

# Binary Fission in Amoeba and Budding in Yeast

## Introduction

- Reproduction, unlike other life processes, is not essential to maintain the life of an individual but is necessary to maintain continuity of life. Reproduction in animals is of two types: asexual and sexual. Cells of organisms divide either through mitosis or meiosis or through both.
- **Mitosis:** When a cell divides into two equal daughter cells with the same number of chromosomes as that of parent cells then the division is called mitotic cell division. This type of cell division occurs both in asexually and sexually reproducing organisms.
- **Meiosis:** When a cell divides into four daughter cells, with half the number of chromosomes as that of parent cell then the division is called meiotic cell division. This type of cell division occurs only in sexually reproducing organisms.
- **Asexual reproduction:** Type of reproduction where only one parent is involved for the production of new individual. Some important types of asexual reproduction are:
  1. **Fission:** Type of asexual reproduction, in unicellular organisms, where two or more daughter cells are formed from a single parent through mitotic division.

When parent cell is divided into two daughter cells, then the fission is known as binary fission. For e.g., in Amoeba and Paramecium parent cell divides into two daughter cells.

When parent cell is divided into many daughter cells, then the fission is known as multiple fission. For e.g., Plasmodium divides into many daughter cells simultaneously.
  2. **Regeneration:** Type of asexual reproduction in which a new individual organism is produced from any fragmented or broken part of a fully differentiated organism. For e.g., simple animals like Hydra and Planaria can be cut into any number of pieces and each piece grows into a complete organism.
  3. **Budding:** Type of asexual reproduction in which a small bud develops as an outgrowth due to repeated cell division at one specific site. These buds develop into tiny individuals and when fully mature detach from the parent body and become new independent individual.

For e.g., Hydra and Yeast reproduce through budding.
  4. **Fragmentation:** This type of reproduction occurs in multi-cellular organisms with relatively simple body organisation and simple reproductive method. For e.g., Spirogyra simply breaks into smaller pieces upon maturation. These pieces or fragments grow into new individuals.

5. **Vegetative propagation:** This type of reproduction occurs in plants where root, stem, leaves, etc. develop into new plants under favourable conditions. Plants produce through vegetative reproduction are genetically similar enough to the parent plant to have all its characteristics.
- **Sexual reproduction:** Sexual reproduction needs two parents, a male and a female. Each parent produces sex cells, called gametes. Sexual reproduction involves two gametes from different parents.
  - In fertilisation these sex cells fuse to form a zygote, a genetically unique individual, creating non-identical offspring with different characteristics is formed. The type of cell division that produces gametes is called meiosis.

## **Biology Lab Manual Experiment – 4**

### **Aim**

To study (a) binary fission in Amoeba and (b) budding in yeast with the help of prepared slides.

### **Theory**

- Reproduction: Plants and animals reproduce (i.e., create new individuals) either by asexual method or by sexual method.
- Asexual reproduction: When an organism reproduces by single organism, it is called asexual reproduction. The different ways of asexual reproduction are fission, budding and regeneration in animals.

### **1. Binary Fission**

- This is commonly seen in single celled animals. There are no gametes or fertilisation. The cells divide many times through mitosis. Animals like Amoeba reproduce in this manner.
- Amoeba is a tiny unicellular organism that has a porous cell membrane, changes its shape constantly and encloses the cell organelles. The genetic material replicate through amitotic division, the cell divides into two equal sized daughter cells. The division of nucleus is called amitosis because the stages of a typical mitotic division are not observed in Amoeba.
- Karyokinesis: The division begins with the nucleus dividing to form two daughter nuclei by the process of karyokinesis.
- Cytokinesis: Karyokinesis is followed by cytokinesis which is the division of cytoplasm in the mother cell. Two daughter Amoebae cell having a nucleus and its own cell organelles are formed.

### **2. Budding**

- In this type of reproduction an outgrowth develops due to repeated cell division on the parent cell that grows to form a bud. The fully grown bud detaches from the mother's body by forming a constriction at the base and become new individual.

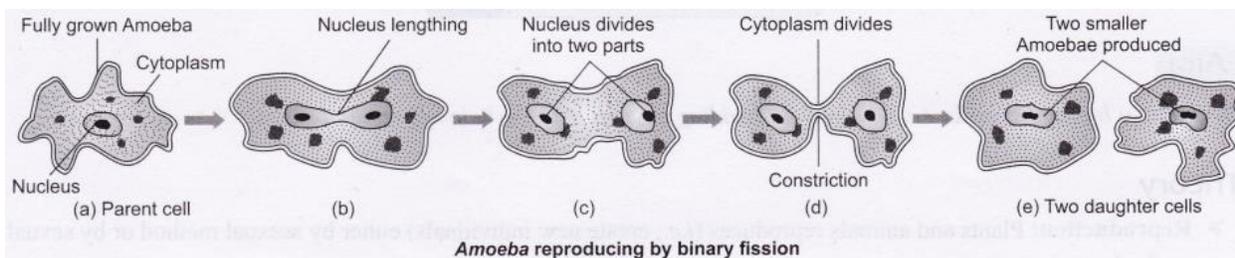
- Yeast are unicellular eukaryotic micro-organisms belonging to the kingdom fungi (some are multicellular). They reproduce by budding. Sometimes chain of cells remain attached to the parent cell. When these cells get detached they form a new individual organism.

## Materials Required

1. Prepared slides of Amoeba showing binary fission with different stages.
2. Prepared slides of yeast showing budding with different stages.
3. Compound microscopes 2-4.

### (A) Binary Fission in Amoeba Procedure

1. Place the prepared slides of Amoeba showing different stages of reproduction on the stage of the microscope.
2. Adjust the mirror of the microscope to focus maximum light on the slide. Adjust the eye-piece of the microscope so that the slide is clearly focussed and seen.
3. Draw diagrams of the stages of binary fission in Amoeba.



### Observations

1. Amoeba is a protozoa that lives in water and has irregular shape.
2. In the centre of Amoeba dense nucleus is seen.
3. In second stage, Amoeba shows the nucleus division, i.e., karyokinesis.
4. In third stage, we can see the cell body division, i.e., cytokinesis.
5. In the fourth stage, two daughter cells of Amoeba are formed.

### Conclusion

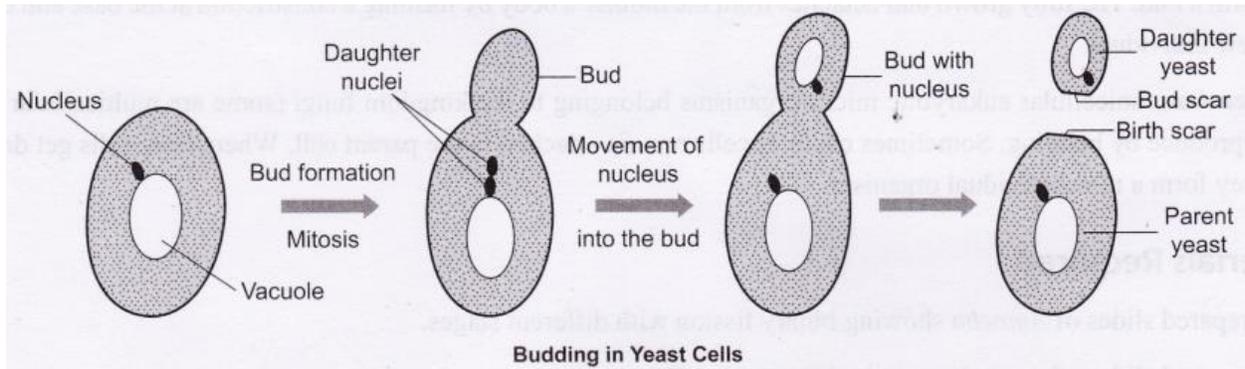
The given slides showed the division of a single cell body into two equal halves. The division of nucleus and cell body are seen which led to the formation of two daughter cells. Hence, the kind of reproduction seen in Amoeba is binary fission.

### (B) Budding in Yeast

#### Procedure

1. Place the permanent/prepared slides of yeast showing different stages of reproduction on the stage of microscope.
2. Make the adjustments in mirror of the microscope for focussing maximum light on the slide.

3. Adjust the eye-piece so that the slide is clearly seen.
4. Draw diagrams of the stages of budding yeast cells.



### Observations

1. Yeast is oval or spherical in shape.
2. It is a unicellular organism.
3. In the second stage, yeast shows a small growth on it called 'bud'.
4. In the third stage, yeast shows that in some situations many such chain of buds is seen on the parent cell. This process is called 'budding'.
5. On maturity the buds get separated from parent cell to form and grow as a new organism. This process is called budding.

### Conclusion

The given slides showed the small growth (bud) on yeast. These buds on maturity separate from parent cell and grow as a new organism, hence, yeast shows budding.

### Precautions

1. Use microscope very carefully. Do not disturb its adjustments.
2. The slides shown under the microscope should not be disturbed.
3. Set the mirror of the microscope for better focus of light on the slide.
4. The slide can be seen under low power or high power of the microscope. These adjustments should be done very carefully.

## Biology Lab Manual Viva Voce

### Question 1:

When an organism divides into two equal halves, what type of reproduction is seen?

#### Answer:

Binary fission (asexual).

### Question 2:

What kind of reproduction is seen in Plasmodium?

#### Answer:

Plasmodium shows multiple fission [under unfavourable conditions of reproduction].

**Question 3:**

What type of reproduction is seen in a bacteria when present in unfavourable conditions of reproduction?

**Answer:**

Multiple fission.

**Question 4:**

Name one organism that reproduces by regeneration.

**Answer:**

Planaria.

**Question 5:**

Give one use of yeast.

**Answer:**

Yeast is used in baking industry for fermentation.

**Question 6:**

What type of reproduction is seen in Amoeba?

**Answer:**

In Amoeba binary fission is seen.

## **Biology Lab Manual Practical Based Questions**

**Question 1:**

Name the type of reproduction in which single parent is required.

**Answer:**

Asexual reproduction.

**Question 2:**

Give two examples where budding is seen.

**Answer:**

Hydra and yeast.

**Question 3:**

Name two stages of binary fission.

**Answer:**

- (i) Karyokinesis: division of nucleus
- (ii) Cytokinesis: division of cell body or cytoplasm.

**Question 4:**

Name different types of asexual reproduction.

**Answer:**

Fission, budding, regeneration.

**Question 5:**

Hydra is a multicellular organism, how does it show asexual reproduction?

**Answer:**

In Hydra, the regenerative cells are used for reproduction in the process of budding, i. e., asexual reproduction.

**Question 6:**

What is fission?

**Answer:**

It is a type of asexual reproduction in which the parent organism divides to form two or more than two organisms.

**Question 7:**

What are the different types of fission reproduction?

**Answer:**

Binary fission and multiple fission are the two types of fission reproduction.

**Question 8:**

What is binary fission?

**Answer:**

When a parent cell divides into two identical daughter cells, it is called binary fission.

**Question 9:**

Name two organisms which reproduce by binary fission.

**Answer:**

Two organisms which reproduce by binary fission are Amoeba and Paramecium.

**Question 10:**

What is multiple fission?

**Answer:**

In multiple fission, from the parent organism many new individuals are formed.

**Question 11:**

Name two organisms that reproduce by multiple fission.

**Answer:**

Plasmodium and some bacteria.

**Question 12:**

What is budding?

**Answer:**

It is the type of asexual reproduction in which a bulb like growth is formed on the parent body. It grows, matures and detaches to form a new individual.

**Question 13:**

Name two organisms that show budding.

**Answer:**

Yeast and Hydra.

**Question 14:**

Name two types of reproduction.

**Answer:**

Two types of reproduction are sexual and asexual.

**Question 15:**

Name two animals which show reproduction by regeneration method. Which one of these two also reproduce by budding method? [Delhi 2011]

**Answer:**

Planaria and Hydra reproduce by regeneration.  
Hydra also reproduces by the budding method.

**Question 16:**

Name two types of fissions. Name two living beings of each type which reproduce by these methods of fission. [Delhi 2013]

**Answer:**

Two types of fissions are:

- (i) Binary Fission
- (ii) Multiple Fission

Two examples of binary fission are —Amoeba and Paramecium

Two examples of multiple fission are — Plasmodium and Spirogyra.

**Question 17:**

Name the process of asexual reproduction shown by yeast. What type of living being is yeast? What is its commercial importance? [Outside Delhi 2013]

**Answer:**

Yeast reproduces by method of budding. Yeast is a unicellular fungus.  
Yeast forms lots of buds in the sugar solution. These buds become young yeast cells which change sugar of the solution to produce ethyl alcohol by fermentation in the distilleries.

**Question 18:**

What do you observe on seeing the slides showing reproduction in Amoeba? What is the name given to this method of reproduction in Amoeba? [Delhi 2014]

**Answer:**

On observing this slide, we see different stages under which the nucleus of Amoeba cell is dividing into two parts. Method of reproduction in Amoeba is binary fission.

## Biology Lab Manual Questions

### Question 1:

Which type of cell division is involved in binary fission?

#### Answer:

Amitosis

### Question 2:

How many daughter cells are formed in binary fission?

#### Answer:

Two daughter cells are formed in binary fission.

### Question 3:

Why binary fission and budding are included under asexual reproduction?

#### Answer:

In asexual reproduction only one parent is involved and the offsprings formed are identical to the parent.

### Question 4:

Are binary fission and budding faster processes of reproduction when compared to sexual reproduction? Justify.

#### Answer:

The asexual reproduction like binary fission and budding are faster as compared to sexual reproduction because the later involves the formation of gametes and then fertilization followed by zygote formation and growth of the foetus.

## Biology Multiple Choice Questions (MCQs)

### Questions based on Procedural and Manipulative Skills

#### Question 1:

Binary fission is seen in

- (a) Tapeworm
- (b) Hydra
- (c) Amoeba
- (d) Earthworm

#### Question 2:

Budding is seen in

- (a) Amoeba
- (b) Spirogyra
- (c) Yeast
- (d) Bacteria

**Question 3:**

The two stages of binary fission are

- (a) Karyokinesis followed by cytokinesis
- (b) Cytokinesis followed by karyokinesis
- (c) both (a) and (b)
- (d) none of these

**Question 4:**

In asexual reproduction

- (a) gametes are formed
- (b) both the parents are involved
- (c) only one parent is involved
- (d) occurs only in single-celled organisms

**Question 5:**

When a single nucleus divides into two is called

- (a) Cytokinesis
- (b) Fragmentation
- (c) Karyokinesis
- (d) Mitosis

**Question 6:**

A student is given a permanent slide showing binary fission in Amoeba. The following are the steps in focussing the object under the microscope

- (i) place the slide on the stage, look through the eye-piece and adjust the mirror and diaphragm to get even illumination.
- (ii) look through the eye-piece and raise the objective using coarse adjustment until the object is focussed.
- (iii) make the focus sharp with the help of fine adjustment.
- (iv) look through the eye-piece and move the slide until the object is visible.

The right sequence is

- (a) (i), (iii), (iv), (ii)
- (b) (ii), (iii), (iv), (i)
- (c) (iv), (iii), (ii), (i)
- (d) (i), (iv), (ii), (iii)

**Question 7:**

The reproduction in which parental identity is lost is:

- (a) budding
- (b) fragmentation
- (c) multiple fission
- (d) vegetative propagation.

**Question 8:**

Two daughter cells formed are same in one of the reproduction that is:

- (a) binary fission
- (b) budding
- (c) multiple fission
- (d) regeneration.

**Question 9:**

The type of cell division seen in fission is:

- (a) mitosis
- (b) meiosis
- (c) both (a) and (b)
- (d) none of these.

**Question 10:**

Multicellular organisms show:

- (a) sexual reproduction
- (b) asexual reproduction
- (c) both (a) and (b)
- (d) none of these.

**Question 11:**

In binary fission of Amoeba'

- (a) many daughter cells are formed
- (b) two daughter cells are formed
- (c) one daughter cell is formed
- (d) depends on the size of Amoeba.

**Question 12:**

The parental identity is lost in:

- (a) binary fission
- (b) multiple fission
- (c) regeneration
- (d) all of these.

**Question 13:**

During budding of yeast, the nucleus of bud is formed by:

- (a) mitosis
- (b) meiosis
- (c) amitosis
- (d) cytokinesis.

**Question 14:**

Amoeba shows its locomotion through:

- (a) cilia
- (b) flagella
- (c) pseudopodia
- (d) tentacles.

**Question 15:**

During asexual reproduction:

- (a) no gametes are formed
- (b) gametes are formed
- (c) parent cell always disappears
- (d) gametes fuse to form daughter cells.

**Question 16:**

The correct step in binary fission is:

- (a) first division of nucleus and then cytoplasm
- (b) first division of cytoplasm and then nucleus
- (c) both cytoplasm and nucleus divides at same time
- (d) none of the above.

**Question 17:**

The type of asexual reproduction seen in unfavourable conditions is:

- (a) binary fission
- (b) multiple fission
- (c) budding
- (d) regeneration.

**Question 18:**

The steps involved in observing a slide under a microscope are given below. They are not in proper sequence. [Outside Delhi 2011]

- I. Focus the object under high power microscope.
- II. Place the slide on the stage of the microscope.
- III. Arrange the mirror to reflect maximum light to the slide.
- IV. Focus the object under low power of microscope. The proper sequence of steps is:

- (a) II, III, IV, I
- (b) I, II, III, IV
- (c) IV, III, II, I
- (d) III, I, II, IV

**Question 19:**

A chain of yeast cells forms because: [Outside Delhi 2012]

- (a) yeast cells do not separate after budding
- (b) daughter cells are unable to survive without parent cells
- (c) buds reproduce as soon as they are formed
- (d) daughter cells stick together with the help of mucus

**Question 20:**

Select the correct statements for the process of budding in yeast: [Delhi 2013]

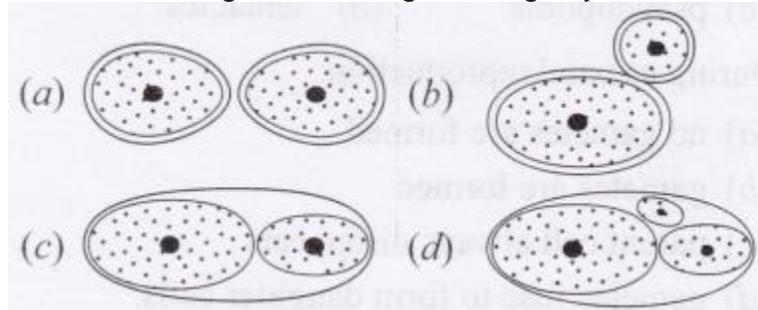
- I. A bud arises from a particular region on a parent body. ‘
- II. A parent cell divides into two daughter cells, here the parental identity is lost.
- III. Before detaching from the parent body a bud may form another bud.
- IV. A bud when detaches from the parent body grows into a new individual.

- (a) I, II and III
- (b) II, III and IV
- (c) III, IV and I
- (d) IV, I and II

**Questions based on Observational Skills**

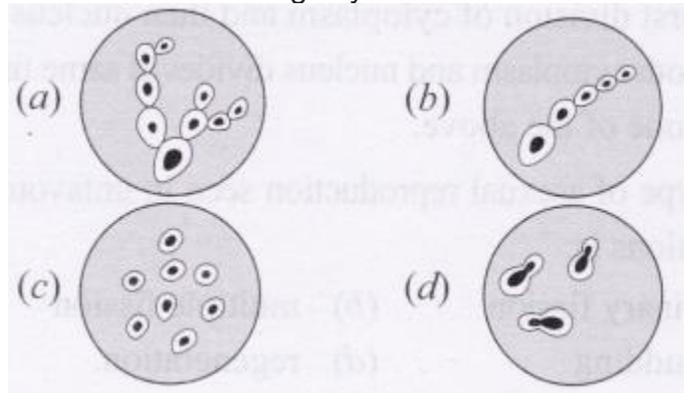
**Question 21:**

The correct diagram showing budding in yeast is:



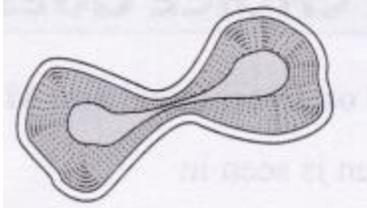
**Question 22:**

The following are the sketches made by some of the students. The sketch not illustrative of budding in yeast is:



**Question 23:**

The diagram given below illustrates



- (a) bud formation in Yeast
- (b) binary fission in Amoeba
- (c) formation of daughter cells in Yeast
- (d) pseudopodia formation of Amoeba.

**Question 24:**

After observing the prepared slides of binary fission in Amoeba and budding in yeast following observations were reported: [Delhi 2012]

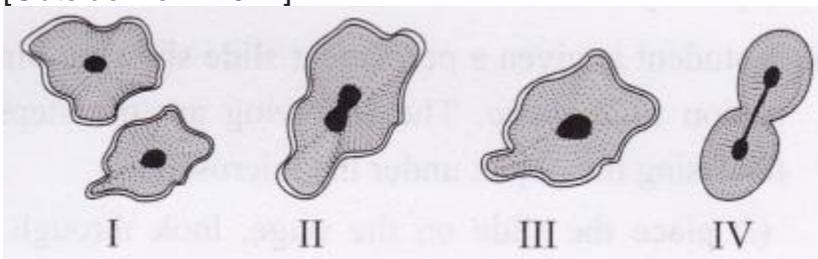
- (A) Single cells of amoeba and yeast were undergoing binary fission and budding respectively.
- (B) Cytokinesis was observed in the yeast cell.
- (C) Elongated nucleus was dividing to form two daughter nuclei in amoeba.
- (D) A chain of buds was observed due to reproduction in amoeba.

The correct observation(s) is/are:

- (a) A and C
- (b) B only
- (c) C and D
- (d) D, A and C

**Question 25:**

The following figures illustrate binary fission in Amoeba in an incorrect sequence. [Outside Delhi 2012]



The correct sequence is:

- (a) III, II, IV, I
- (b) III, IV, II, I
- (c) II, III, IV, I
- (d) IV, III, II, I

**Question 26:**

Slides of binary fission in Amoeba and budding in yeast were given for observations to a group of students. Some of the observations reported by the group are given below: [Outside Delhi 2013]

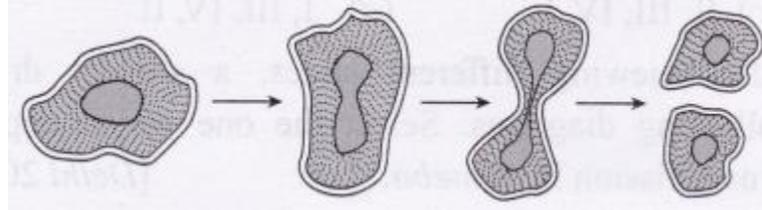
- I. Cytokinesis was observed in the yeast cell.
  - II. A chain of buds were observed due to reproduction in Amoeba.
  - III. Single cell of Amoeba and single cell of yeast were undergoing binary fission and budding respectively.
  - IV. Elongated nucleus was dividing to form two daughter nuclei in Amoeba.
- The correctly reported observations are:

- (a) I and II
- (b) II and III
- (c) III and IV
- (d) I and IV

**Questions based on Reporting and Interpretation Skills**

**Question 27:**

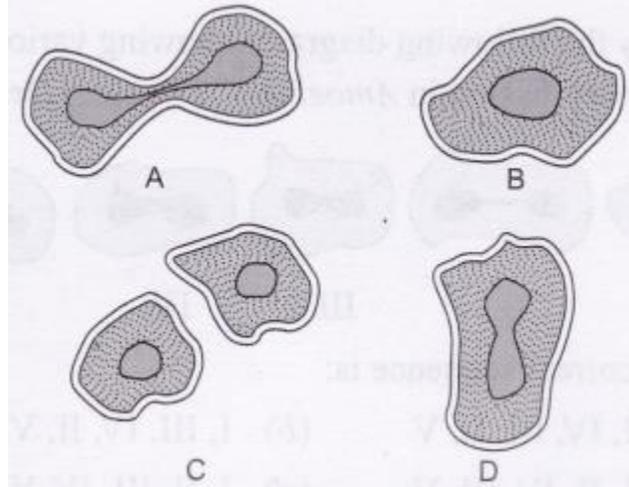
The process represented in the diagram below is the



- (a) formation of spores in Amoeba
- (b) formation of bud taking place in Amoeba
- (c) identical gametes being formed in Amoeba
- (d) formation of daughter cells in Amoeba

**Question 28:**

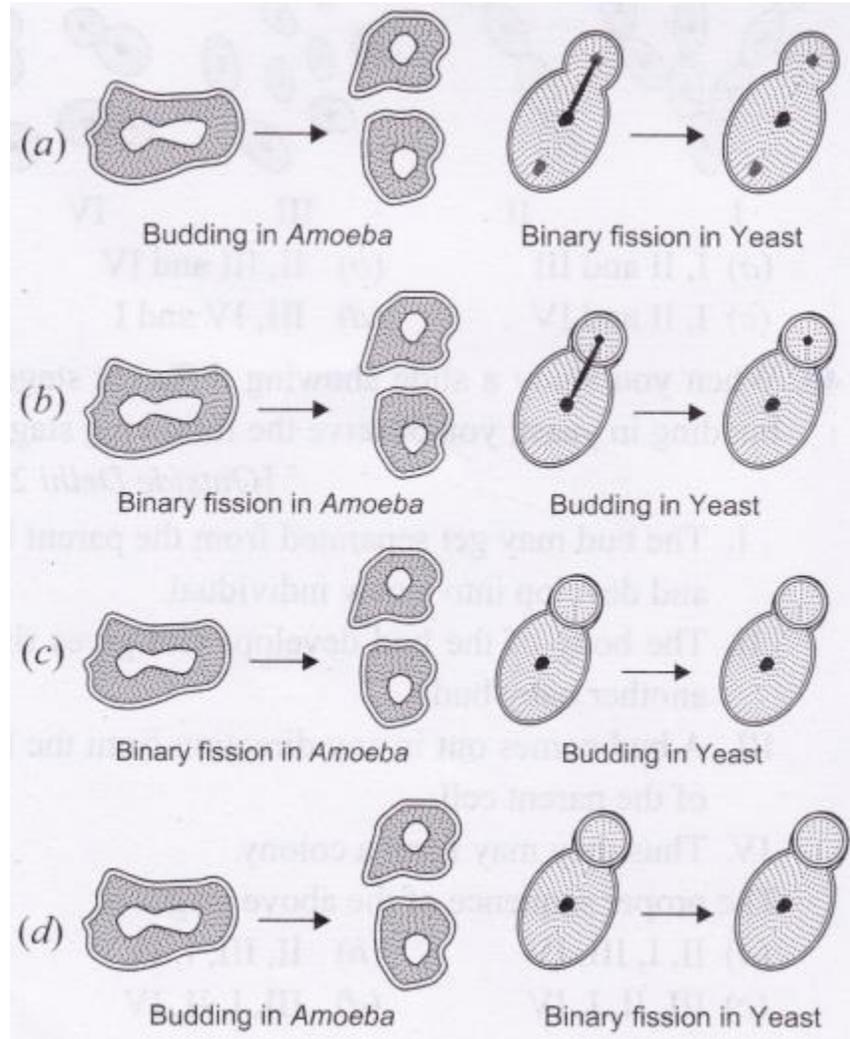
Given below are stages of binary fission in Amoeba. Which one of the following would you select as the correct sequence of these stages?



- (a) A, B, C, D
- (b) D, C, A, B
- (c) B, D, A, C
- (d) C, A, D, B

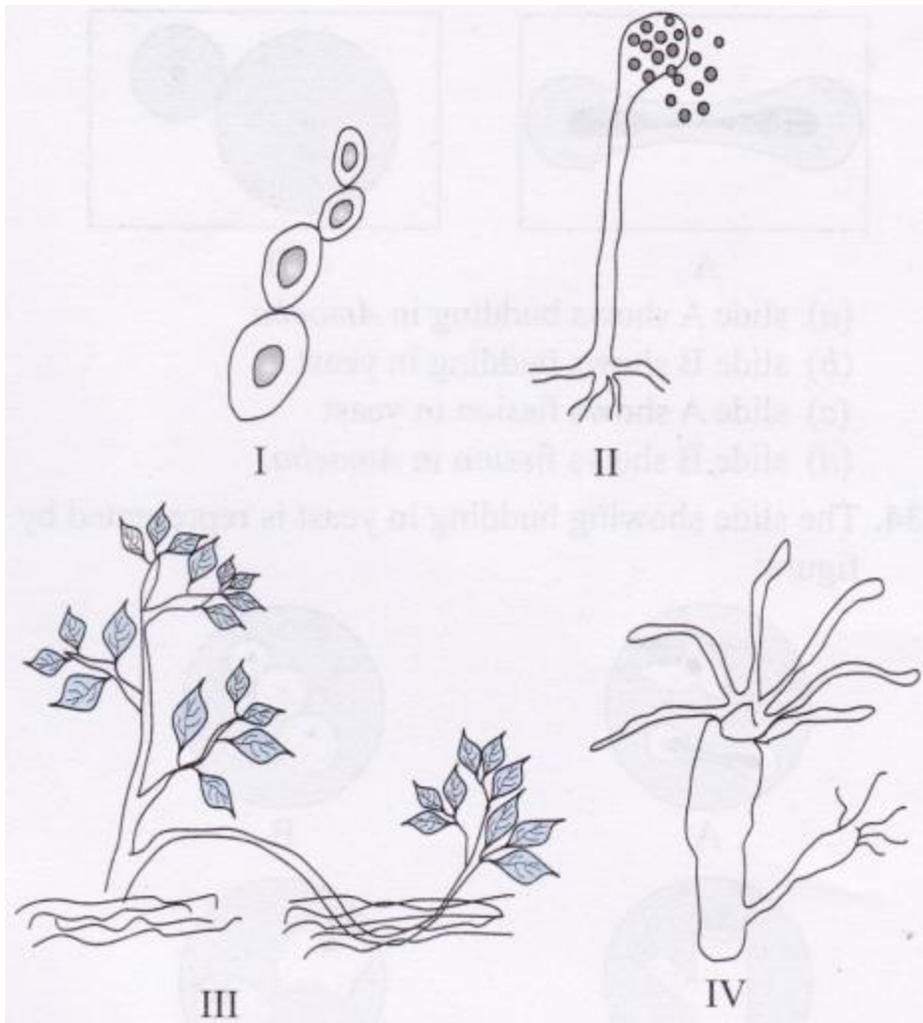
**Question 29:**

Which one of the following sets of diagrams correctly depicts reproduction in Amoeba and Yeast?



**Question 30:**

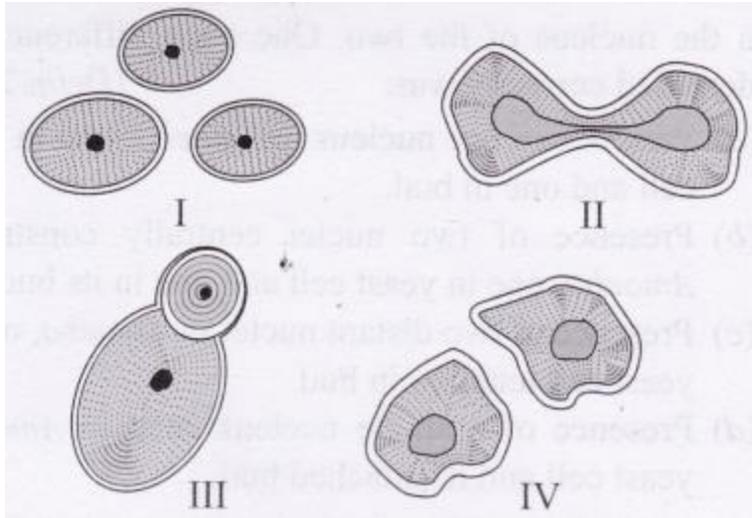
Two out of the following four figures that illustrate budding are:



- (a) I and II
- (b) I and III
- (c) I and IV
- (d) II and IV

**Question 31:**

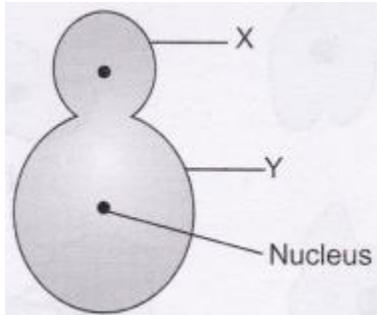
Which out of the four slides I, II, III, IV whose details are shown below, should be focussed under the microscope showing budding in yeast?



(a) I (b) II (c) III (d) IV

**Question 32:**

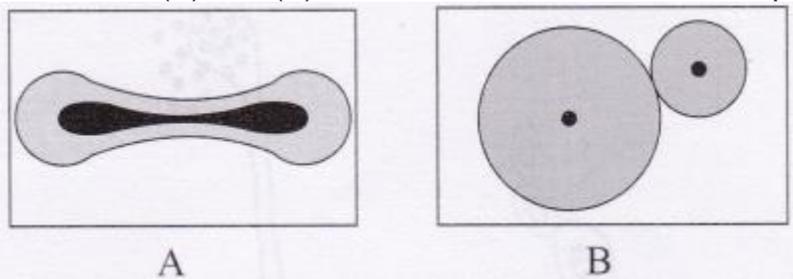
A student draws the sketch of budding in yeast:



- (a) X is the parent cell.
- (b) Y is the bud cell,
- (c) X is the bud cell.
- (d) None of these.

**Question 33:**

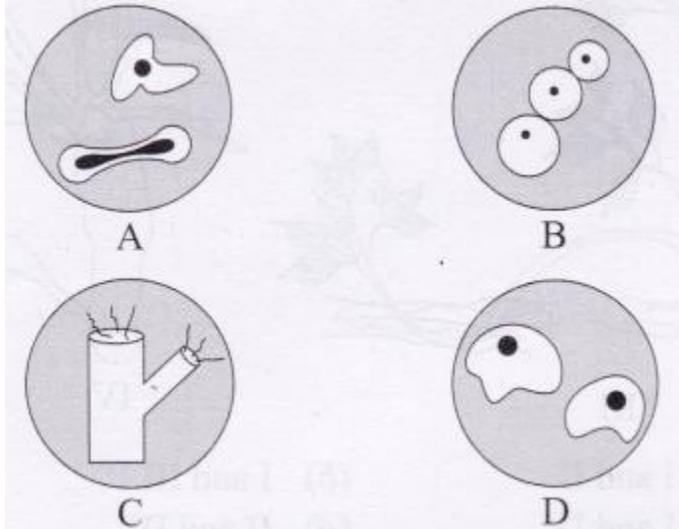
Two slides (A) and (B) were shown under the microscope. The correct observation is:



- (a) slide A shows budding in Amoeba
- (b) slide B shows budding in yeast
- (c) slide A shows fission in yeast
- (d) slide B shows fission in Amoeba.

**Question 34:**

The slide showing budding in yeast is represented by figure:



- (a) A
- (b) B
- (c) C
- (d) D

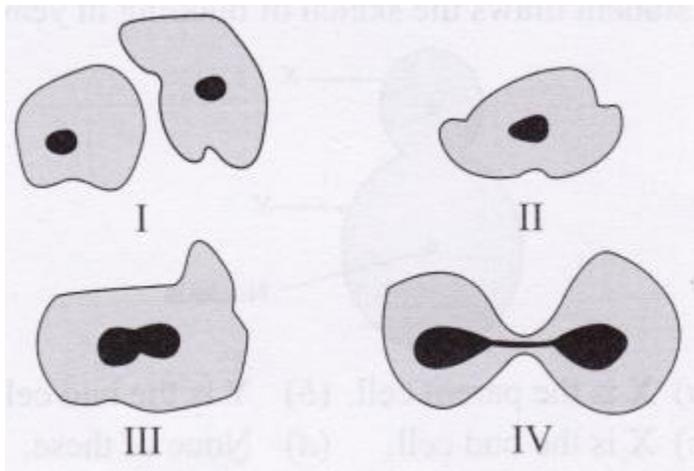
**Question 35:**

A student was given two permanent slides, one of binary fission in Amoeba and other of budding in yeast. He was asked to identify any one difference in the nucleus of the two. One such difference, he identified correctly was: [Delhi 2011]

- (a) Presence of one nucleus in Amoeba, two in yeast cell and one in bud.
- (b) Presence of two nuclei centrally constricted Amoeba, one in yeast cell and one in its bud.
- (c) Presence of two distant nuclei in Amoeba, one in yeast cell and two in bud.
- (d) Presence of a single nucleus each in Amoeba, yeast cell and its attached bud.

**Question 36:**

The given figures illustrate binary fission in Amoeba [Outside Delhi 2011]

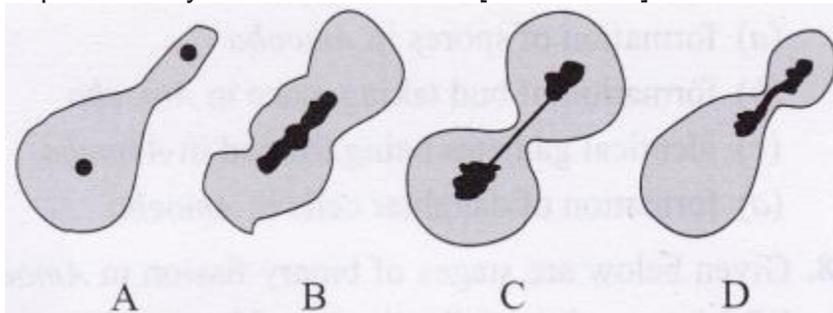


The correct order is:

- (a) III, IV, III, I
- (b) IV, III, II, I
- (c) II, III, IV, I
- (d) I, III, IV, II

**Question 37:**

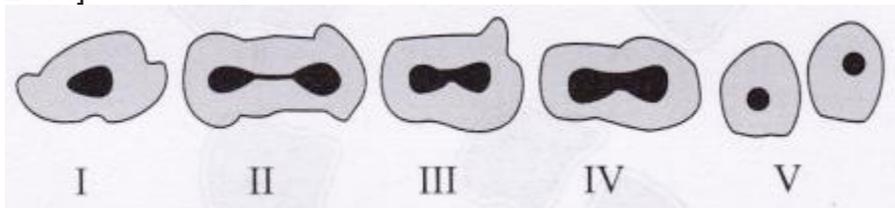
After viewing different slides, a student draws following diagrams. Select the one which depicts binary fission in Amoeba. [Delhi 2012]



- (a) A
- (b) B
- (c) C
- (d) D

**Question 38:**

Study the following diagrams showing various stages of binary fission in Amoeba. [Delhi 2014]

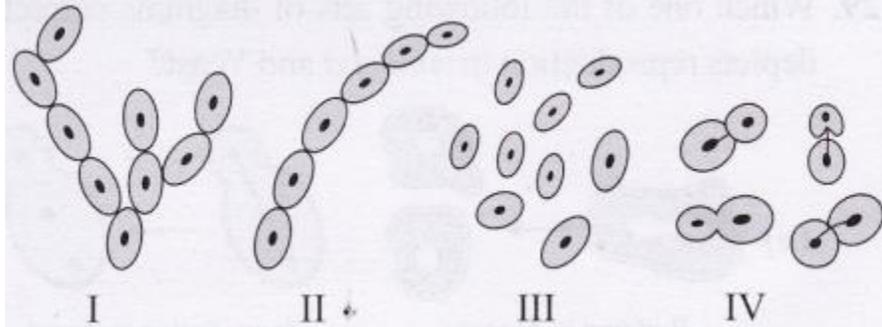


The correct sequence is:

- (a) I, IV, III, II, V
- (b) I, III, IV, II, V
- (c) I, II, IV, III, V
- (d) I, II, III, IV, V

**Question 39:**

Identify the figures showing the process of budding in yeast. [Delhi 2014]



- (a) I, II and III
- (b) II, III and IV
- (c) I, II and IV
- (d) III, IV and I

**Question 40:**

When you study a slide showing different stages of budding in yeast, you observe the following stages:[Outside Delhi 2014]

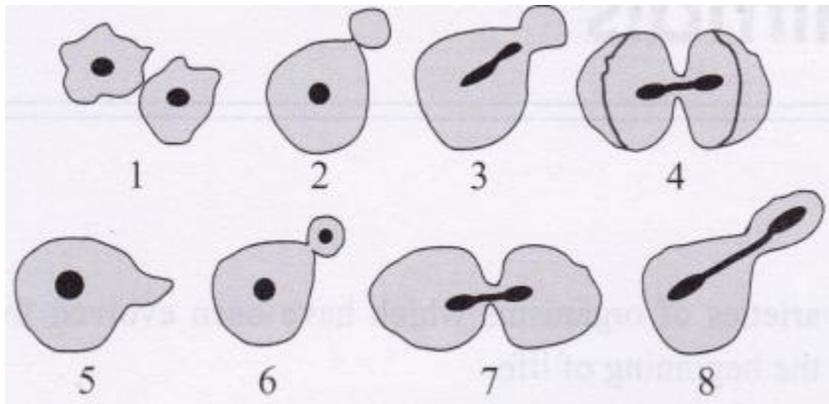
- I. The bud may get separated from the parent body and develop into a new individual.
- II. The body of the bud develops and gives rise to another baby bud.
- III. A bud comes out in any direction from the body of the parent cell.
- IV. Thus they may form a colony.

The proper sequence of the above stages is:

- (a) II, I, III, IV
- (b) II, III, I, IV
- (c) III, II, I, IV
- (d) III, I, II, IV

**Question 41:**

From the following diagrams, select the correct ones showing stages of binary fission in Amoeba and budding in yeast in their proper sequence.



- (a) 5, 1, 4 and 2, 3, 6  
 (b) 3, 4, 7 and 2, 8, 6  
 (c) 7, 4, 1 and 3, 8, 6  
 (d) 8, 7, 4 and 3, 2, 6

**Answers:**

1. (c)	2. (c)	3. (a)	4. (c)	5. (c)
6. (d)	7. (c)	8. (a)	9. (a)	10. (c)
11. (b)	12. (d)	13. (a)	14. (c)	15. (a)
16. (a)	17. (b)	18. (a)	19. (a)	20. (c)
21. (b)	22. (c)	23. (b)	24. (a)	25. (a)
26. (c)	27. (d)	28. (c)	29. (b)	30. (c)
31. (c)	32. (c)	33. (b)	34. (b)	35. (b)
36. (c)	37. (c)	38. (b)	39. (c)	40. (d)
41. (c)				

**Biology Lab Manual Scoring Key With Explanation**

- (c) Amoeba splits into two daughter cells.
- (c) Yeast forms an outgrowth as a bud.
- (a) Nucleus division is seen first followed by cytoplasm.
- (c) Single parent means asexual (only one sex).
- (c) Division of nucleus is called karyokinesis.
- (d) It is the procedure to focus a slide.
- (c) In fission, parent is lost and new ones are developed (binary/multiple).
- (a) In binary fission, the two cells formed are identical.
- (a) Single cell forming two cells is mitosis.
- (c) Some show asexual and some show sexual reproduction.

11. (b) Binary means two.
12. (d) In fission and in regeneration, the parent is lost and new ones are formed.
13. (a) One nucleus splits into two.
14. (c) Pseudopodia are the false feet in Amoeba used for locomotion.
15. (a) No sex cells are involved.
16. (a) Nucleus divides first.
17. (b) The outer wall formed by the organism protects it from unfavourable conditions and the cells divide inside.
18. (a) It is the correct procedure.
19. (a) Many cells keep budding to detach later.
20. (c) In budding, a parent cell does not divide into two daughter cells.
21. (b) Outgrowth on cell is seen.
22. (c) The cells are far apart.
23. (b) A cell splitting in two daughter cells (Binary fission).
24. (a) Amoeba shows binary fission, yeast shows budding and nucleus is elongated.
25. (a) Single cell, nucleus splits, followed by cell splitting into two daughter cells.
26. (c) Amoeba shows binary fission, yeast shows budding and nucleus is elongated.
27. (d) From one cell two cells are formed (fission).
28. (c) Cell, nucleus develops constriction, then cytoplasm and separates.
29. (b) Amoeba—binary fission, yeast-budding, nucleus in each cell.
30. (c) A younger growth on the parent organism is seen.
31. (c) A growth on parent organism.
32. (c) X is the bud cell.
33. (b) A is fission and B is budding.
34. (b) Yeast shows small round/oval buds on it.
35. (b) Binary fission in Amoeba and budding in yeast.
36. (c) Single cell, nucleus splits, followed by cell splitting into two daughter cells.
37. (c) The nucleus of the Amoeba first divides to form two daughter nuclei and then; the cytoplasm in the mother cell divides into two daughter cells.
38. (b) The process of the division of the nucleus is illustrated in steps.
39. (c) In III all the cells are separate and single.
40. (d) The bud may keep forming new buds on parent body or may get detached.
41. (c) Correct sequence of binary fission in Amoeba and budding in yeast.