ZOO501 FINAL TERM MCQS

1. Mode of commitment_____3___
2. strageries of commitment_____2___
3. Rana pipiens usually lays around __2500 eggs_____while the bullfrog, Rana catesbiana, can lay as many as 20,000
4. Multinucleated type of cell form._____syncytiotrophoblast
5. slow block, initiated by the intracellular release of_____ calcium ions
6. There are_____ two ____ major modes of bone formation, or **osteogenesis**
7. Mutations of the ___*SOX9* gene____cause camptomelic dysplasia, a rare disorder of skeletal development that results in deformities of most of the bones of the body
8. Human brain contains_____**10^{12}** glial cells____
9. Telolecithal is cleavage is found in eggs of _____Birds and Fishes
10. ____Pax6 _____ plays a major role in eye formation
11. ___Pax1_____and Scleraxis are the transcription factors are thought to activate cartilage-specific genes
12. The eggs of insects have their yolk in the ____center_____ (i.e., they are centrolecithal),
13. Egg activates due to which ion more _____Ca____
14. Which dermis give rise to brain _____Ectoderm____
15. Which dermis give rise to eye _____Ectoderm_____
16. Mod of commitment in insects _____syncytial specification____
17. Regulative development arises from_____ conditional specification
18. Nucleosome is composed of an octamer of histone proteins wrapped with two loops containing approximately ___140 base pairs___ of DNA
19. the membrane potential of the sperm becomes ___more negative___ as potassium ions leave the sperm
20. Paracrine factors such as TGF- and FG**F7** are important in normal _____skin development
21. The male leopard ___frog___release sperm in the summer
22. In mouse ZP3 is attached to_____zona pellucid
23. It is estimate ____egg is 25000 to 50000 mRNA. _____Sea Urchin
24. Fertilin protein is important for sperm-egg fusion in _____Mammals___
25. Fast block to polyspermy is initiated by _____Sodium___
26. Transition from fertilization to cleavage is caused by factor _____MPF
27. Eggs having sparse and equally yolk space are called _____isolethial___
28. Archenteron is used for _____primitive gut___
29. Spiral cleavage found in _____Snails____
30. Sonic hedgehog is a type of _____protein____
31. Which type of neurulation in fish _____secondary___
32. Nural crest divides functionally in domains _____4_____
33. Myogenic bHLH proteins are specific for development of _____muscle cell___

34. Zygote which divide mitotically to produce all the cells of the body.
35. Tatratology the study of birth defect.
36. Identical twins occur in roughly 0.25% of human births.
37. Requlatively development is seen in most vertebrate embroys , and it is obviously critical in development of identical twins.
38. Insect such as drosophila use all three mods of specification to commit their cells to particular fates.
39. The speed of metamorphosis is directly linked with environment pressures
40. In acetabularia unicellular organisms, development us controlled at both the transciptional and translational level.
41. The individuals of each species, however is divided into two mating types Plus and minus calamadomonas.
42. 140 base pairs of DNA nucleosome.
43. Viteline envelop contains at least eight different glycoproteins.
44. The first evidence suggestion the importance of sperm in reproduction came from a series experiment performed by Lazzaro Spallanzani
45. The volume of the sea urchin is about 200 Pico liters
46. Hindbrain Rhombencephalon
47. The most crucial, difference between mammalian cleavage and all other types involves the phenomenon of compaction
48. The embryo contains three germ layers. The ectoderm, the endoderm and the mesoderm.
49. The neural form keel fish
50. Spiral holoblastic clevage is characteristic of several animals groups, including annelid worms, some flateworms, and most mollusks(snails).
51. Diploblastic animals are those who have ectoderm and endoderm but no true mesoderm (hydra)
52. Cell fate is determined by signalling. The micromeres constitute a major signalling center. B-catenin is important for the inducing capacity of micromeres.
53. Even distribution of yolk in ovum isolecithal
54. Size of bindin protein 30,500-Da
55. which has two parts in cell cycle options Blastomere
56. After the blastoderm cells have covered about half the zebra fish yolk cell, a thickening occurs throughout the margin of the epibolizing blastoderm. This thickening is called the **germ ring**
57. Which forms spinal cord, hind brain and mid brain chordamesoderm.
58. This streak is first visible in birds as a thickening of the Epiblast at the posterior region of the embryo, just anterior to koller sickle.
59. I will induce the uterine cells of the mammals to from the matrenal portion of the placenta, the Decidua.
60. Between the area pellucida and the area opaca is a thin layer of cells called the **marginal zone** (or marginal belt).
61. The mitotic division of the nucleus is called karyokinesis
62. Fishes, reptiles , and birds undergo discoidal meroblastic cleavage, wherein the early cell divisions do not cut through the yolk of the egg.
63. The fast block, initiated by sodium influx into the cell in sea urchin.

64. The cells adjacent to the chordamesoderm, the paraxial mesoderm cells, are the precursors of the mesodermal somites in the fish.
65. The rudiment of the central nervous system, is called neurulation.
66. Blastula produced by radial cleavage has no blastocoel and are called stereoblastulae.
67. Fraternal twins are the result of two separate fertilization events.
68. The prechordal ____plate_____induces the formation of the forebrain; the chordamesoderm induces the formation of the midbrain, hindbrain, and spinal cord.
69. The resulting larvae of snail is called _____glochidia____which resemble tiny bear traps.

ZOO501 CURRENT MCQS MIDTERM (2018) UPDATED

1. Red blood cells make_____Globins
2. how many strategies for developmental commitment _____2
3. Ribosomes produce in sea urchin _____10^{12}
4. Resact is isolated from egg jelly of _____sea urchin
5. ___is a discipline that studies embryonic & other developmental processes___Developmental Biology
6. 0nly___small___ %age of genome expressed in particular cell
7. Digestive & respiratory system formed by_____Endoderm
8. Progesterone work for signals the egg to resume its _____meiotic division
9. Insect characteristics are ..... specification_____syncytial
10. In Chlamydomonas haploid chromosome has.....copy _____one
11. Modes of commitments are..... _____3
12. After fertilization developmental process proceed by _____Cleavage
13. Ca ion responsible for cortical granules stores in _____Endoplasmic Reticulum of Eggs
14. Seawater has a particularly high ___ ion concentration _____Na (Sodium)
15. There are ___approaches of anatomy_____4(four)
16. The major cell adhesion molecules appear to be the Cadherins.
17. It is estimate ____egg is 25000 to 50000 mRNA. _____*Sea Urchin*
18. Fusion of ____and sperm cell plasma membrane. _____Egg
19. Resact diffuse readily in _____sea water.
20. The requirement of capacitance varies from species to _____Species.
21. The division of embryo into 3 _____Germ layers
22. Cell potency___≥___fate
23. Zona pellucida___ also initiate the acrosomal reaction after sperm bound to it.
24. Mammalian egg is surrounded by layer called. _____Cumulus
25. The volume of the sea urchin is about ___200___ Picoliters.
26. The sperm travel by the amoeboid motion of ____lamellipodial extensions __of the cell membrane.
27. The sex and __Reproduction___ process included into fertilization.
28. The term spermatozoa means.. _____Sperm Animals
29. In 1824____J. L. Prevost and J. B. Dumasclaimed_ sperm is not parasite.

30. 4 cadherin classes are found in Vertebrates embryos. .
31. The second major group of protostomes are the Lophotrochozoa
32. Sperm discovered in 1678
33. Transcription factors have three major domains
34. How many Amphibian oocytes produces ribosomes as 10^{12}
35. Enhancers can also be used to inhibit transcription
36. In deutrosomes the mouth opening would formed after... opening Anal
37. Germs cell formed in.... specialized portion of egg cytoplasm
38. Syncytial specification found in insects
39. Third anatomical approach to developmental biology is Teratology
40. The mature sea urchin is metabolically sluggish and activated by. Sperm
41. The resting membrane potential is.....mv. 70mV
42. Fusion is a Active process that is activated by fusogenic proteins.
43. Axoneme s formed by. Microtubules
44. Acrosome can be modified secreted by..... Golgi apparatus (not sure)
45. The male leopard frog release sperm in the summer.
46. Eukaryotic genes are contained within a complex of DNA and protein called Chromatin
47. The negative enhancers are called Silencers
48. The ability of embryonic cells to change their fates is called..... Regulation
49. Pax6 transcription factor found in mammalian eye, nervous system and pancreas.
50. E- Cadherin is expressed on all early mammalian embryonic cells.
51. Annelids, molluscs and flatworms belong to..... Lophotrochozoa
52. Potency of cell decrease if cell is committed.
53. Fertilization in Rana Pipiens usually lasts for about 3 (three) years.
54. An uncommitted cell can be described as Naive
55. Lying immediately beneath the plasma membrane of the egg is a thin Shell
56. Acroomal vesicles are considered as modified secretory vesicles
57. Most marine organisms release their gametes into the environment
58. The fast block method is used to prevent Polyspermy
59. Autonomous specification was first demonstrated in 1887
60. In mouse ZP3 is attached to zona pellucid
61. TAFs used in transcription factor activity
62. in slow block method which is cortical granule protein hyalin and peroxidase
63. Egg shell formed weight of egg. 9 – 12%
64. potency is intrinsic property
65. cytoplasm that contains many nuclei called syncytium
66. Ectoderm forms..... epidermis, nervous system, and pigment cells.
67. according to dutch sperm are ... parasitic animals (spermatozoa)
68. Acrosome & nucleus constitute the head of the sperm.
69. cortical granules are membrane bound structures
70. Acrosomal reaction has 2 (two) component
71. Acrosome-reacted sperm transfer their binding from ZP3 to the adjacent ZP2 molecules
72. Ca & bicarbonate ions maybe critical in activating cAMP

73. Peroxidase enzyme hardens fertilization envelope
74. The Fast block to polyspermy is achieved by changing the electric potential
75. P-cadherin stands for _____Placental Cadherin
76. Most transcription factor can bind to specific DNA sequences
77. MITF protein necessary for production of pigments cell and their pigments.
78. Outside of plasma membrane is the vitelline envelope.
79. Mouse __fertilin___is localized to posterior plasma membrane of the sperm.
80. Finally the fourth cortical granules protein ___hyaline___ forms a coating around egg.
81. The cleavage stages are called.____Blastomere
82. Enhancers are....._DNA Sequences
83. The mitotic spindle and contractile ring are perpendicular to each other
84. J.Whittaker stained blastomeres for the presence of the enzyme acetyl cholinesterase
85. Protocadherins are involved in separating notochord from mesoderm in __Xenopus gastrulation
86. Pax6 factor needed for mammalian eye
87. Which stands comparative embryology is ____First_
88. Cell type specification precedes any large-scale embryonic cell migration
89. Series of extremely rapid divisions in zygote is ___Cleavage
90. In protosome, mouth is formed first than Deuterostomes: forms.
91. Northern blots, in situ hybridization, & the PCR can show which cells are transcribing particular genes.
92. Coding regions of DNA are called ___Exon
93. Na and __K__ Are important in fast block polyspermy.
94. The force for sperm propulsion is provided by __dynein
95. Spallenazani demonstrated that filtered __toad__ semen devoid of sperm would not fertilize egg.
96. Mesoderm generates the____KIDNEY.
97. Sperms are attracted towards egg of their species by CHEMOTAXIS.
98. Mathematical modeling seeks to desire developmental phenomenon in terms of EQUATIONS.
99. A region that is not translated in proteins is called UNTRANSLATED region.
100. Invariable cleavage produce the ___SAME___ lineages in embryo
101. Germ layers are formed as a result of ___GASTRULATION
102. RNA polymerase binds with PROMOTOR in start of transcription
103. The region of globular actin molecule lies between nuclear and acrosomal vesicle in ____SEA URCHIN
104. Which technique is used in situ hybridization ____Northern blots
105. Conditional specification involves interaction with RELATIVE POSITIONS cells
106. Particular proteins or carbohydrate on the sperm surface __LOST__ during capacitation
107. ___LOSS____ of hydrogen ion causes pH to rise.
108. Peroxidase enzyme hardens the fertilization envelope by crosslinking TYROSINE residues
109. FERTILIZATION transmits genes from parents to offspring.
110. Regulation of gene expression accomplished by SELECTIVE MESSENGER RNA TRANSLATION
111. Development contact genotype and PHENOTYPE
112. Nucleosome is composed of OCTAMER of histone protein.
113. Knowledge of gene activity in humans can be obtained by candidate GENE MAPPING & POSITIONAL CLONING
114. Anatomical abnormalities are caused by MUTANT GENES
115. All multicellular organisms arise by a slow process of progressive change called DEVELOPMNET

116. Animals development is the division of embryo into three layers Ectoderm, Mesoderm and ENDODERM
117. The ions which are responsible for increasing granule reactions Ca (Calcium)
118. The zona pellucida is a fglycoprotein matrix, which is synthesized and secreted by the growing oocyte
119. In several other species, certain regions of the membrane are specialized for sperm recognition & fusion
120. An intrinsic program has been activated within the cell that causes it to follow a particular pathway of development
121. Activation of egg metabolism to start development
122. Insects such as Drosophila use all three modes of specification to commit their cells to particular fates
123. Nuclear control of cell morphogenesis and the interaction of nucleus and cytoplasm are well studied in Acetabularia.
124. Upon fertilization, the intracellular calcium ion concentration of the egg increases greatly
125. Bacteria are able to transmit genes from one individual to another by means of sex pili
126. +ve and – ve mating take place *Chlamydomonas*

SUBJECTIVE

2marks:

1. **Define Blastocoel?**

A fluid-filled cavity, the blastocoel, forms in the animal hemisphere. This cavity will be important for allowing cell movements to occur during gastrulation.

2. **Define periosteum?**

The entire region of calcified spicules becomes surrounded by compact mesenchymal cells that form the **Periosteum** (a membrane that surrounds the bone).

3. **Define Germ ring?**

After the blastoderm cells have covered about half the zebra fish yolk cell, a thickening occurs throughout the margin of the epibolizing blastoderm. This thickening is called the **germ ring**, and it is composed of a superficial layer, the **epiblast**, and an inner layer, the **hypoblast**.

4. **What is primitive knot or hensen node?**

At the anterior end of the primitive streak is a regional thickening of cells called the **primitive knot** or **Hensen's node.**

5. **Write difference between Bicoid and Nanos?**

The anterior most portion of the egg contains an mRNA that encodes a protein called Bicoid. The posterior most portion of the egg contains an mRNA that encodes a protein called Nanos.

6. **Difference between axoneme & dyenin?**

Answer: The major motor portion of the flagellum is called the **axoneme.**

The force for sperm propulsion is provided by **dynein**, a protein that is attached to the microtubules.

7. **Define Silencers?**

Enhancers can also be used to inhibit transcription. In some cases, the same transcription factors that activate the transcription of one gene can be used to repress the transcription of other genes. These "negative enhancers " are also called silencers.

8. **What is embryonic shield?**

The cells of both the epiblast and hypoblast intercalate on the future dorsal side of the embryo to form a localized thickening, the embryonic shield.

9. **What is naïve?**

An uncommitted cell can be described as naive, meaning that it has received no instructions directing it along a particular developmental pathway.

10. **Egg jelly formation?**

Many types of eggs have glycoprotein meshwork called egg jelly outside the vitelline envelope which is used either to attract or to activate sperm. The egg, then, is a cell specialized for receiving sperm and initiating development.

11. **Differentiate between Blastomere and cleavage?**

Cleavage is a series of extremely rapid mitotic divisions wherein the enormous volume of zygote cytoplasm is divided into numerous smaller cells. These cells are called **blastomeres.**

12. **What is marginal belt?**

Between the area pellucida and the area opaca is a thin layer of cells called the **marginal zone** (or **marginal belt**).

13. **Define Neural Crest?**

A group of ectodermal cells that gives rise to the spinal ganglia and various structures of the autonomic nervous system.The neural crest cells originate at the dorsal most region of the neural tube.The neural crest can be divided into four main functional (but overlapping) domains.

14. **Define Regulative development?**

conditional specification gives rise to a pattern of embryogenesis called **regulative development**.

15. **Neural plate in tunicats?**

In **primary neurulation**, the cells surrounding the neural plate direct the neural plate cells to proliferate, invaginate, and pinch off from the surface to form a hollow tube.

16. **Role.of TGF nd FGF7 in human body development**

Paracrine factors such as **TGF- and FGF7** are important in normal skin development.

17. **Define primary and secondary neurulation?**

In **primary neurulation**, the cells surrounding the neural plate direct the neural plate cells to proliferate, invaginate, and pinch off from the surface to form a hollow tube.

In **secondary neurulation**, the neural tube arises from a solid cord of cells that sinks into the embryo and subsequently hollows out to form a hollow tube. **Neurulation in fishes is exclusively secondary.**

18. **Define Prechordal plate?**

Cells migrating through Hensen's node become chordamesoderm (notochord) cells. These extend up to the presumptive midbrain, where they meet the prechordal plate. The **prechordal plate** induces the formation of the forebrain.

3MARKS

19. **Write three distinct lineage of Osteogenesis? Or What are lineages to generate skeleton?**

There are three distinct lineages that generate the skeleton.

- The somites generate the axial skeleton.
- The lateral plate mesoderm generates the limb skeleton.
- The cranial neural crest gives rise to the branchial arch and craniofacial bones and cartilage.

20. **What are syncytiotrophoblast and its function?**

The multinucleated type of cell forms the **syncytiotrophoblast**.

The extra-embryonic mesoderm joins the trophoblastic extensions and gives rise to the blood vessels that carry nutrients from the mother to the embryo. The narrow connecting stalk of extra-embryonic mesoderm that links the embryo to the trophoblast eventually forms the vessels of the **umbilical cord**.

21. **Write the function of Metencephalon?**

The Myelencephalon eventually becomes the **Medulla oblongata**, whose neurons generate the nerves that regulate respiratory, gastrointestinal, and cardiovascular movements. The **Metencephalon** gives rise to the cerebellum, the part of the brain responsible for coordinating movements, posture, and balance.

22. Pattern of embryonic cleavage?

Patterns of embryonic cleavage

Indeed, different organisms undergo cleavage in distinctly different ways. The pattern of embryonic cleavage particular to a species is determined by two major parameters:

1. The amount and distribution of yolk protein within the cytoplasm.
2. The factors in the egg cytoplasm that influence the angle of the mitotic spindle and the timing of its formation.
3. The yolk-rich pole is referred to as the **vegetal pole**; the yolk concentration in the **animal pole** is relatively low. The zygote nucleus is frequently displaced toward the animal pole. In general, yolk inhibits cleavage.

23. Write the role of calcium in the fusion of egg and sperm?

Upon fertilization, the intracellular calcium ion concentration of the egg increases greatly. In this high-calcium environment, the cortical granule membranes fuse with the egg plasma membrane, releasing their contents. Once the fusion of the cortical granules begins near the point of sperm entry, a wave of cortical granule exocytosis propagates around the cortex to the opposite side of the egg. The release of calcium from intracellular storage can be monitored visually using calcium-activated luminescent dyes such as aequorin (isolated from luminescent jellyfish) or fluorescent dyes such as fura-2. These dyes emit light when they bind free calcium ions.

Several experiments have demonstrated that calcium ions are directly responsible for propagating the cortical granule reaction, and that these calcium ions are stored within the egg itself.

24. Differentiate between Autonomous and syncytial specification?

Autonomous specification:

Specification by differential acquisition of certain cytoplasmic molecules present in the egg.

- Characteristic of most invertebrates.
- Cell type specification precedes any large-scale embryonic cell migration.

- Autonomous specification gives rise to a pattern of development referred to as **mosaic development**, in which the embryo appears to be constructed like a tile mosaic of independent self-differentiating parts. Invariant cleavages produce the same lineages in each embryo of the species. Blastomere fates are generally invariant.

Syncytial specification:

- Characteristic of most insect classes.
- Specification of body regions by interactions between cytoplasmic regions prior to cellularization of the blastoderm.
- Variable cleavage produces no rigid cell fates for particular nuclei.
- After cellularization, conditional specification is most often seen.

25. Difference between evolutionary embryology and tetralogy?

Evolutionary embryology:

The second strand, based on the first, is evolutionary embryology, the study of how changes in development may cause evolutionary changes and of how an organism's ancestry may constrain the types of changes that are possible.

Teratology:

The third anatomical approach to developmental biology is **teratology**, the study of birth defects. These anatomical abnormalities may be caused by mutant genes or by substances in the environment that interfere with development. The study of abnormalities is often used to discover how normal development occurs.

26. Difference b/w identical and fraternal twins?

Identical twins occur in roughly **0.25%** of human births. About **33%** of identical twins have two complete and separate chorions, indicating that separation occurred before the formation of the trophoblast tissue at **day 5.**

Fraternal twins are the result of two separate fertilization events, whereas identical twins are formed from a single embryo whose cells somehow dissociated from one another.

27. Differnce b/w gray matter and white matter?

Glial cells cover many of the axons in the marginal zone in myelin sheaths, giving them a whitish appearance. Hence, the mantle zone, containing the neuronal cell bodies, is often referred to as the **Gray matter**;

The axonal, marginal layer is often called the **White matter**. In the spinal cord and medulla, this basic three-zone pattern of ependymal, mantle, and marginal layers is retained throughout development. The gray matter (mantle) gradually becomes a butterfly-shaped structure surrounded by white matter; and both become encased in connective tissue.

28. Define Medial hinge point?

In birds and mammals, the cells at the midline of the neural plate are called the **medial hinge point** (**MHP**) **cells**. They are derived from the portion of the neural plate just anterior to Hensen's node and from the anterior midline of Hensen's node.

29. Diff b/w late and early response of egg to sperm?

Early responses: Contact b/w sea urchin sperm & egg activates the 2 major blocks to polyspermy: the fast block, initiated by sodium influx into the cell, & the slow block, initiated by the intracellular release of Ca+ ions. The activation of all eggs appears to depend on an increase in the conc. of free Ca+ ions within the egg. Such an increase can occur in 2 ways: Ca+ ions can enter the egg from outside, or Ca+ ions can be released from the endoplasmic reticulum within the egg.
Late responses: Shortly after the Ca+ ion levels rise in a sea urchin egg, its intracellular pH also increases. The rise in intracellular pH begins with a 2nd influx of Na+ ions, which causes a 1:1 exchange b/w sodium ions from the seawater & hydrogen ions from the egg. This loss of hydrogen ions causes the pH to rise. It is thought that the pH increase and the calcium ion elevation act together to stimulate new protein synthesis and DNA synthesis.

30. Write the general concept of fertilization?

Fertilization is the process whereby two sex cells (gametes) fuse together to create a new individual with genetic potentials derived from both parents.

Fertilization accomplishes two separate processes:

- Sex (the combining of genes derived from the two parents) and
- Reproduction (the creation of new organisms)
- Thus, the first function of fertilization is to transmit genes from parent to offspring, and the second is to initiate in the egg cytoplasm those reactions that permit development to proceed.

31. What is Marble bone disease?

Osteopetrosis or Marble bone disease

Osteopetrosis is a bone disease that makes bones abnormally dense and prone to breakage (fracture).

This disorder is characterized by increased bone density and abnormal bone growth.

32. Estrogen and progesterone function?

Estrogen is a hormone that can instruct the liver to make and secrete the yolk proteins, which are then transported through the blood into the enlarging eggs in the ovary. The yolk is transported into the bottom portion of the egg.

progesterone, signals the egg to resume its meiotic division. This is necessary because the egg had been "frozen" in the metaphase of its first meiosis. When it has completed this first meiotic division, the egg is released from the ovary and can be fertilized.

33. What are resact and its function?

Answer: **Resact** is specific for ***A. punctulata*** and does not attract sperm of other species. *A. punctulata* sperm have receptors in their plasma membranes that bind resact and can swim up a concentration gradient of this compound until they reach the egg. Resact also acts as a **sperm-activating peptide**.

5MARKS:

34. Write the functional domains of neural crest?

- A group of ectodermal cells that gives rise to the spinal ganglia and various structures of the autonomic nervous system.
- The neural crest cells originate at the dorsal most region of the neural tube.
- The neural crest can be divided into four main functional (but overlapping) domains.
- The cranial (cephalic) neural crest, whose cells migrate dorso-laterally to produce the craniofacial mesenchyme that differentiates into the cartilage, bone, cranial neurons, glia, and connective tissues of the face.

35. life cycle of chlamydomonas?

the life cycle of *Chlamydomonas.* Which is usually haploid, having just one copy of each chromosome. The individuals of each species, however, are divided into two mating types: plus and minus. When a plus and a minus meet, they join their cytoplasm, and their nuclei fuse to form a diploid zygote. The flagella of two individuals twist around each other, enabling specific regions of the cell membranes to come together. These specialized regions contain mating type-specific components that enable the cytoplasms to fuse.

36. Describe primary neurulation?

Primary neurulation

- During primary neurulation, the original ectoderm is divided into three sets of cells.
- The internally positioned neural tube, which will form the brain and spinal cord.

- The externally positioned epidermis of the skin.
- The neural crest cells. The neural crest cells form in the region that connects the neural tube and epidermis, but then migrate elsewhere; they will generate the peripheral neurons and glia, the pigment cells of the skin, and several other cell types.

37. Transcription domain?

Transcription factors have three major domains.

1. **DNA-binding domain**
2. **Protein-protein interaction domain**
3. ***Trans*-activating domain**

- **DNA-binding domain:**It recognizes a particular DNA sequence.
- **Protein-protein interaction domain:** It allows the transcription factor's activity to be modulated by TAFs or other transcription factors.
- ***Trans*-activating domain:** It activates or suppresses the transcription of the gene whose promoter or enhancer it has bound. Usually, this *trans*-activating domain enables the transcription factor to interact with proteins involved in binding RNA polymerase.Examples,***MITF:(***Microphthalmia-Associated Transcription Factor. The microphthalmia (MITF) protein is necessary for the production of pigment cells and their pigments.
- ***Pax6:*** Paired box gene 6. The Pax6 transcription factor, which is needed for mammalian eye, nervous system, and pancreas development, contains two potential DNA-binding domains.
- **Pdx1:** Pancreatic And Duodenal Homeobox 1 gene. It is specific for the pancreatic region of the endoderm.

38. 2 ways for the formation of neural tube?

Formation of the Neural Tube

There are two major ways of forming a neural tube

1) Primary neurulation 2) **Secondary neurulation**

- In **primary neurulation**, the cells surrounding the neural plate direct the neural plate cells to proliferate, invaginate, and pinch off from the surface to form a hollow tube.

- In **secondary neurulation**, the neural tube arises from a solid cord of cells that sinks into the embryo and subsequently hollows out to form a hollow tube. **Neurulation in fishes is exclusively secondary.**
- In **amphibians**, such as ***Xenopus,*** most of the tadpole neural tube is made by **primary neurulation**, but the tail neural tube is derived from **secondary neurulation**.

39. Enlist 4 factors that cause movement in gene regulation?

The regulation of gene expression can be accomplished at several levels:

- **Differential gene transcription:** It regulates that which of the nuclear genes are transcribed into RNA.
- **Selective nuclear RNA processing:** It regulating which of the transcribed RNAs (or which parts of such a nuclear RNA) enter into the cytoplasm to become messenger RNAs.
- **Selective messenger RNA translation:** It regulates that which of the mRNAs in the cytoplasm become translated into proteins.
- **Differential protein modification:** It regulates that which proteins are allowed to remain or function in the cell.

40. Write modes of commitment?

Three basic modes of commitment are

1: Autonomous specification:

Specification by differential acquisition of certain cytoplasmic molecules present in the egg.

- Characteristic of most invertebrates.
- Cell type specification precedes any large-scale embryonic cell migration.
- Autonomous specification gives rise to a pattern of development referred to as **mosaic development**, in which the embryo appears to be constructed like a tile mosaic of independent self-differentiating parts. Invariant cleavages produce the same lineages in each embryo of the species. Blastomere fates are generally invariant.

Produces "mosaic" ("determinative") development: cells cannot change fate if a blastomere is lost.

2: Conditional specification:

- Characteristic of all vertebrates and few invertebrates.

- Specification by interactions between cells. Relative positions are important.
- Variable cleavages produce no invariant fate assignments to cells.
- Massive cell rearrangements and migrations precede or accompany specification.

Capacity for "regulative" development: allows cells to acquire different functions.

3: Syncytial specification:

- Characteristic of most insect classes.
- Specification of body regions by interactions between cytoplasmic regions prior to cellularization of the blastoderm.
- Variable cleavage produces no rigid cell fates for particular nuclei.
- After cellularization, conditional specification is most often seen.

41. Define : Area opaca , Area pellicuda , sub-germinal cavity, marginal zone?

- Between the blastoderm and the yolk is a space called the **sub-germinal cavity**.
- The peripheral ring of blastoderm cells that have not shed their deep cells constitutes the **area opaca**.
- The deep cells in the center of the blastoderm are shed and die, leaving behind a onecell- thick **area pellucida**.
- Between the area pellucida and the area opaca is a thin layer of cells called the **marginal zone** (or **marginal belt**).

42. Hammering experiment for role of nucleus in morphology?

Nuclear control of cell morphogenesis and the interaction of nucleus and cytoplasm are well studied in *Acetabularia.* This enormous single cell (2-4 cm long) consists of three parts:

- a cap,
- a stalk,
- a rhizoid.

The single nucleus of the cell resides within the rhizoid. The size of *Acetabularia* and the location of its nucleus allow investigators to remove the nucleus from one cell and replace it with a nucleus from another cell.

J.Hammerling exchanged nuclei between two morphologically distinct species, *A. mediterranea* and *A. crenulata* **J. Hammerling** found that when he transferred the nucleus from one species into the stalk of another species, the newly

formed cap eventually assumed the form associated with the *donor* nucleus. Thus, the nucleus was seen to control *Acetabularia* development.

The formation of a cap is a complex morphogenic event involving the synthesis of numerous proteins, which must be accumulated in a certain portion of the cell and then assembled into complex, species-specific structures.

10 Marks:

43. Endochondral?

- Endochondral ossification involves the formation of cartilage tissue from aggregated mesenchymal cells, and the subsequent replacement of cartilage tissue by bone.
- The process of Endochondral ossification can be divided into five stages.
- First, the mesenchymal cells are committed to become cartilage cells. This commitment is caused by paracrine factors that induce the nearby mesodermal cells to express two transcription factors, Pax1 and **Scleraxis**.
- Pax1 and Scleraxis are the transcription factors are thought to activate cartilage-specific genes.
- Thus, Scleraxis is expressed in the mesenchyme from the sclerotome, in the facial mesenchyme that forms cartilaginous precursors to bone, and in the limb mesenchyme
- During the second phase of endochondral ossification, the committed mesenchyme cells condense into compact nodules and differentiate into **chondrocytes**, the cartilage cells. N-cadherin appears to be important in the initiation of these condensations.
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- In humans, the *SOX9* gene, which encodes a DNA-binding protein, is expressed in the precartilaginous condensations. Mutations of the *SOX9* gene cause camptomelic dysplasia, a rare disorder of skeletal development that results in deformities of most of the bones of the body.
- During the third phase of endochondral ossification, the chondrocytes proliferate rapidly to form the model for the bone. As they divide, the chondrocytes secrete a cartilage-specific extracellular matrix In the fourth phase, the chondrocytes stop dividing and increase their volume dramatically, becoming hypertrophic chondrocytes. These large chondrocytes alter the matrix they produce (by adding collagen X and more fibronectin) to enable it to become mineralized by calcium carbonate.
- The fifth phase involves the invasion of the cartilage model by blood vessels.
- **The hypertrophic chondrocytes die by apoptosis.** This space will become **bone marrow**. As the cartilage cells die, a group of cells that have surrounded the cartilage model differentiate into osteoblasts.
- The osteoblasts begin forming bone matrix on the partially degraded cartilage. Eventually, all the cartilage is replaced by bone. Thus, the cartilage tissue serves as a model for the bone that follows

44. Explain Osteogenesis in detail?

Osteogenesis:

- Some of the most obvious structures derived from the paraxial mesoderm are bones.

There are three distinct lineages that generate the skeleton.

- The somites generate the axial skeleton.
- The lateral plate mesoderm generates the limb skeleton.
- The cranial neural crest gives rise to the branchial arch and craniofacial bones and cartilage.
- There are two major modes of bone formation, or **osteogenesis**, and both involve the transformation of a preexisting mesenchymal tissue into bone tissue.
- The direct conversion of mesenchymal tissue into bone is called **intramembranous ossification**. This process occurs primarily in the bones of the skull.
- In other cases, the mesenchymal cells differentiate into cartilage, and this cartilage is later replaced by bone. The process by which a cartilage intermediate is formed and replaced by bone cells is called endochondral ossification.