ZOO-501 Addition 4 (6 September 2021)

CURRENT PAPER FILE (2021)

Sir Arslan

Special instruction from sir Arslan

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1) Different bt polyspermy and monospermy ? 2

is that monospermy is fertilization of an oocyte by a single spermatozoon while polyspermy is the penetration of an ovum by more than one sperm.

2) Vegetal and animal pole? 2

The yolk-rich pole is referred to as the vegetal pole; the yolk concentration in the animal pole is relatively low

3) axoneme.2

In most species, however, each sperm is able to travel long distances by whipping its flagellum. Flagella are complex structures. The major motor portion of the flagellum is called the axoneme.

4) Late response of activation of egg metabolisms?3

Shortly after the calcium ion levels rise in a sea urchin egg, its intracellular pH also increases. The rise in intracellular pH begins with a second influx of sodium ions, which causes a 1:1 exchange between sodium ions from the seawater and 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.

5) Cleavage 2 mark?

In developmental biology, cleavage is the division of cells in the early embryo.

6) Cortex of egg ?2

The egg cortex is a large assemblage of the plasma membrane, extracellular coat, and subsurface skeleton to which a characteristic set of cytoskeletal elements, or- ganelles and macromolecules adhere. It behaves as a func- tional unit during the reorganizations that precede and follow fertilization.

7) Function of zp3?2

ZP3 also initiates the acrosomal reaction after sperm have bound to it. The mouse sperm can thereby concentrate its proteolytic enzymes directly at the point of attachment at the zona pellucida.

Plz read thses extra for mcq given bellow

Bleil and Wassarman (1988) isolated an 83-kDa glycoprotein, ZP3, from the mouse zona that was the active site for sperm binding

. ➢ The other two zona glycoproteins they found, ZP1 and ZP2, failed to compete for sperm binding.

➢ Thus, ZP3 is the specific glycoprotein in the mouse zona pellucida to which the sperm bind.

8) : protozoan.2

Ans, Protozoa are **single celled organisms**. They come in many different shapes and sizes ranging from an Amoeba which can change its shape to Paramecium with its fixed shape and complex structure

9) Domain of commitment?3

domain of commitment

Ans: Transcription factors domains

Transcription factors have three major domains.

1) DNA-binding domain

2) Protein-protein interaction domain

3) Trans-activating domain

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10) Composition of shell egg? 2

The shell is the egg's outer covering, accounting for about 9 to 12% of its tota weight depending on egg size. The shell is the egg's first line of defense against bacterial contamination. This bumpy and grainy outer covering has approximately 17,000 tiny pores and is made almost entirely of calcium carbonate. It is semipermeable, which means that air and moisture can pass through its pores.

The Shell Membranes

Lying between the eggshell and albumen, these two transparent protein membranes provide efficient defense against bacterial invasion.

11) Bicoid ?2

the anterior of the egg cytoplasm is markedly different from the posterior. In Drosophila, for instance, the anterior most portion of the egg contains an mRNA that encodes a protein called Bicoid.

12) Part of sperm? 2

Each sperm consists of

, 1) A haploid nucleus,

2) A propulsion system to move the nucleus, and

3) A sac of enzymes that enable the nucleus to enter the egg

The head of the sperm contains the DNA, which when combined with the egg's DNA, will create a new individual.

The tip of the sperm head is the portion called the acrosome, which enables the sperm to penetrate the egg.

The midpiece contains the mitochondria which supplies the energy the tail needs to move.

12) Role nanos? 2

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

13) Pax 6 ? 2

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.

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14) Examples of Transcription factors ?3

MITF: (Microphthalmia-Associated Transcription Factor. The microphthalmia (MITF) protein is necessary for the production of pigment cells and their pigments.

Pdx1: Pancreatic And Duodenal Homeobox 1 gene. It is specific for the pancreatic region of the endoderm.

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

15) Work of willcox? 2

Wilcox and colleagues (1995) found that nearly all human pregnancies result from sexual intercourse during a 6-day period ending on the day of ovulation.This means that the fertilizing sperm could have taken as long as 6 days to make the journey.

16) What happen when dyes come in contact in calcium ? 3

The release of calcium from intracellular storage can be monitored visually using calciumactivated 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.

17) What happen sperm and egg fuse?

Fertilization occurs when the nucleus of both a sperm and an egg fuse to form a diploid cell, known as zygote. of sea urchin gametes remains one of the best-studied examples of fertilization The successful fusion of gametes forms a new organism.?

18) Blastocoels and fuction?

During cleavage, the volume of the frog egg stays the same, but it is divided into tens of thousands of cells. A fluid-filled cavity, the blastocoel, forms in the animal hemisphere. This cavity will be important for allowing cell movements to occur during gastrulation.

19) Composition of egg yolk?

Yolk color ranges from just a hint of yellow to a magnificent deep orange, according to the feed and breed of the hen. The yolk has important nutritional and functional qualities. From a nutritional perspective, the yolk contains less water and more fat than the white, a little less than

half of the protein of the white, and most of the vitamins and minerals of the egg. These include iron, vitamin A, vitamin D, phosphorus, calcium, thiamine, and riboflavin.

20) Bicoid and syncytical specifiifation?

A cytoplasm that contains many nuclei is called a syncytium.

the anterior of the egg cytoplasm is markedly different from the posterior. In Drosophila, for instance, the anterior most portion of the egg contains an mRNA that encodes a protein called Bicoid.

21) Coronaradiata

The innermost layer of cumulus cells, immediately adjacent to the zona pellucida, is called the corona radiata.

22) Types of cadherin

In vertebrate embryos, several major cadherin classes have been identified:

- ✓ **E-cadherin**
- ✓ **P-cadherin**
- ✓ **N-cadherin**
- ✓ **Protocadherins**

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23) Germ line in mammls?

Germline development in mammals. Mammalian PGCs are specified by signalling between cells (induction), rather than by the segregation of germ plasm as the embryo divides. .

24) Osteoclasts

Osteoclasts are probably derived from the same precursors as macrophage blood cells 223. charby desired to know the cause of birth defects .

25) Osteogenesis

Osteogenesis imperfecta (OI), also known as brittle bone disease, is a group of genetic disorders that mainly affect the bones. It results in bones that break easily.

26) Role of cortical granules (5)

Ans: Cortical granule reaction to prevent polyspermy This removal is accomplished by the cortical granule reaction, a slower, mechanical block to polyspermy that becomes active about a minute after the first successful sperm-egg attachment. If we insert an electrode into an egg and place a second electrode outside it, we can measure the constant difference in charge across the egg plasma membrane. Directly beneath the sea urchin egg plasma membrane are about 15,000 cortical granules. Upon sperm entry, these cortical granules fuse with the egg plasma membrane and release their contents into the space between the plasma membrane and the fibrous mat of vitelline envelope proteins.

27) Types of egg insect ?2

Ans: The eggs of insects have their yolk in the center (i.e., they are centrolecithal), and the divisions of the cytoplasm occur only in the rim of cytoplasm around the periphery of the cell m(i.e., superficial cleavage).

28) Difference between intron and exon ?2

Exons: Coding regions of DNA.

Introns: Non-coding regions.

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29) how egg protected from sunlight.

Ans: Many eggs contain ultraviolet filters and dna repair enzymes that protect them from sunlight. The layer of enzyme found on uper surface of egg.

30) **Difference b/w promotor and enhancer (5)**

Promoter: A region, which is responsible for the binding of RNA polymerase and for the subsequent initiation of transcription.

Enhancer:It is a DNA sequence that can activate the utilization of a promoter, controlling the efficiency and rate of transcription from that particular promoter. The human β-globin gene has an enhancer in its 3´ UTR, roughly 700 base pairs.

31) Developmental biology.

Ans: Developmental biology is the study of the process by which animals and plants grow and develop. Developmental biology also encompasses the biology of regeneration, asexual reproduction, metamorphosis, and the growth and differentiation of stem cells in the adult organism.

32) Five steps of interaction btwn sperm and egg?

Ans: The interaction of sperm and egg generally proceeds according to five basic step:

➢ The chemo-attraction of the sperm to the egg by soluble molecules secreted by the egg.

➢ The exocytosis of the acrosomal vesicle to release its enzymes.

➢ The binding of the sperm to the extracellular envelope (vitelline layer or zona pellucida) of the egg.

➢ The passing of the sperm through this extracellular envelope.

➢ Fusion of egg and sperm cell plasma membranes.

33) vegital and animal hemisphere

the bottom half of the egg usually contains the yolk, it divides more slowly (because the large yolk deposits interfere with cleavage). This portion is the vegetal hemisphere of the egg. Conversely, the upper half of the egg usually has less yolk and divides faster. This upper portion is called the animal hemisphere of the egg.

34) egg parts ?2

Ans: Anatomy of an Egg The egg is composed of many parts, namely:

➢ Yolk

➢ Albumen or egg white

➢ Shell membranes

➢ Shell

35) vacquier and co worker.?2

In 1977, Vacquier and co-workers isolated this nonsoluble 30,500-Da (Dalton) protein from the acrosome ofStrongylocentrotuspurpuratus and found it to be capable of binding to dejellied eggs of the same species.

36) fluidity of sperm.?2

Ans; the fluidity of the sperm plasma membrane is altered by the removal of cholesterol by albumin proteins found in the female reproductive tract.

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37) air spaces or air cell ? 2

An air space forms when the contents of the egg cool and contract after the egg is laid. The air cell usually rests between the outer and inner membranes at the egg's larger end.

38) which hormone resume mitotic division.

Ans;The transition from fertilization to cleavage is caused by the activation of mitosis promoting factor (MPF).

MPF was first discovered as the major factor responsible for the resumption of meiotic cell divisions in the ovulated frog egg.

39) Zona pellucid and function

Zona pellucida: The strong membrane that forms around an ovum as it develops in the ovary. The membrane remains in place during the egg's travel through the fallopian tube. To fertilize the egg, a sperm must penetrate the thinning zona pellucida. If fertilization takes place, the zona pellucida disappears, to permit implantation in the uterus. The zona pellucida supports communication between oocytes and follicle cells during oogenesis; protects oocytes, eggs, and embryos during development, and regulates interactions between ovulated eggs and free-swimming sperm during and following fertilization.

40) Stages of Development of frog 5

- **Ans:** Stage 1: Egg. Eggs are laid in a group in the water by the frog. ...
- Stage 2: Tadpole. When the eggs hatch, tadpoles emerge. ...
- Stage 3: Young Frog. The juvenile frog grows front legs and its tail gradually becomes shorter until it is no longer there. ...
- Stage 4: Adult Frog.

41) GASTRULATION

A series of extensive cell rearrangements is called gastrulation, and the embryo is said to be in the gastrula stage. As a result of gastrulation, the embryo contains three germ layers: the ectoderm, the endoderm, and the mesoderm.

42) ORGANOGENESIS ? 3

Once the three germ layers are established, the cells interact with one another and rearrange themselves to produce tissues and organs. This process is called organogenesis. Many organs contain cells from more than one germ layer.

For example, the outer layer of skin comes from the ectoderm, while the inner layer (the dermis) comes from the mesoderm. Also during organogenesis, certain cells undergo long migrations from their place of origin to their final location.

43) GAMETOGENESIS

The germ cells eventually migrate to the gonads, where they differentiate into gametes. The development of gametes, called gametogenesis, is usually not completed until the organism has become physically mature.

44) Developmental hierarchy. 3

Ans: The developmental hierarchy is the hierarchical series of decisions involving specific preexisting cell types.These developmental decisions are usually irreversible, that progressively and irreversibly restrict cell fate. Animal development is the division of embryo into the three germ layers.

1. Ectoderm

2. Mesoderm

3. Endoderm

45) role of poly A tail in krna.

The poly(A) tail

- ✓ Confers stability on the messenger RNA.
- ✓ Allows the mRNA to exit the nucleus.
- ✓ Permits the mRNA to be translated into protein.

45) bicoids and nanos

The Bicoid and Nanos proteins form a coordinate system based on their ratios, such that .each region of the embryo will be distinguished by a different ratio of the two proteins.

46) Role of nanos (3)

47) Endoderm, mesoderm, ectoderm.

- ✓ The **ectoderm** gives rise to the epidermis, nervous system, and pigment cells.

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- ✓ The **mesoderm** generates the kidneys, gonads, bones, heart, and blood cells.
- ✓ The **endoderm** forms the lining of the digestive tube and the respiratory system

48) how proteolytic enzyme secret cortical.

Ans: Cortical granules are membrane-bound structures containing proteolytic enzymes.

49) fertilization event.

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.

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.

50) Blastopore formed in frog.

Gastrulation in the frog begins at a point on the embryo surface roughly 180 degrees opposite the point of sperm entry with the formation of a dimple, called the blastopore.The blastopore expands into a circle and cells migrating through this circle become the lateral and ventral mesoderm..

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51) Bicoid importance?

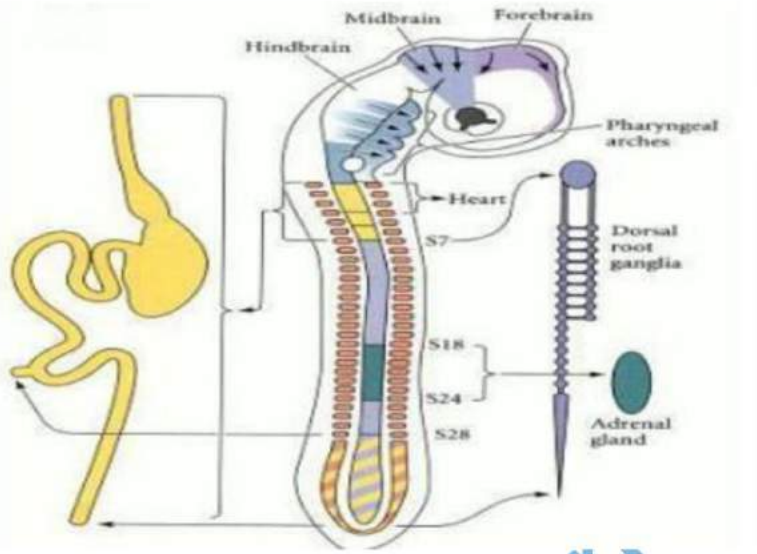
Already describe above

52) Define cumulus?

The mammalian egg is also surrounded by a layer of cells called the cumulus. The innermost layer of cumulus cells, immediately adjacent to the zona pellucida, is called the corona radiata.

53) Neural crest and pathway ?

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 dorsolaterally to produce the craniofacial mesenchyme that differentiates into the cartilage, bone, cranial neurons, glia,and connective tissues of the face.

Major pathways in differentiation of neural crest

- The trunk neural crest, whose cells take one of two major pathways.
- Neural crest cells that become the pigment-synthesizing melanocytes migrate dorsolaterally into the ectoderm and continue on their way toward the ventral midline of the belly.
- The second migratory pathway takes the trunk neural crest cells ventrolaterally through the anterior half of each sclerotome. Sclerotomes are blocks of mesodermal cells, derived from somites, that will differentiate into the vertebral cartilage of the spine.
- The vagal and sacral neural crest, whose cells generate the parasympathetic (enteric) ganglia of the gut.
- The vagal (neck) neural crest lies opposite chick somites 1-7, while the sacral neural crest lies posterior to somite 28.
- The cardiac neural crest is located between the cranial and trunk neural crests.
- The cardiac neural crest cells can develop into melanocytes, neurons, cartilage, and connective tissue (of the third, fourth, and sixth pharyngeal arches).

54) What is larva?

A larva is an **insect** at the stage of its life after it has developed from an egg and before it changes into its adult form. The eggs quickly hatch into larvae

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55) What is reproducation?

Reproduction means **to reproduce**. It is a biological process by which an organism reproduces an offspring who is biologically similar to the organism. Reproduction enables and ensures the continuity of species, generation after generation.

56) Function of dynein?

The core of the axoneme consists of two central microtubules surrounded by a row of nine doublet microtubules. The force for sperm propulsion is provided by dynein, a protein that is attached to the microtubules. Dynein hydrolyzes molecules of ATP and can convert the released chemical energy into the mechanical energy that propels the sperm

57) Name of protective chemical egg? 5

Many eggs contain ultraviolet filters and DNA repair enzymes that protect them from sunlight; some eggs contain molecules that potential predators find distasteful; and the yolk of bird eggs even contains antibodies.

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.

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58) Recognition of egg and sperm in sea urchin ?

proteins are used to extend a fingerlike acrosomal process from the sperm during the early stages of fertilization. In sea urchins and several other species, recognition between sperm and egg involves molecules on the ac

59) Define syndrome ?

Syndromes consists of sets of developmental abnormalities that "run together." Organs that are linked in developmental syndromes share either a common origin or au common mechanism of formation.

60) Karl von baer principal?

Karl von Baer's principles state that the general features of a large group of animals appear earlier in the embryo than do the specialized features of a smaller group. The early embryo of a "higher" animal species is not like the adult of a "lower" animal.

Homologous structures in different species are those organs whose similarity is due to theiru sharing a common ancestral structure. Analogous structures are those organs whose similarity

comes from their serving a similar function (but which are not derived from a common ancestral structure).

61) Homologous and analogous?

Homologous structures in different species are those organs whose similarity is due to their sharing a common ancestral structure.

Analogous structures are those organs whose similarity comes from their serving a similar function (but which are not derived from a common ancestral structure).

62) cadherin and its type 3

There are several classes of molecules that can mediate cell adhesion. The major cell adhesion molecules appear to be the Cadherins. Cadherins interact with other Cadherins on adjacent cells, and they are anchored into the cell by a complex of proteins called Catenins.

In vertebrate embryos, several major cadherin classes have been identified:

1) E-cadherin:

a. Epithelial cadherin is expressed on all early mammalian embryonic cells, even at the 1cell stage. Later, this molecule is restricted to epithelial tissues of embryos and adults.

2) P-cadherin:

a. Placental cadherin appears to be expressed primarily on the trophoblast cells (those placental cells of the mammalian embryo that contact the uterine wall) and on the uterine wall epithelium.

3) N-cadherin:

a. Neural cadherin is first seen on mesodermal cells in the gastrulating embryo as they lose their E-cadherin expression. It is also highly expressed on the cells of the developing central nervous system.

4) Protocadherins:

a. Calcium-dependent adhesion proteins that differ from the classic Cadherins in that they lack connections to the cytoskeleton through catenins. Protocadherinshave been found to be very important in separating the notochord from the other mesodermal tissues during Xenopus gastrulation

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63) Define Sex and Reproduction

Sex involves the combining of genes from two different individuals into new arrangements. Reproduction in the absence of sex is characteristic of organisms that reproduce by fission (i.e.,

splitting into two); there is no sorting of genes when an amoeba divides or when a hydra buds off cells to form a new colony.

64) what structures develop from the ectoderms?

During neurulation, ectoderm differentiates into two parts. The first is the surface ectoderm, which gives rise to tissues on the outer surface of the body like epidermis, hair, and nails. The second is the neuroectoderm, which forms the nervous system of the embryo.

65) Polysaccharide function ?

In sea urchins, the acrosomal reaction is thought to be initiated by a fucose containing polysaccharide in the egg jelly that binds to the sperm and allows calcium to enter into the sperm head. The exocytosis of the acrosomal vesicle is caused by the calciummediated fusion of the acrosomal membrane with the adjacent sperm plasma membrane.

66) Development accomplishes two major objectives:

✓ It generates cellular diversity and order within each generation.

✓ It ensures the continuity of life from one generation to the next.

67) Difference between germ cells and somatic cells ? 5

In many species a specialized portion of egg cytoplasm gives rise to cells that are the precursors of The gametes (the sperm and egg). The gametes and their precursor cells are collectively called germ cells, and they are set aside for reproductive function. All the other cells of the body are called Somatic cells. This separation of somatic cells (which give rise to the individual body) and germ cells (which contribute to the formation of a new generation) is often one of the first differentiations to occur during animal development.

Example"

somatic cells make up all the internal organs, skin, bones, blood and connective tissue, while mammalian germ cells give rise to spermatozoa and ova which fuse during fertilization to produce a cell called a zygote, which divides and differentiates into the cells of an embryo. ...

68) What control the role of cell division and position of blastomere ?

In most species (mammals being the chief exception), the rate of cell division and the placement of the blastomeres with respect to one another is completely under the control of the proteins and mRNAs stored in the oocyte by the mother.

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69) relationship Genes and Development ?

- ✓ Development connects genotype and phenotype.
- ✓ Nuclear genes are not lost or mutated during development. The genome of every cell is equivalent.
- ✓ The ability of nuclei from differentiated cells to direct the development of complete adult organisms has recently confirmed the principle of genomic equivalence.
- ✓ The functions of a gene often can be ascertained by antisense mRNA, transgenic expression, or (in the case of mammals) gene knockouts.
- ✓ Knowledge of gene activity in humans can be obtained by candidate gene mapping or positional cloning.

70) Species-specific sperm attraction in which organisms ? 3

Species-specific sperm attraction has been documented in numerous species, including cnidarians, molluscs, echinoderms, and urochordates. In many species, sperm are attracted toward eggs of their species by chemotaxis, that is, by following a gradient of a chemical secreted by the egg.

Plz read also extra point avoid risk

In 1978, Miller demonstrated that the eggs of the cnidarian Orthopyxis caliculata not only secrete a chemotactic factor but also regulate the timing of its release..

71) Structure of sperm ? 5

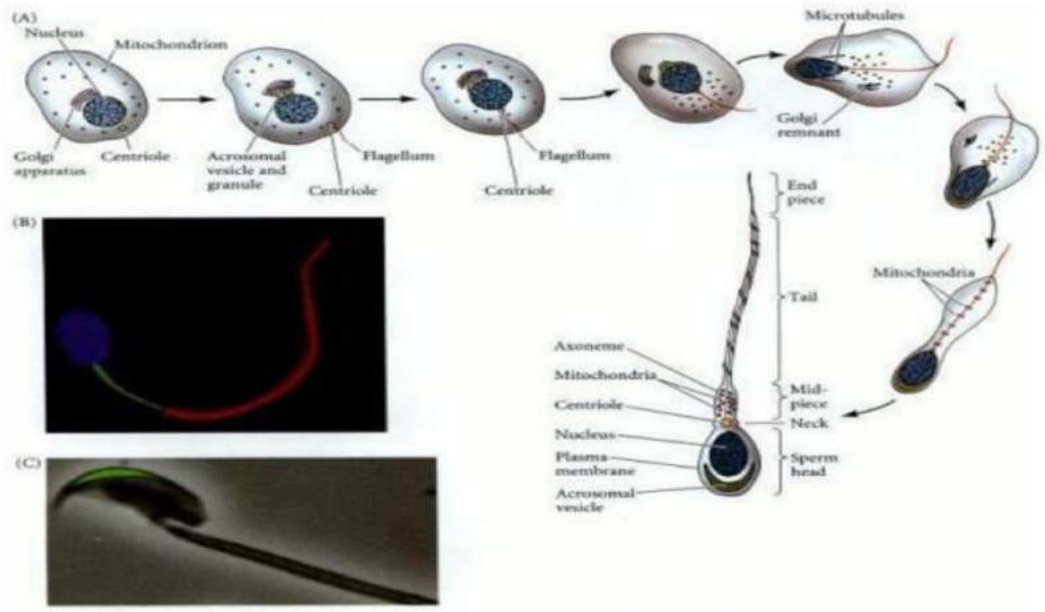
Each sperm consists of,

1) A haploid nucleus,

2) A propulsion system to move the nucleus, and

3) A sac of enzymes that enable the nucleus to enter the egg

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In front of this compressed haploid nucleus lies the acrosomal vesicle, or acrosome, which is derived from the Golgi apparatus and contains enzymes that digest proteins and complex sugars; thus, it can be considered a modified secretory vesicle.

These stored enzymes are used to lyse the outer coverings of the egg. In many species, such as sea urchins, a region of globular actin molecules lies between the nucleus and the acrosomal vesicle.

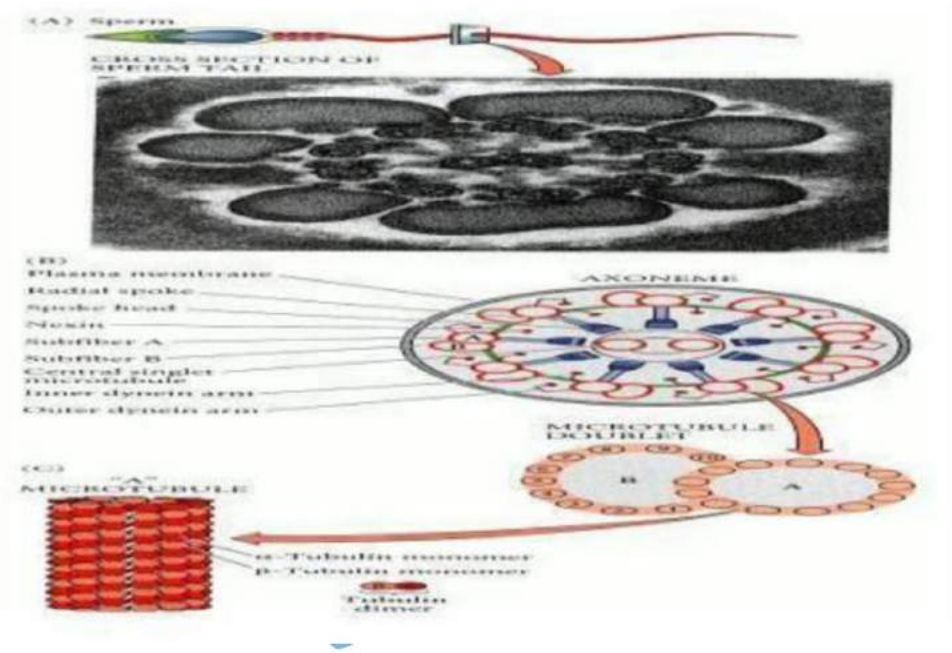
These proteins are used to extend a fingerlike acrosomal process from the sperm during the early stages of fertilization.

In sea urchins and several other species, recognition between sperm and egg involves molecules on the acrosomal process. Together, the acrosome and nucleus constitute the head of the sperm.

The means by which sperm are propelled vary according to how the species has adapted to environmental conditions. In some species (such as the parasitic roundworm Ascaris), the sperm travel by the amoeboid motion of lamellipodial extensions of the cell membrane.

In most species, however, each sperm is able to travel long distances by whipping its flagellum. Flagella are complex structures. The major motor portion of the flagellum is called the axoneme. It is formed by microtubules emanating from the centriole at the base of the sperm nucleus.

The core of the axoneme consists of two central microtubules surrounded by a row of nine doublet microtubules.The force for sperm propulsion is provided by dynein, a protein that is attached to the microtubules. Dynein hydrolyzes molecules of ATP and can convert the released chemical energy into the mechanical energy that propels the sperm.



The sperm released during ejaculation are able to move, yet they do not have the capacity to bind to and fertilize an egg. These final stages of sperm maturation (called capacitation) do not occur until the sperm has been inside the female reproductive tract for a certain period of time.

72) Anatomical approaches? 5

Following important parameters weave together to form the anatomical approaches to development.

1. ➢ **Comparative embryology**
2. ➢ **Evolutionary embryology**
3. ➢ **Teratology**
4. ➢ **Mathematical modeling**

➢ **Comparative embryology:**

The first strand is comparative embryology, the study of how anatomy changes during the development of different organisms. For instance, a comparative embryologist may study which tissues form the nervous system in the fly or in the frog

➢ **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.

➢ **Mathematical modeling:**

The fourth anatomical approach is mathematical modeling, which seeks to describe developmental phenomena in terms of equations. Certain patterns of growth and differentiation can be explained by interactions whose results are mathematically predictable.

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73) Late responses of fertilization ? 3

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. The late responses of fertilization brought about by these ionic changes include the activation of DNA synthesis and protein synthesis.

74) what create dramatic change in the structure of organism? 2

Allometric growth can create dramatic changes in the structure of organisms.

75) In mice how the fertilin proteins help fusion of egg and sperm ? 2

In mammals, the fertilin proteins in the sperm plasma membrane are essential for sperm membrane-egg membrane fusion. Mouse fertilin is localized to the posterior plasma membrane of the sperm head. It adheres the sperm to the egg by binding to the 6β1 integrin protein on the egg plasma membrane.

76) What Periosteum ? 2

the entire region of calcified spicules becomes surrounded by compact mesenchymal cells that form the Periosteum (a membrane that surrounds the The periosteum is a membrane that covers

the outer surface of all bones, except at the joints of long bones. Endosteum lines the inner surface of the medullary cavity of all long bones.

77) Spermatozoa ? 2

Spermatozoa (sperm) are **the male sex cells that carry a man's genetic material**. .

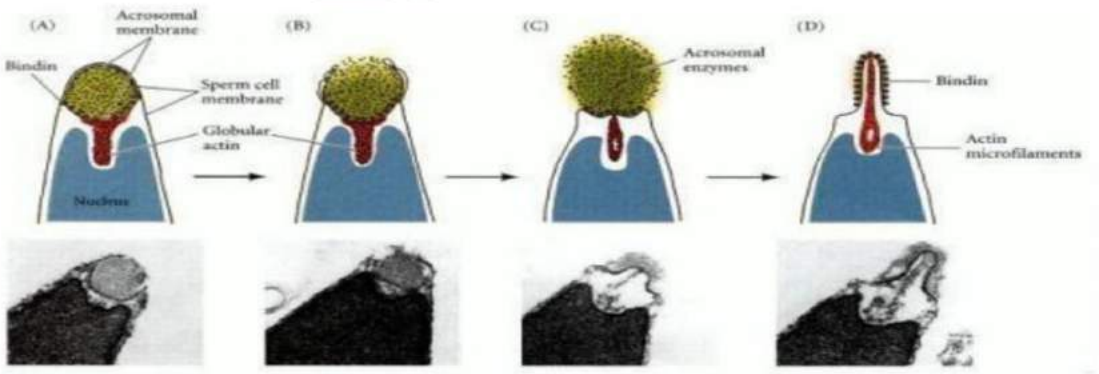
A.V Leeuwenhoek, the Dutch microscopist who co-discovered sperm in 1678, first believed them to be parasitic animals living within the semen (hence the term spermatozoa, meaning "sperm animals").

78) Acrosom in marine invertebrate ? 5

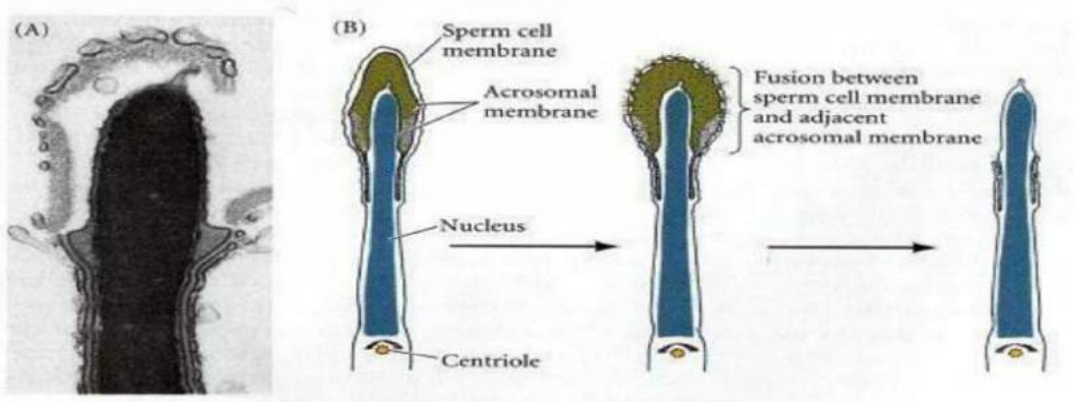
The acrosomal reaction in sea urchins

In most marine invertebrates, the acrosomal reaction has two components:

The fusion of the acrosomal vesicle with the sperm plasma membrane (an exocytosis that results in the release of the contents of the acrosomal vesicle).The extension of the acrosomal process. The acrosomal reaction in sea urchins is initiated by contact of the sperm with the egg jelly. Contact with egg jelly causes the exocytosis of the sperm's acrosomal vesicle and the release of proteolytic enzymes that can digest a path through the jelly coat to the egg surface. In sea urchins, the acrosomal reaction is thought to be initiated by a fucosecontaining polysaccharide in the egg jelly that binds to the sperm and allows calcium to enter into the sperm head. The exocytosis of the acrosomal vesicle is caused by the calciummediated fusion of the acrosomal membrane with the adjacent sperm plasma membrane.



The second part of the acrosomal reaction involves the extension of the acrosomal process. This protrusion arises through the polymerization of globular actin molecules into actin filaments. The egg jelly factors that initiate the acrosomal reaction in sea urchins are often highly specific to each species.



79) MODES OF COMMITMENT ? 3

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Three basic modes of commitment are,

❖ Autonomous specification ❖ Conditional specification ❖ 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.

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

CONDITIONAL SPECIFICATION:

➢Characteristic of all vertebrates and few invertebrates. o Specification by interactions between cells. Relative positions are important. o Variable cleavages produce no invariant fate

assignments to cells. o Massive cell rearrangements and migrations precede or accompany specification.

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

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.

80) Regulation of gene expression ? 5

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.

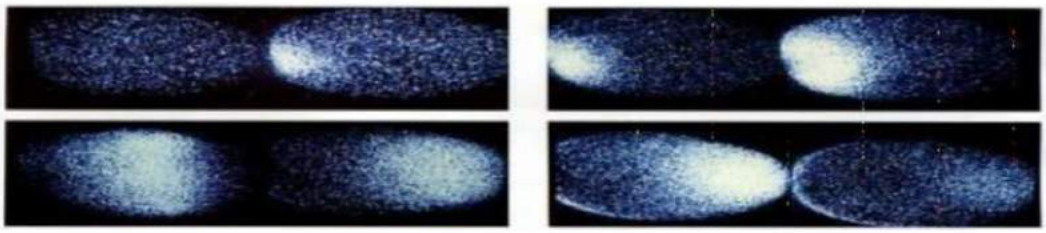
Differential protein modification:

It regulates that which proteins are allowed to remain or function in the cell.

81) Role of calcium in cortical reaction ? 5

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.

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The release of calcium from intracellular storage can be monitored visually using calciumactivated 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.

The drug A23187 is a calcium ionophore (a compound that transports free calcium ions across lipid membranes, allowing these cations to traverse otherwise impermeable barriers).

Placing unfertilized sea urchin eggs into seawater containing A23187 causes the cortical granule reaction and the elevation of the fertilization envelope.

Therefore, A23187 must be causing the release of calcium ions already sequestered in organelles within the egg.

The calcium ions responsible for the cortical granule reaction are stored in the endoplasmic reticulum of the egg. In sea urchins and frogs, this reticulum is pronounced in the cortex and surrounds the cortical granules.

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82) How polyspermy avoid in sea urchin ? 5

The fast block to polyspermy

The eggs of sea urchins (and many other animals) have a second mechanism to ensure that multiple sperm do not enter the egg cytoplasm. The fast block to polyspermy is transient, since the membrane potential of the sea urchin egg remains positive for only about a minute.

The slow block to polyspermy

This brief potential shift is not sufficient to prevent polyspermy, which can still occur if the sperm bound to the vitelline envelope are not somehow removed .

Cortical granule reaction to prevent polyspermy

This removal is accomplished by the cortical granule reaction, a slower, mechanical block to polyspermy that becomes active about a minute after the first successful sperm-egg attachment. If we insert an electrode into an egg and place a second electrode outside it, we can measure the constant difference in charge across the egg plasma membrane. Directly beneath the sea urchin egg plasma membrane are about 15,000 cortical granules. Upon sperm entry, these cortical granules fuse with the egg plasma membrane and release their contents into the space between the plasma membrane and the fibrous mat of vitelline envelope proteins.

83) Peroxidase function in preventing polyspermy ?

A third protein released by the cortical granules, a peroxidase enzyme, hardens the fertilization envelope by crosslinking tyrosine residues on adjacent proteins.

84) The inheritance of cytoplasmic determinant?

The inheritance of cytoplasmic determinants: Cytoplasmic determinants are the molecules in cytoplasm that can help to determine cell fate. The asymmetric distribution of cytoplasmic determinants indicates that the mechanism of differentiation is entirely intrinsic.

▪ For example, if a mother cell contains cytoplasmic determinants that is localized to one pole as the cell under goes division, that determinant will be inherited by only one of the daughters.

85) volume of a sea urchin ?

The volume of a sea urchin egg is about 200 picoliters (2 ×10-4 mm3, more than 10,000 times the volume of the sperm.

86) What is Syncytium?

A cytoplasm that contains many nuclei is called a syncytium.

87) Composition Albumen ? 2

Albumen The egg white is known as the albumen, which comes from albus, the Latin word for "white." Albumen accounts for most of an egg's liquid weight, about 67%. It contains more than half the egg's total protein.

88) Part of acetabularia ? 2

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,

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➢a rhizoid.

89) What is chemotaxis ? 2

In many species, sperm are attracted toward eggs of their species by chemotaxis, that is, by following a gradient of a chemical secreted by the egg.

The mechanisms of chemotaxis differ among species. One chemotactic molecule, a 14- amino acid peptide called resact, has been isolated from the egg jelly of the sea urchin Arbacia punctulata.

90) PRINCIPLES OF DEVELOPMENT ? 5

Organisms must function as they form their organs. They have to use one set of structures while constructing others

Preformation is not in the anatomical structures, but in the instructions to form them.

The inheritance of the fertilized egg includes the genetic potentials of the organism.

The preformed nuclear instructions include the ability to respond to environmental stimuli in specific ways.

The **ectoderm** gives rise to the epidermis, nervous system, and pigment cells

.The **mesoderm** generates the kidneys, gonads, bones, heart, and blood cells.

The **endoderm** forms the lining of the digestive tube and the respiratory system.

Karl von Baer's principles state that the general features of a large group of animals appear earlier in the embryo than do the specialized features of a smaller group. The early embryo of a "higher" animal species is not like the adult of a "lower" animal.

Homologous structures in different species are those organs whose similarity is due to their sharing a common ancestral structure. Analogous structures are those organs whose similarity comes from their serving a similar function (but which are not derived from a common ancestral structure).

"**Community of embryonic structure** reveals community of descent" (Charles Darwin).

Congenital anomalies can be caused by genetic factors (mutations, aneuploidies, translocations) or by environmental agents (certain chemicals, certain viruses, radiation).

Syndromes consists of sets of developmental abnormalities that "run together." Organs that are linked in developmental syndromes share either a common origin or au common mechanism of formation.

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Allometric growth can create dramatic changes in the structure of organisms.

91) Blastocoels and its function ?5

blastocoel and its function

A **blastocoel** is also termed the **blastocyst cavity**[2] (or *cleavage* or *segmentation cavity*) is the name given to the fluid-filled cavity of the blastula (blastocyst) that results from cleavage of the oocyte (ovum) after fertilization.[3][4] It forms during embryogenesis,[4] as what has been termed a "Third Stage" after the single-celled fertilized oocyte (zygote, ovum[1]) has divided into 16-32 cells,[3] via the process of mitosis.[5] It can be described as the first cell cavity formed as the embryo enlarges,[6] the essential precursor for the differentiated, topologically distinct, gastrula.[1]

The blastocoel is the cavity that forms within the early embryonic ball of cells. If the blastocoel can be said to have a function, I guess it would be to provide space for the invagination of one side of the hollow blastula, to form a two-layered embryo called the gastrula. That process itself is called gastrulation, and it ultimately gives rise to the three germ layers of the embryo: ectoderm, mesoderm, and endoderm

The **blastocoel** probably serves two major **functions** in frog embryos: (1) it permits cell migration during gastrulation, and (2) it prevents the cells beneath it from interacting prematurely with the cells above it

92) composition of egg?5

Composition of Egg

The egg also has a remarkable cytoplasmic storehouse that it has accumulated during its maturation. This cytoplasmic storehouse includes the following,

Proteins:

The early embryonic cells need a supply of energy and amino acids which is provided by yolk proteins in the egg. Many of the yolk proteins are made in other organs (liver, fat body) and travel through the maternal blood to the egg.

Ribosomes and tRNA: Protein synthesis is accomplished by ribosomes and tRNA, which exist in the egg. The developing egg has special mechanisms to synthesize ribosomes, and certain amphibian oocytes produce as many as 1012 ribosomes.

Messenger RNA: The instructions for proteins made during early development are already packaged in the oocyte. It is estimated that the eggs of sea urchins contain 25,000 to 50,000 different types of mRNA

Morphogenetic factors: Molecules that direct the differentiation of cells into certain cell types are localized in different regions of the egg and become segregated into different cells during cleavage.

Protective chemicals: Many eggs contain ultraviolet filters and DNA repair enzymes that protect them from sunlight; some eggs contain molecules that potential predators find distasteful; and the yolk of bird eggs even contains antibodies. 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.

93) The molecular changes that account for capacitation are ?

Capacitation The set of physiological changes that allow the sperm to be competent to fertilize the egg is called capacitation. The requirement for capacitation varies from species to species.

First, the fluidity of the sperm plasma membrane is altered by the removal of cholesterol by albumin proteins found in the female reproductive tract.

Second, particular proteins or carbohydrates on the sperm surface are lost during capacitation. It is possible that these compounds block the recognition sites for the proteins that bind to the zona pellucida.

Third, the membrane potential of the sperm becomes more negative as potassium ions leave the sperm.

This change in membrane potential may allow calcium channels to be opened and permit calcium to enter the sperm. Calcium and bicarbonate ions may be critical in activating cAMP (Cyclic adenosine monophosphate) production and in facilitating the membrane fusion events of the acrosomal reaction.

Fourth, protein phosphorylation occurs.

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94) Define Germ layers ? 2

These developmental decisions are usually irreversible, that progressively and irreversibly restrict cell fate. Animal development is the division of embryo into the three germ layers.

1. Ectoderm
2. Mesoderm
3. Endoderm

95) Neural tube? 3

A rod of mesodermal cells in the most dorsal portion of the embryo. At this stage, the embryo is called a Neurula. The neural precursor cells elongate, stretch, and fold into the embryo forming the neural tube.

Function

This neural tube serves as the embryonic brain and spinal cord, the central nervous system

96) Osteopetrosis ?

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.

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.

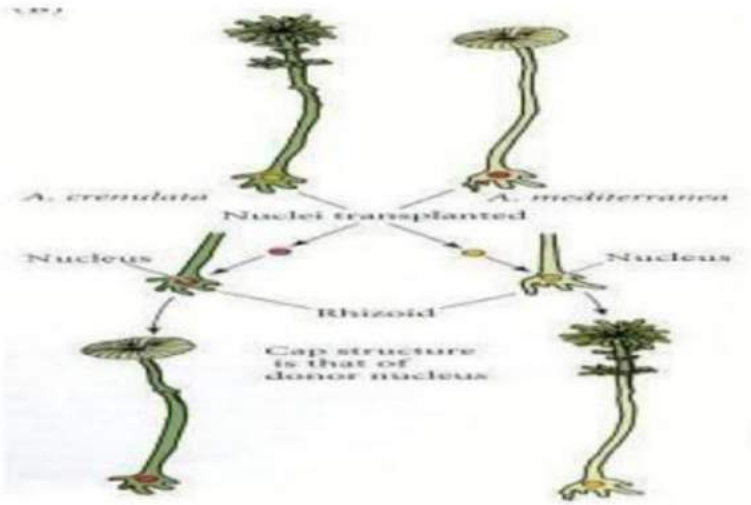
➢The direct conversion of mesenchymal tissue into bone is called intramembranous ossification. This process occurs primarily in the bones of the skull.

➢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.

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97) J.Hammerling work ?

J.Hammerling exchanged nuclei between two morphologically distinct species, A. mediterranea and A. crenulata. Figure shows that these two species have very different cap structures.



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.

These studies suggest that

➢Nucleus contains information specifying the type of cap produced (i.e., it contains the genetic information that specifies the proteins required for the production of a certain type of cap).

➢Material containing this information enters the cytoplasm long before cap production occurs.

➢One hypothesis proposed on the base of Hammerling study is that,

➢"The nucleus synthesizes a stable mRNA that lies dormant in the cytoplasm until the time of cap formation".

➢Hence, the expression of the cap is controlled not only by nuclear transcription, but also by the translation of the cytoplasmic RNA. In this unicellular organism, "development" is controlled at both the transcriptional and translational levels.

98) fertilization tube ?

This tube contacts and fuses with a specific site on the minus individual.

In evolving sexual reproduction, two important advances had to be achieved.

➢The first was the mechanism of meiosis whereby the diploid complement of chromosomes is reduced to the haploid state.

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➢The second was a mechanism whereby the two different mating types could recognize each other

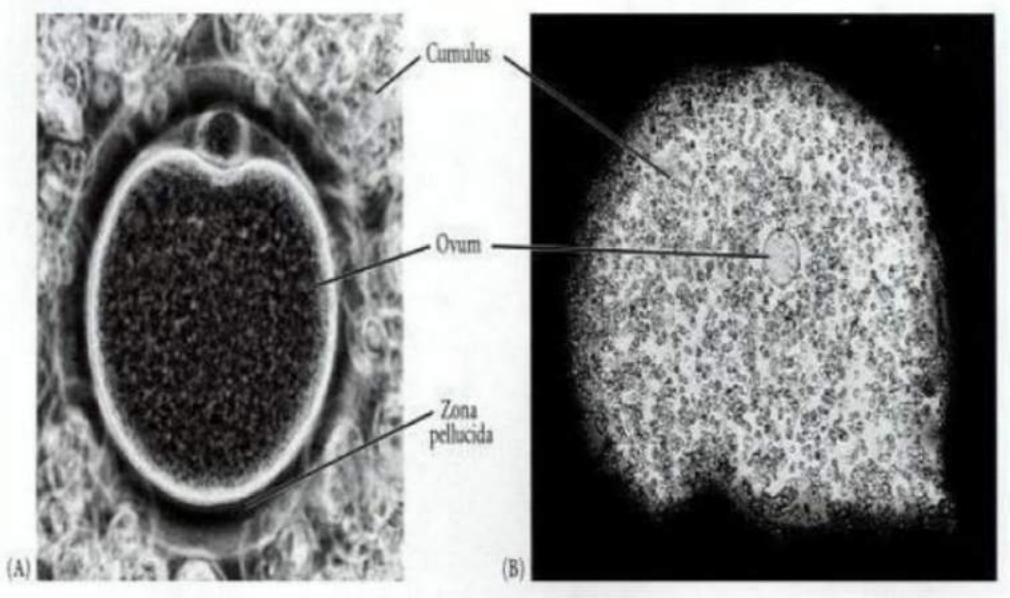
99) Structure of Egg of sea urchin? 5

The volume of a sea urchin egg is about 200 picoliters (2 ×10-4 mm3, more than 10,000 times the volume of the sperm)

Enclosing the cytoplasm is the egg plasma membrane that regulates the flow of certain ions during fertilization and must be capable of fusing with the sperm plasma membrane.

Outside the plasma membrane is the vitelline envelope, which forms a fibrous mat around the egg. This envelope contains at least eight different glycoproteins and is often involved in spermegg recognition.

The vitelline envelope is essential for the species-specific binding of sperm. In mammals, the vitelline envelope is a separate and thick extracellular matrix called the zona pellucid.



The mammalian egg is also surrounded by a layer of cells called the cumulus.

The innermost layer of cumulus cells, immediately adjacent to the zona pellucida, is called the corona radiata.

Lying immediately beneath the plasma membrane of the egg is a thin shell (about 5 μm) of gellike cytoplasm called the cortex.

The cytoplasm in this region is stiffer than the internal cytoplasm and contains high concentrations of globular actin molecules. During fertilization, these actin molecules polymerize to form long cables of actin known as microfilaments.

Microfilaments are necessary for cell division, and they also are used to extend the egg surface into small projections called microvilli, which may aid sperm entry into the cell.

Cortical granules are membrane-bound structures containing proteolytic enzymes. However, whereas each sperm contains one acrosomal vesicle, each sea urchin egg contains approximately 15,000 cortical granules.

100) J. L. Prevost and J. B. Dumas work ? 2

1. J. L. Prevost and J. B. Dumas claimed that sperm were not parasites, but rather the active agents of fertilization. "They proposed that the sperm entered the egg and contributed materially to the next generation".

101) peroxidase

A third protein released by the cortical granules, a peroxidase enzyme, hardens the fertilization envelope by crosslinking tyrosine residues on adjacent proteins.

112) Role of Enhancers in differential gene expression ? 5

Enhancer:It is a DNA sequence that can activate the utilization of a promoter, controlling the efficiency and rate of transcription from that particular promoter

An enhancer is a DNA sequence that can activate the utilization of a promoter, controlling the efficiency and rate of transcription from that particular promoter.Enhancers can regulate the temporal and tissue-specific expression of any differentially regulated gene, but different types of genes normally have different enhancers

Most genes require enhancers for their transcription.

υ Enhancers are the major determinant of differential transcription in space (cell type) and time

.υ A given gene can have several enhancer sites linked to it, and each enhancer can be bound by more than one transcription factor. The interaction between the proteins bound to the enhancer sites and the transcription

υ initiation complex assembled at the promoter is thought to regulate transcription.

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Enhancers are modular. It is the combination of transcription factors that causes particularυ genes to be transcribed. A gene can have several enhancer elements, each turning it on in a different set of cells.υ Enhancers can also be used to inhibit transcription.

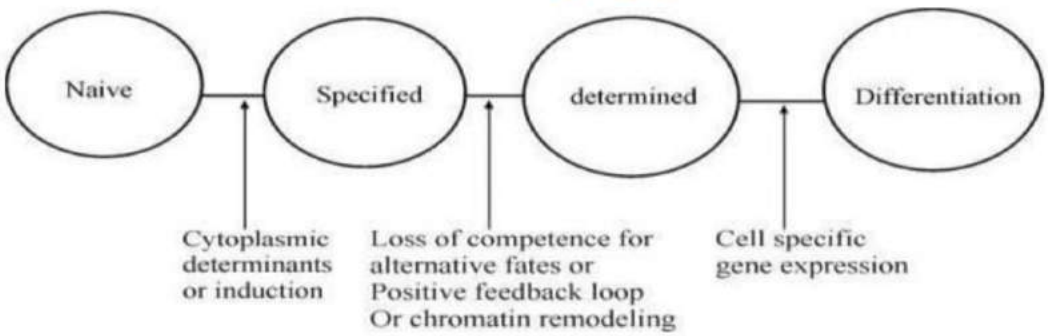
In some cases, the same transcriptionυ factors that activate the transcription of one gene can be used to repress the transcription of other genes. These "negative enhancers " are also called silencers.

4 stage of DEVELOPMENTAL COMMITMENT ? 5

➢ As cell fate becomes restricted following each decision in the developmental hierarchy, cells become committed to a certain fate.

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

➢ The fate of a cell is said to be determined if it cannot be changed, regardless of cell's environment. Commitment at this stage becomes irreversible.



➢ Fate of a cell is said to be specified if the cell is directed to follow a certain developmental pathway and does so when placed in isolation, which should provide a neutral environment. Commitment at this stage is reversible as it may be specified if placed in different environment.

Addition 5 not continues……

HAPPY LEARNING

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