

Exercise 8

Aim: To study the blastula stage of embryonic development in mammals, with the help of permanent slide, chart, model or photograph

Principle: The zygote undergoes a few cycles of mitotic divisions to form a solid ball of cells called morula. The cells continue to divide and at a later stage a cavity is formed within it. This stage is blastula. The internal structural details of blastula can be observed in its transverse section.

Requirement: Permanent slide, chart/model of T.S. of blastula, compound microscope, lens cleaning fluid and paper

Procedure

Observe the slide under lower magnification of the microscope. In case of chart/models/photographs, note the feature of blastula in your practical record and draw labelled diagram.

Observation

In transverse section, the blastula appears as a sphere with a cavity, called blastocoel within it (Fig. 8.1). Notice an outer layer of blastomeres called trophoblasts. A cellular mass, adhered to the trophoblast is present on one end of the blastula. It is called inner cell mass.

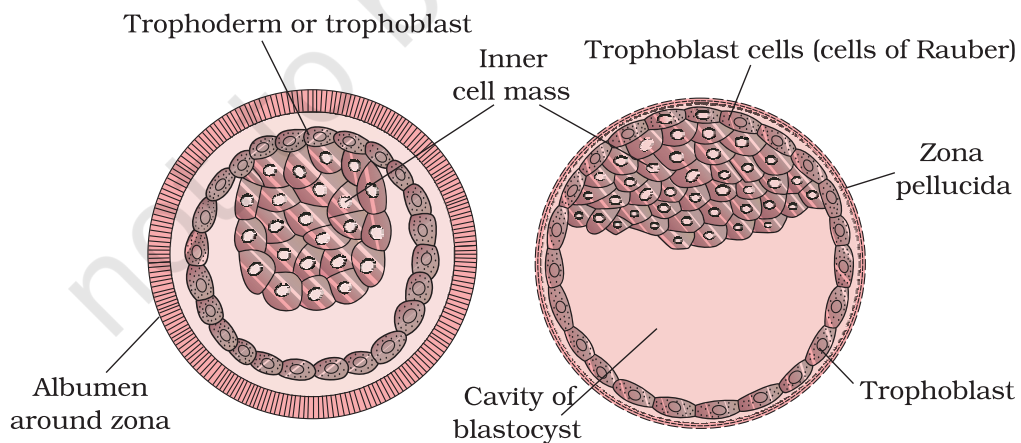


Fig.8.1 Blastula stage of a mammal

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Questions

1. What are the differences between blastula and morula?
2. What are the main structures you observe in T.S. blastula?
3. Match the stages in column I with features in column II

Column I

- (a) Trophoblast
- (b) Morula
- (c) Blastocoel

Column II

- (i) Dividing cells of the morula
- (ii) Outer layer of blastula
- (iii) Solid ball of cells
- (iv) Cavity

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Exercise 9

Aim: To verify Mendel's Law of Segregation

Principle: When two pure lines with contrasting forms of a particular character (phenotypes) are crossed to produce the next generation (F_1 generation), all the members of the progeny are of only one phenotype i.e. of one of the two parents. The phenotype that appears is called dominant, and the one that does not appear is called recessive. When the F_1 plants are selfed, the progeny i.e. the F_2 generation is in the ratio of 3 dominant: 1 recessive ($\frac{3}{4}$: $\frac{1}{4}$ or 75%: 25%). This reappearance of the recessive phenotype in F_2 generation verifies law of segregation.

Requirement: 64 yellow and 64 green plastic beads, all of exactly same shape and size, (when beads are not available, pea seeds may be coloured using paint, these beads represent the gametes of a specific trait), plastic beakers/petri dishes and a napkin/hand towel

Procedure

Students have to work in pairs to perform the experiment. The following steps are to be strictly followed in the sequence mentioned below.

- (i) Put 64 yellow beads in one beaker/petridish and 64 green beads in the other to represent respectively male and female gametes. Let the yellow bead be indicated by 'Y' and green bead by 'y'.
- (ii) Take a bead from each container and place them together (it represents fertilisation) on the napkin spread before you on the table. (One student to take out beads and to put in the hands of the other student who will put them on the table).
- (iii) Just like the previous step, continue to pick beads and arrange them in pairs. Thus 64 pairs of beads are obtained representing the 64 heterozygous F_1 progeny.
Note that all the F_1 individuals are represented by one yellow and one green bead.
- (iv) Put 32 F_1 progeny in one petridish and the remaining 32 in another petridish (representing the F_1 males and females).
- (v) Stir the beads of each petridish with a pencil/pen for about 10 times taking care that no bead falls off.

EXERCISE 9

- (vi) To obtain the F_2 generation, one student would withdraw one bead from one beaker labelled male and one from the other beaker labelled female keeping his/her eyes closed (to ensure randomness), and put them together in the stretched palm of the partner, who will put them together on the napkin spread over the table. Continue this process till all the beads are paired. Thus 64 offsprings of F_2 are obtained.
- (vii) Note the genotype (YY or Yy or yy) of each pair, and their possible phenotype.
- (viii) Have six repeats of the experiment (steps i to vii) with partners changing their roles. Pool all the data from the six repeats together.
- (ix) Calculate the genotypic and phenotypic ratios of your pooled data. Note that larger the sample size, more accurate is the result.

Observation

Record the result in the following table:

Generation	Repeat No.	Total no. of individuals	Genotype (s)			Phenotype (s)
			YY	Yy	yy	
F_1	1.					
	2.					
	3.					
	4.					
	5.					
	6.					
	Total					
F_2	1.					
	2.					
	3.					
	4.					
	5.					
	6.					
	Total					

Phenotypic Ratio: in F_1

in F_2

Genotypic Ratio: in F_1

in F_2

Discussion

The results are so because each diploid individual contains two copies of every gene - one copy on each of the two homologous chromosomes. These two copies of the gene may be of similar type (YY or yy) or are dissimilar Yy. The former (YY or yy) are called homozygous for that particular character, and the Yy are called heterozygous ones. The pure lines in the above cross are homozygous ones, which contributed only one copy of their gene (as a result of meiosis) to their F₁ progeny to restore its diploid nature with genotype Yy (heterozygous) where only one form (**allele**) is expressed (dominant) and the other form (**allele**) is not expressed (recessive). This is the phenomenon of **Dominance**.

When the F₁ individuals are crossed together to raise the F₂ generation, each F₁ individual produces two types of gametes: 50% having dominant allele, and the remaining 50% having recessive allele. These gametes undergo random fusion during fertilisation to produce the F₂ generation. According to simple probability of mixing of opposite sex gametes (sperms and ova), offsprings of three genotypes are likely to appear as follows: [(half of gametes of Y type + half of remaining gamete y type) X (half gametes of Y type + half of remaining gamete of y type)] = One-fourth of F₂ individuals of YY phenotype + half of F₂ individual Yy type + one-fourth of F₂ individual of yy type. Among these proportion of dominant phenotype would be $\frac{1}{4}$ YY + $\frac{1}{2}$ Yy = $\frac{3}{4}$ yellow and recessive phenotype $\frac{1}{4}$ yy i.e. green phenotypes in 3:1 or 75%:25% ratio.

This ratio of 3:1 in the F₂ suggests that in the F₁ heterozygotes, the recessive allele does not get destroyed and remains only in the recessive (dormant) state to get an opportunity to express itself when it has separated from the influence of the dominant allele (Y). This is called **Law of Segregation** of the alleles.

Questions

1. Do you expect the same results in terms of 3:1 ratio in F₂ if you had started with smaller number of beads (say 10 beads)?