plant cell.
**Reason** Any viable plant cell can differentiate into somatic embryos.

(a) If both Assertion and Reason are true and Reason is the correct explanation of the Assertion.
(b) If both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.
(c) If Assertion is true, but Reason is false.
(d) If both Assertion and Reason are false.

100. During translation initiation in prokaryotes, a GTP molecule is needed in

(a) association of 30 S, mRNA with formyl-met-tRNA
(b) association of 50 S subunit of ribosome with initiation complex
(c) formation of formyl-met-tRNA
101. Which one of the following pairs of features is a good example of polygenic inheritance?

(a) Human height and skin colour  
(b) ABO blood group in humans and flower colour of *Mirabilis jalapa*  
(c) Hair pigment of mouse and tongue rolling in humans  
(d) Human eye colour and sickle-cell anaemia

**Polygenic Inheritance:** Human skin color is a good example of polygenic (multiple gene) inheritance. A genotype with all "dominant" capital genes (AABBCC) has the maximum amount of melanin and very dark skin. A genotype with all "recessive" small case genes (aabbcc) has the lowest amount of melanin and very light skin.

A simplified model for polygenic inheritance of skin color.

102. The membranous cover of the ovum at ovulation is

(a) corona radiate  
(b) zona radiata  
(c) zona pellucida  
(d) chorion

The **corona radiata** is the innermost layer of the cumulus oophorus and is directly adjacent to the **zona pellucida**, the outer protective layer of the **ovum**. Its main purpose in many animals is to supply vital proteins to the cell.

103. Intensely lactating mother do not generally conceive due to the

(a) suppression of gonadotropins  
(b) hypersecretion of gonadotropins  
(c) suppression of gametic transport  
(d) suppression of fertilization
GnRH is a hormone that is produced in the hypothalamus region of the brain. Once produced, GnRH moves through the bloodstream to the pituitary gland. There, it binds to certain receptors, which signals the pituitary gland to create two more hormones: LH and follicle-stimulating hormone (FSH).

Gonadotropin suppression, in which FSH, LH, and testicular T are suppressed, produces changes in these spermatogonial subtypes. However, in these suppression models, it is not possible to dissect the specific effects of each hormone. GnRH stimulates (causes) the pituitary gland to produce follicle stimulating hormone (FSH), the hormone responsible for starting follicle (egg) development and causing the level of estrogen (the primary female hormone) to rise.

During pregnancy and lactation, female physiology adapts to meet the added nutritional demands of fetuses and neonates. An average full-term fetus contains ~30 g calcium, 20 g phosphorus, and 0.8 g magnesium. About 80% of mineral is accreted during the third trimester; calcium transfers at 300-350 mg/day during the final 6 wk. The neonate requires 200 mg calcium daily from milk during the first 6 mo, and 120 mg calcium from milk during the second 6 mo (additional calcium comes from solid foods). Calcium transfers can be more than double and triple these values, respectively, in women who nurse twins and triplets. About 25% of dietary calcium is normally absorbed in healthy adults. Average maternal calcium intakes in American and Canadian women are insufficient to meet the fetal and neonatal calcium requirements if normal efficiency of intestinal calcium absorption is relied upon. However, several adaptations are invoked to meet the fetal and neonatal demands for mineral without requiring increased intakes by the mother. During pregnancy the efficiency of intestinal calcium absorption doubles, whereas during lactation the maternal skeleton is resorbed to provide calcium for milk. This review addresses our current knowledge regarding maternal adaptations in mineral and skeletal homeostasis that occur during pregnancy, lactation, and post-weaning recovery. Also considered are the impacts that these adaptations have on biochemical and hormonal parameters of mineral homeostasis, the consequences for long-term skeletal health, and the presentation and management of disorders of mineral and bone metabolism.
104. Condoms are one of most popular contraceptives because of contraceptives because of the following reasons

(a) these are effective barriers for insemination
(b) they do not interfere with coital act
(c) these help in reducing the risk of STDs
(d) All of the above

105. The vas deferens receives duct from the seminal vesicle and opens into urethra as

(a) epididymis    (b) ejaculatory duct    (c) efferent ductule    (d) ureter
The **ejaculatory ducts** (*ductus ejaculatorii*) are paired structures in **male anatomy**. Each ejaculatory duct is formed by the union of the **vas deferens** with the **duct of the seminal vesicle**. They pass through the **prostate**, and open into the **urethra** at the **Colliculus seminalis**. During **ejaculation**, **semen** passes through the prostate gland, enters the urethra and exits the body via the tip of the **penis**.

106. A mammalian ovum fails to get fertilised, which one of the following is unlikely?

   (a) Corpus luteum will disintegrate  
   (b) Oestrogen secretion further decreases  
   (c) Primary follicle starts developing  
   (d) Progesterone secretion rapidly declines

107. Cu ions released from copper-releasing intra Uterine Devices (IUDs)

   (a) make uterus unsuitable for implantation  
   (b) increase phagocytosis of sperms  
   (c) suppress sperm motility  
   (d) prevent ovulation

108. Which one of the following statements about human sperm is correct?

   (a) Acrosome has a conical pointed structure used for piercing and penetrating the egg, resulting in fertilisation  
   (b) The sperm lysins in the acrosome dissolves the egg envelope facilitating fertilisation  
   (c) Acrosome serves as a sensory structure leading the sperm towards the ovum  
   (d) Acrosome serves no particular function

In Eutherian mammals the **acrosome** contains digestive enzymes (including hyaluronidase and acrosin). These enzymes break down the outer membrane of the ovum, called the zona pellucida, allowing the haploid nucleus in the sperm cell to join with the haploid nucleus in the ovum.
109. Cu-T prevents pregnancy by preventing

(a) fertilisation  (b) ovulation
(c) implantation of fertilised egg  (d) None of these

110. Which part of ovary in mammals acts as an endocrine gland after ovulation?

(a) Graafian follicle  (b) Stroma
(c) Germinal epithelium  (d) Vitelline membrane

About every 28 days between puberty and the onset of menopause, one of the follicles develops to maturity, or ripens, into a graafian follicle (or vesicular ovarian follicle). As it ripens, it increases in size. The ovum within becomes larger, the follicular wall becomes thicker, and fluid collects in the follicle and surrounds the ovum. The follicle also secretes oestradiol, the hormone that prepares the endometrium to receive a fertilized egg. As the follicle matures, it moves to the surface of the ovary and forms a projection. When fully mature, the graafian follicle breaks open and releases the ovum, which passes into the FALLOPIAN TUBES. This release of the ovum is called OVULATION; it occurs midway in the menstrual cycle, generally about 14 days after the commencement of the menstrual flow.

111. In the human female, menstruation can be deferred by the administration of

(a) LH only  (b) combination of FSH and LH
(c) combination of oestrogen and progesterone  (d) FSH only

The ovaries begin to produce less estrogen after menopause (the change of life). estrogen and progestin combination (ovarian hormone therapy) is prescribed to make up for the lower amount of estrogen. Estrogens help relieve signs of menopause, such as hot flashes and unusual sweating, chills, faintness, or dizziness.

112. Both corpus luteum and macula lutea are

(a) found in human ovaries  (b) a source of hormones
(c) characterised by a yellow colour
(d) contributory in maintaining pregnancy

The yellow color and name of the corpus luteum, like that of the macula lutea of the retina, is due to its concentration of certain carotenoids.

The corpus luteum (Latin for "yellow body"; plural corpora lutea) is a temporary endocrine structure in female ovaries that is involved in the production of relatively high levels of progesterone and moderate levels of estradiol and inhibin A. It is colored as a result of concentrating carotenoids (including lutein) from the diet and secretes a moderate amount of estrogen to inhibit further release of gonadotropin-releasing hormone (GnRH) and thus secretion of luteinising hormone (LH) and follicle-stimulating hormone (FSH). A new corpus luteum develops with each menstrual cycle.

The function of the macula lutea is to provide accurate and detailed central vision. It gets its name because it's a yellow spot in the macula, which is in the center of the retina. It is abundant in specialized light-sensitive cells called cones.

113. Which one is a true statement regarding DNA polymerase used in PCR?

(a) it is used to ligate introduced DNA in recipient cells
(b) it serves as a selectable marker
(c) it is isolated from a virus
(d) it remains active at high temperature

The polymerase chain reaction (PCR) is a technique used in molecular biology to amplify a single copy or a few copies of a piece of DNA across several orders of magnitude, generating thousands to millions of copies of a particular DNA sequence.

114. DNA and RNA segment, tagged with a radioactive molecule is called

(a) vector          (b) probe          (c) clone          (d) plasmid
DNA Probes are
- Single stranded, fragments / pieces of DNA
- Contain nucleotide sequence complimentary to
  the target sequence
- Radiolabeled with radioisotopes (usually $^{32}$P)
  to visualize on an X-ray film
- Use: for detecting a target sequence in
  Southern and Northern blot techniques

Nucleic Acid Probes
- Spontaneous pairing of complementary DNA strands forms basis for
  techniques used to detect and characterize genes.
- Probe technology used to identify individual genes or DNA
  sequences.
- Nucleic acid probe short strand of DNA or RNA of known sequence
  used to identify presence of complementary single strand of DNA in
  patient sample.
- Binding of 2 strands (probe and patient) known as hybridization.
- Two DNA strands must share at least 16 to 20 consecutive bases of
  perfect complementarity to form stable hybrid.
- Match occurring as a result of chance less than 1 in a billion.
- Probes labeled with marker: radioisotope, fluorochrome, enzyme or
  chemiluminescent substrate.
- Hybridization can take place in solid support medium or liquid.

115. Microbes found to be very useful in genetic engineering are

(a) *Escherichia coli* and *Agrobacterium tumefaciens*
(b) *Vibrio cholera* and a tailed bacteriophage
(c) *Diplococcus* sp. And *Pseudomonas* sp.
(d) Crown gall bacterium and *Caenorhabditis elegans*
In order to obtain virus free plants through tissue culture the best method is

(a) protoplast culture  (b) embryo rescue
(c) anther culture   (d) meristem culture

This study was performed for comparison of meristem culture technique with shoot tip culture technique for obtaining virus-free plant, comparison of micropropagation success of two different nutrient media, and determination of effectiveness of real-time PCR assay for the detection of viruses. Two different garlic species (Allium sativum and Allium tuncelianum) and two different nutrient media were used in this
Biology 12 sphs

experiment. Results showed that Medium 2 was more successful compared to Medium 1 for both A. tuncelianum and A. sativum (Kastamonu garlic clone). In vitro plants obtained via meristem and shoot tip cultures were tested for determination of onion yellow dwarf virus (OYDV) and leek yellow stripe virus (LYSV) through real-time PCR assay. In garlic plants propagated via meristem culture, we could not detect any virus. OYDV and LYSV viruses were detected in plants obtained via shoot tip culture. OYDV virus was observed in amount of 80% and 73% of tested plants for A. tuncelianum and A. sativum, respectively. LYSV virus was found in amount of 67% of tested plants of A. tuncelianum and in amount of 87% of tested plants of A. sativum in this study.

117. Part of the plant, which is cultured to obtain virus free clones is

(a) leaf  (b) root  (c) shoot tip  (d) embryo

In tissue culture cells, tissues, and organs of a plant are separated. These separated cells are grown especially in containers with a nutrient media under controlled conditions of temperature and light. The cultured plant requires a source of energy from sugar, salts, a few vitamins, amino acids, etc. that are provided in the nutrient media. From these cultured parts, an embryo or a shoot bud may develop, which then grows into a whole new plantlet. Similarly, portions of organs or tissues can be cultured in a culture media. Generally, these give rise to an unorganized mass of cells called callus (soft tissue that forms over a cut surface).

Tissue culture plantlets have poor photosynthesis efficiency and lack the proper mechanism to control water loss. They need to be hardened gradually by moving them along a humidity gradient in the greenhouse. Once these plants are in the research fields, they are evaluated under field conditions and the data is collected every 6 months. A large number of tissue culture plants that have grown into trees are remarkably uniform and show an increase in biomass production over the conventionally raised plants.

Application of tissue culture

- **Micropropagation**
  Rapid vegetative multiplication of valuable plant material for agriculture, horticulture, and forestry.

- **Production of disease-free plants**
  When the apex of shoot is used for multiplication by tissue culture, we get disease free plants because the shoot apical meristem, a group of dividing cells at the tip of a stem or root, is free from pathogens.

- **Plant breeding**
  Tissue culture has also been successfully used in plant breeding programmes.
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- Production of disease- and pest-resistant plants

Plants grown from tissue culture usually pass through callus phase and show many variations. These show some agronomic characteristics like tolerance to pests, diseases, etc.

Cloning

Genetically identical plants derived from an individual are called clones. Processes that produce clones can be put under the term ‘cloning’. This includes all the methods of vegetative propagation such as cutting, layering, and grafting. Propagation by tissue culture also helps in producing clones. Using the shoot tip, it is possible to obtain a large number of plantlets. This technique is used extensively in the commercial field for micropropagation of ornamental plants like chrysanthemum, gladiolus, etc. and also crops such as sugar cane, tapioca, and potato. Thus an unlimited number of plants that are genetically similar or are clones can be produced in a short span of time by tissue culture.

118. If Darwin’s theory of pangenesis shows similarity with theory of inheritance of acquired characters then what shall be correct according to it?

(a) Useful organs become strong and developed, while useless organs become extinct. These organs help in struggle for survival
(b) Size of organs increase with ageing
(c) Development of organs is due to will power
(d) There should be some physical basis of inheritance

Many biologists and other academics held to the idea of blending inheritance during the 19th century, prior to the discovery of genetics. Blending inheritance was merely a widespread hypothetical model, rather than a formalized scientific theory. It was never formally presented to a scientific body, nor published in any scientific journals, nor ascribed to any specific person; in which it was thought inherited traits were determined randomly, from a range bound by the homologous traits found in the parents. The height of a person, with one short parent and one tall parent, was thought to always be of some interim value between its two parents’ heights. The shortcoming to this idea was in how it required the person of interim height, in turn, to then become one of the limiting bounds (either upper or lower) for future offspring, and so on down the entire lineage. Thus, in each family, the potential for variation would tend to narrow, quite dramatically, with each generation, and, so it would go for the entire population with every trait. If blending inheritance were true, in this example, all members of a species would eventually converge upon a single value for height for all members. In short, “blending inheritance is incompatible...with obvious fact. If it were really true that variation disappeared, every generation should be more uniform than the previous one. By now, all individuals should be as indistinguishable as clones.”

119. which one of the following groups of structures/organs have similar function?

(a) Typhlosole in earthworm, intestinal villi in rat and contractile vacuole in Amoeba
(b) Nephridia in earthworm, Malpighian tubules in cockroach and urinary tubules in rat
(c) Antennae of cockroach, tympanum of frog and clitellum of earthworm
(d) incisors of rat, gizzard (proventriculus) of cockroach and tube feet of starfish

These are found situated on the inter-segmental septum between 15th and 16th segments to the posterior side of the body.
Each septum bears nephridia on both the surfaces arranged in semicircles around the intestine, two rows in front of the septum and two behind it. Each septum has about 40 to 50 nephridia in front and the same number behind, so that each segment possesses 80 to 100 septal nephridia except the 15th segment which has only 40 to 50 nephridia. These are not found in the segments up to 14th.

The excretory organ of cockroach is the malpighian tubules. It is found at the junction of the midgut and hind gut and are about 150 in number. They are fine, yellow coloured and branched threads present in bundles. They lie freely in the haemolymph.

The distal parts of the tubules extract inorganic ions, uric acid and amino acids by active transport and water by diffusion from the surrounding haemolymph. The filtrate moves towards the ileum. In the proximal parts of the malpighian tubules water and other useful substances are reabsorbed. The remaining materials passes into the gut. More water and inorganic ions are reabsorbed in the gut. Almost solid uric acid, is finally eliminated with the faeces.

120. A baby has been born with a small tail. It is the case exhibiting

(a) retrogressive evolution    (b) atavism
(c) mutation                  (d) metamorphosis

An atavism is an evolutionary throwback, such as traits reappearing that had disappeared generations before. Atavisms can occur in several ways.

In many plants (e.g., Rosa, Hibiscus, Oxalis, Poppy), some of the stamens and even carpels get changed to petal-like structures indicating that stamens