Biology · Structure and Function in Living Organisms · Immunity in Living Organisms

Immunity in Plants

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Multiple choice questions — 68 questions

1 Which of the following is NOT a stage of immunity?

(A) Preventing the pathogen from spreading inside the host cells

(B) Recognizing the cause of the disease

(C) Eliminating the pathogens

(D) Bacteria secreting toxins inside the host cells

---

2 Which of the following cells prevent the pathogen from entering the plant?

(A) Parenchyma (B) Collenchyma (C) Sclerenchyma (D) Cork

---

3 Which of the following is a structural immune defense that is permanently present in the plant?

(A) Tyloses (B) The cell wall (C) Gums (D) Receptors

---

4 Which of the following statements does NOT apply to structure (X) in the opposite figure?



(A) One of the forms of innate immunity

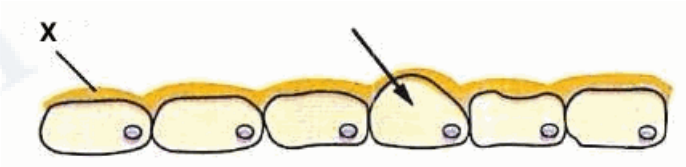
(B) A structure that senses the presence of microbes

(C) It belongs to the first line of defense

(D) Part of the outer cuticle

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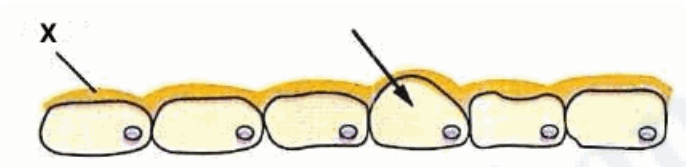
5 From the opposite figure, which shows part of the epidermis of a plant stem:
Which of the following is the role of part (X) in the plant?



(A) Support only
(B) Pre-existing structural immunity only
(C) Structural immunity formed as a result of infection only
(D) Support and pre-existing structural immunity

---

6 From the opposite figure, which shows part of the epidermis of a plant stem:
Which of the following is the cause of the change shown by the arrow?



(A) Water loss
(B) Being cut
(C) More deposition of cutin
(D) Direct penetration by the pathogen

---

7 Which of the following is NOT correct about the role of the cell wall in plant immunity?

(A) Its shape changes during the invasion by the pathogen
(B) It is thickened with more cellulose or lignin
(C) It lets water pass into and out of the cell
(D) It is made of strong, flexible cellulose fibres

---

8 Which of the following immune defenses shows that the microbe succeeded in entering the plant?

(A) The presence of the waxy layer of the cuticle
(B) Deposition of gums
(C) Formation of cork
(D) Formation of tyloses

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9 Which of the following is the simplest route for pathogens to enter the plant?

(A) The cell wall (B) Cracks (C) The cuticle (D) Cork

10 Which of the following immune defenses prevents the microbe from entering the plant?

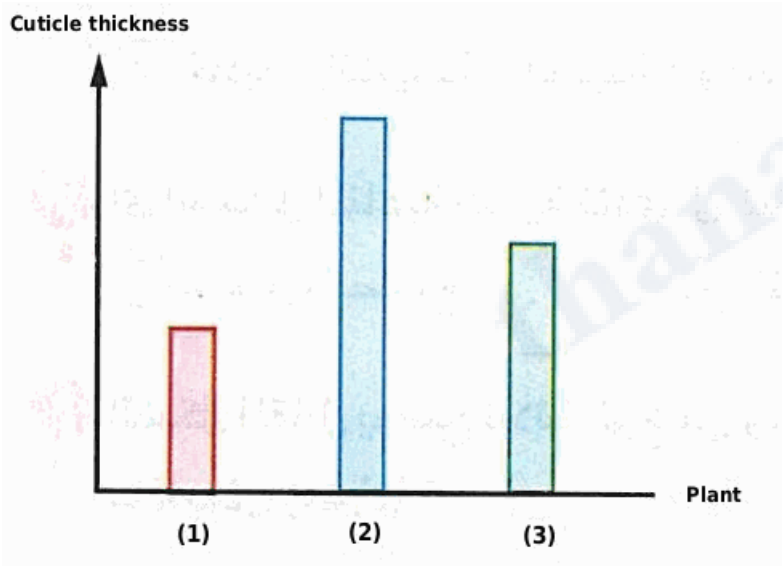
(A) Forming an insulating sheath around the microbe

(B) Formation of tyloses

(C) Hypersensitivity

(D) Deposition of gums

11 The opposite graph shows the thickness of the cuticle in three different plants. Which of the following statements is correct?



(A) The thickness of the cuticle is inversely proportional to the resistance to pathogens

(B) Plant (1) is the most resistant to pathogens

(C) The microbe penetrates plant (2) more easily than plant (1)

(D) Plant (3) is more resistant to pathogens than plant (1)

12 What do you expect to happen when the outer layer of the stems of woody trees is cut?

(A) Cork forms and tyloses form

(B) Cork forms or gums are deposited

(C) Gums are deposited or tyloses form

(D) Cork and tyloses form and gums are deposited

13 Which of the following substances is NOT found in healthy plants?

(A) Cutin (B) Gum (C) Receptors (D) Cellulose

14 Which of the following has no waxy layer?

(A) The apple fruit
(B) The leaves of the cactus plant
(C) The stem of the sugar cane plant
(D) The root hairs of the Jew's mallow (molokhia) plant

15 Which of the following are means of protection in the leaves of the cactus plant?

(A) Thorns only (B) Cutin and thorns (C) Cutin only (D) Hairs and cutin

16 In what are gums similar to cork in the plant?

(A) The mechanism of formation (B) The immune function
(C) The shape (D) The structure

17 What is the main reason that makes the prickly pear plant more resistant to diseases?

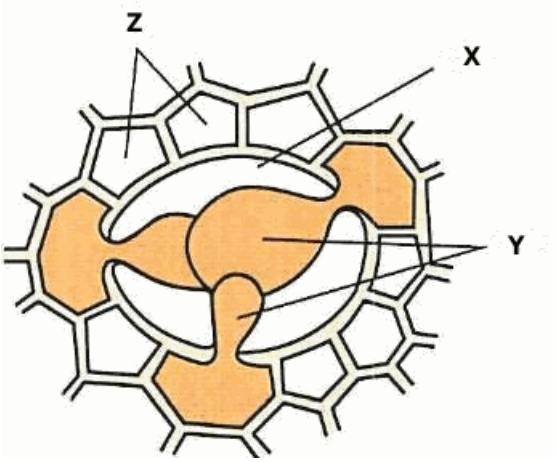
(A) The cell membranes of the plant
(B) The outer cuticle of the plant surface
(C) The cork cells formed by the plant
(D) The chemical substances secreted by the plant

18 From the opposite table, what do you expect (X), (Y), (Z) to be, respectively?

What covers the cuticle	
X	Apple fruit
Y	Peach fruit
X - Z	Cactus plant

(A) Cutin / thorns / hairs (B) Thorns / hairs / cutin
(C) Cutin / hairs / thorns (D) Hairs / cutin / thorns

19 In the opposite figure, what do (X), (Y), (Z) represent, respectively?



(A) Parenchyma cells / gum / tyloses

(B) Cell wall / swelling of the epidermis cells / xylem vessel

(C) Xylem vessel / tyloses / parenchyma cells

(D) Parenchyma cells / tracheid / xylem vessel

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20 Which of the following immune defenses leads the infected plant to close some of the stomata of its leaves?

(A) Deposition of gums

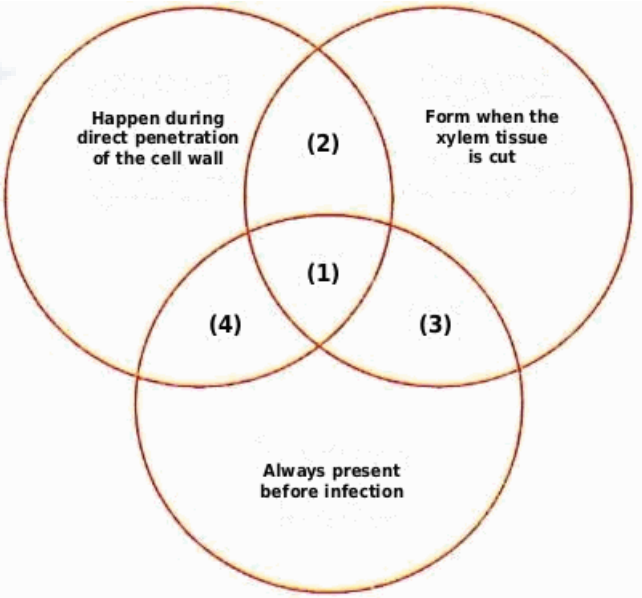
(B) Formation of tyloses

(C) Formation of cork

(D) Swelling of the cell walls

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21 The opposite figure shows three kinds of structural immune defenses in the plant. What does number (4) represent?



(A) Changes in shape
(B) Related to the cell wall
(C) Acquired immunity
(D) Pre-existing immunity

22 Which of the following statements applies to tyloses?

(A) They are always present in the plant
(B) They prevent the microbe from entering the plant
(C) They increase the diameter of the xylem tracheids
(D) They appear in the cross section of an infected stem

23 Which of the following may cause blocking of the tracheids?

(A) A cut in the xylem tissue of the plant
(B) Tearing of the stem epidermis cells of the plant
(C) Infection of the tissue under the epidermis of a plant leaf
(D) Infection of the plant epidermis by a fungal mycelium

24 Which of the following defenses was not present before and formed as a result of infection by a pathogen?

(A) Thickening of the cell wall with lignin

(B) Formation of the waxy layer of the epidermis cells

(C) Formation of hairs on the outer cuticle of the plant

(D) Formation of tyloses

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25 Which of the following is found in the trunks of healthy trees and also forms after an infection?

(A) Gums

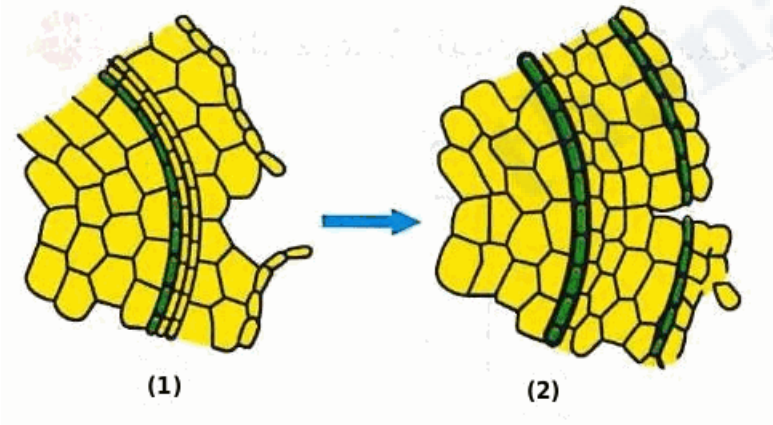
(B) Tyloses

(C) Cork

(D) Cellular immune structures

---

26 The opposite figure shows one of the plant tissues in a woody stem. What is the aim of the change from (1) to (2)?



(A) Protection from grazing animals

(B) Preventing the microbe from entering through the injured area

(C) Preventing the microbe from spreading to the neighbouring tissues

(D) Inhibiting the penetration of the microbe into the neighbouring cells

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27 In what is the formation of tyloses similar to the deposition of gums?

(A) Shape and structure

(B) The place of formation

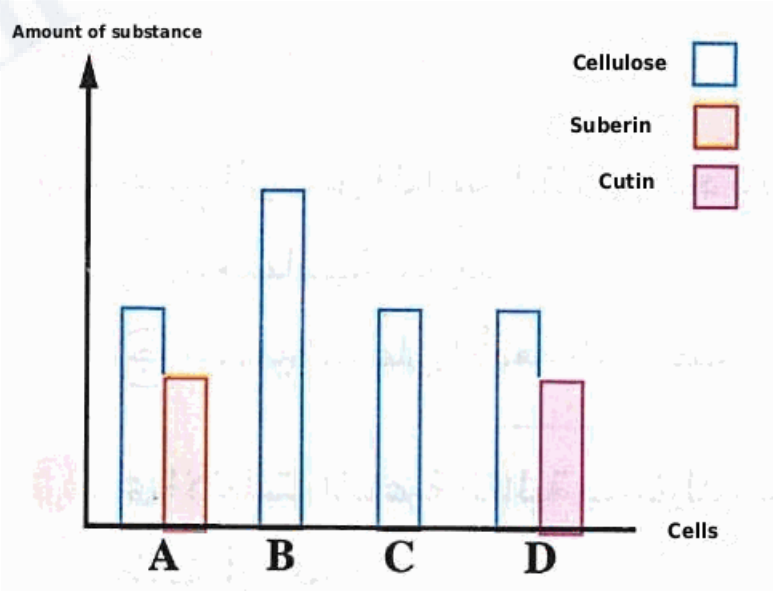
(C) Forming after infection

(D) Preventing the microbe from entering

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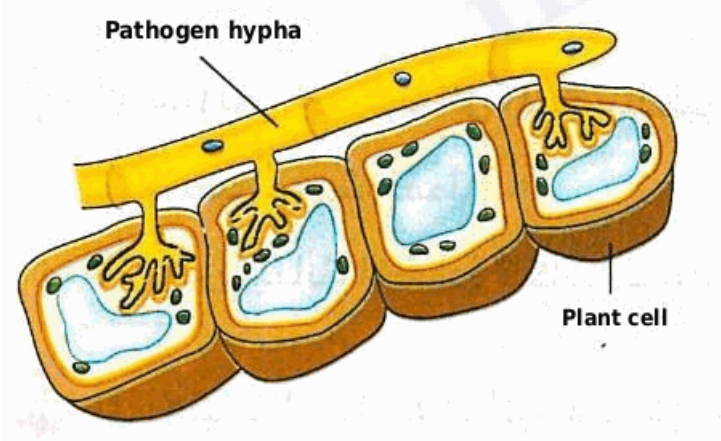
28 The opposite graph shows the amount of substances in the walls of some plant cells. Study it, then answer:

Which plant cells are formed again in response to cutting or tearing of a tree trunk?



(A) Cell A (B) Cell B (C) Cell C (D) Cell D

29 Which of the following is the immune response of the plant shown in the opposite figure?



(A) Getting rid of the infected tissue

(B) Deposition of gums

(C) Swelling of the cell walls

(D) Surrounding the pathogen with an insulating sheath

30 Which immune route does the plant use when it fails to eliminate the cause of the disease?

(A) Formation of tyloses (B) Hypersensitivity

(C) Deposition of gums (D) Forming an insulating sheath

31 Which of the following properties of the cell wall makes it play a double immune function for the plant?

(A) It is made mainly of cellulose and may be thickened with lignin

(B) Suberin is deposited on it and it prevents pathogens from entering and spreading

(C) Hard substances are deposited on it and some changes in its shape happen as a result of invasion

(D) It supports most living plant cells and surrounds the microbe with an insulating sheath

---

32 Some pathogenic fungi produce an enzyme called cutinase, an enzyme that breaks down cutin, which makes it easier for the fungus to penetrate the plant cells. Which of the following defenses will the plant use when infected?

(A) Surrounding the fungal hyphae with an insulating sheath

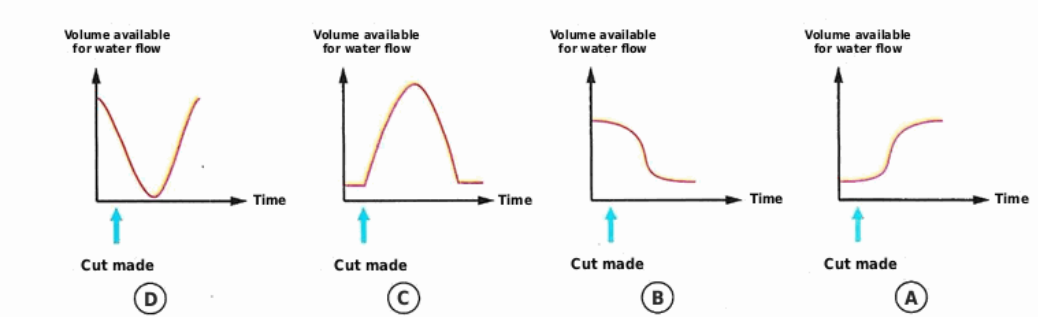
(B) Formation of cork

(C) Increasing the thickness of the cuticle

(D) Deposition of gums

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33 Which of the following graphs shows the volume available for water flow inside a xylem vessel that was cut in a plant?



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34 The effect of all the following immune defenses increases with an increase in the concentration of receptors except .....

(A) Hypersensitivity

(B) Cellular immune structures

(C) Hairs on the outer cuticle

(D) Deposition of gums

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35 Which of the following immune mechanisms happens both when the plant is infected by a fungus through its roots and by another fungus through its leaves?

(A) Formation of cork
(B) Formation of tyloses
(C) An increase in the concentration of receptors
(D) Deposition of gums

36 Which of the following stimulates the natural immune defenses of the plant when it is infected by a microbe?

(A) Receptors only
(B) The kind of pathogen only
(C) Antimicrobial proteins and receptors
(D) Receptors and the kind of pathogen

37 Which of the following defense mechanisms CANNOT happen against plant pathogens carried by water inside the plant?

(A) An increase in the concentration of receptors
(B) Formation of tyloses
(C) Hypersensitivity
(D) Forming an insulating sheath around the microbe

38 Which of the following is NOT one of the first line of defense means in the plant?

(A) Formation of cork
(B) Formation of gums
(C) Formation of phenols
(D) The presence of cutin

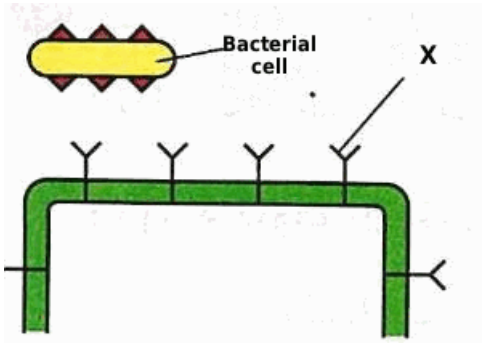
39 Which of the following is needed to activate the biochemical immunity of the plant against a certain pathogen?

(A) Detoxification enzymes
(B) Plant receptors
(C) Antimicrobial chemical substances
(D) Antimicrobial proteins

40 When the plant is infected by a pathogen, which of the following immune defenses kills the microbe?

(A) The waxy layer on the leaves
(B) Lignin on the cell wall
(C) Phenols
(D) Blocking of some xylem tracheids

41 From the opposite figure, which of the following statements is NOT correct about (X)?



(A) Its concentration increases on infection by pathogenic bacteria

(B) It inhibits the formation of antimicrobial proteins

(C) It increases the concentration of phenols during infection

(D) It activates the inherited immune system of the plant

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42 Glycosides are similar to canavanine in all of the following except that they .....

(A) Are means of the second line of defense

(B) Are toxic substances to microorganisms

(C) Respond to the effect of receptors

(D) Have the same chemical structure

---

43 Which of the following immune defenses kills pathogenic bacteria directly?

(A) Hypersensitivity

(B) Tyloses

(C) Glycosides

(D) Detoxification enzymes

---

44 Which of the following can go with the hypersensitivity mechanism in an infected plant?

(A) Formation of tyloses

(B) Swelling of the cell walls

(C) Formation of cork

(D) An increase in the concentration of phenols

---

45 Which of the following immune defenses forms only after the plant is infected by a microbe?

(A) Receptors

(B) Canavanine

(C) Cephalosporin

(D) Detoxification enzymes

---

46 How correct are the two following statements?

Phenols are toxic chemical compounds that kill pathogens.

Their presence always shows that the plant is infected.

(A) Both statements are correct

(B) The first statement is correct and the second is wrong

(C) Both statements are wrong

(D) The first statement is wrong and the second is correct

---

47 How do the receptors in plant cells work as a means of defense?

(A) They work as an insulator to stop the spread of the pathogen to other parts

(B) They bind to the chemical substances produced by the plant to increase their effectiveness

(C) They bind to the protein molecules on the surface of pathogens and stimulate the immune response

(D) They bind to the chemical substances in the plant cells to form gums

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48 Pathogens produce substances harmful to the plant. Which of the following will the plant produce to limit this harm without affecting the pathogen?

(A) Cephalosporin

(B) Glycosides

(C) Detoxification enzymes

(D) Receptors

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49 In what are receptors similar to detoxification enzymes?

(A) They form on infection

(B) They have a high concentration during infection by the microbe

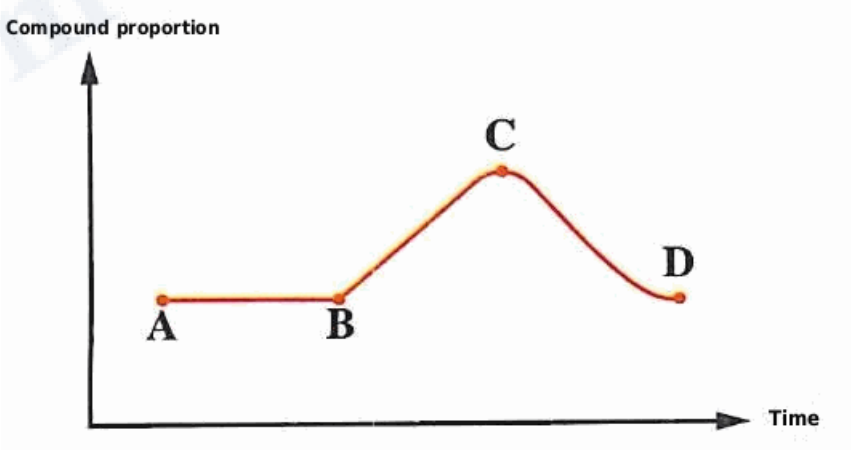
(C) They are pre-existing in the plant

(D) They have a direct effect against the microbe

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50 The opposite graph shows the change in the proportion of a compound in the plant when it is infected by a microbe. Answer:

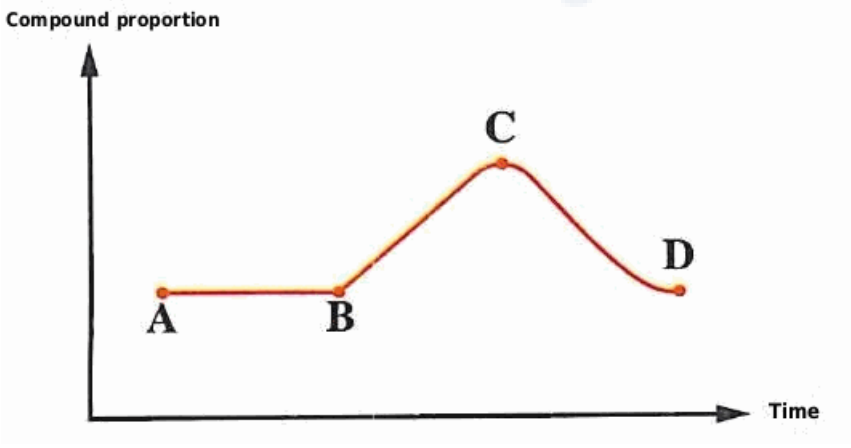
What do you expect this compound to be?



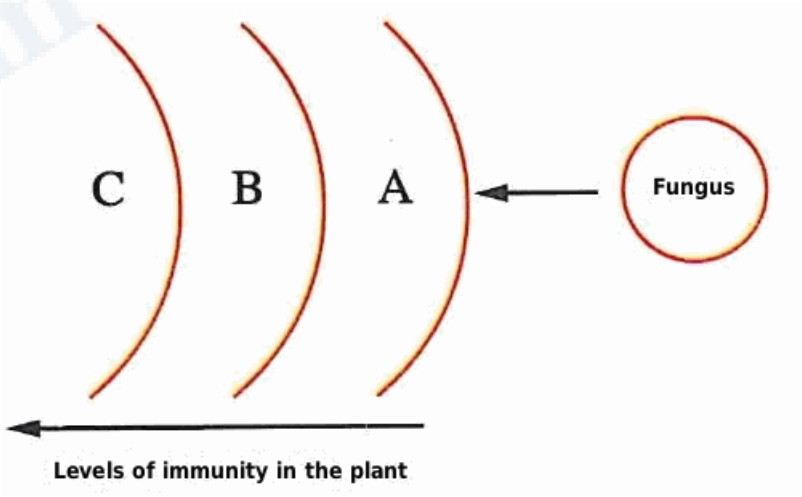
(A) Receptors
(B) Detoxification enzymes
(C) Cellulose
(D) Cutin

51 The opposite graph shows the change in the proportion of a compound in the plant when it is infected by a microbe. Answer:

At which point was the plant infected?



52 The opposite diagram shows the levels of immunity in the plant when its leaves are attacked by a fungus. Which of the following choices can correctly show the immune defenses at levels (A), (B) and (C), respectively?



(A) The outer cuticle of the plant / surrounding the fungal mycelium with an insulating sheath / detoxification enzymes

(B) The outer cuticle of the plant / formation of tyloses / formation of cork

(C) The cell wall / formation of cork / formation of tyloses

(D) The cell wall / deposition of gums / detoxification enzymes

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53 Which of the following has no effect on pathogens?

(A) Phenols (B) Glycosides

(C) Canavanine (D) Detoxification enzymes

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54 The leaves of some plants produce inhibitors that stop the germination of the reproductive structures of some pathogens, as a mechanism to defend themselves against .....

(A) Insects (B) Fungi (C) Viruses (D) Algae

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55 If you know that tannic acid is an organic chemical compound produced by some plants, which causes contraction of the mucous tissues such as the tongue and the inside of the mouth when eaten, what kind of immune response does this plant have?

(A) Pre-existing structural

(B) Structural formed in response to infection

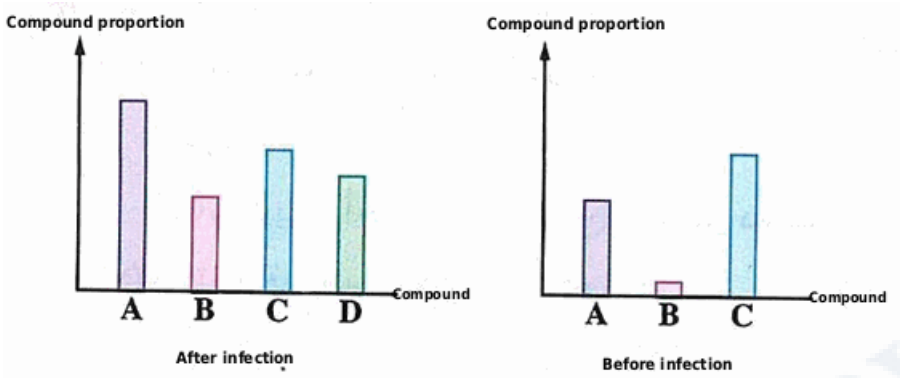
(C) Pre-existing biochemical

(D) Biochemical formed in response to infection

56 Which of the following immune defenses disappears when the danger of infection is over?

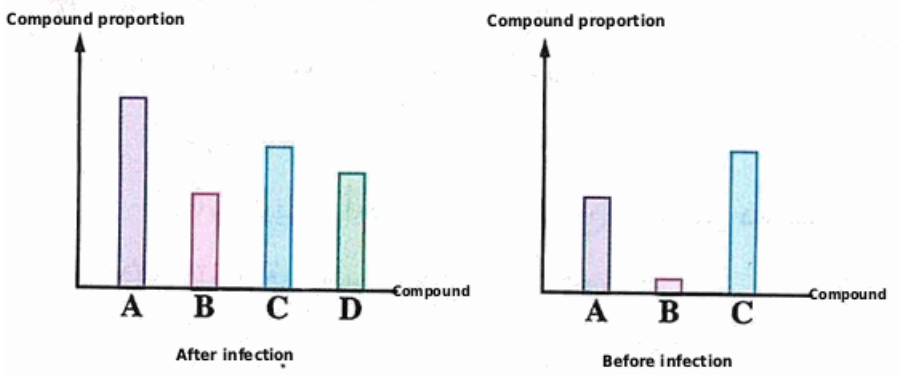
(A) Cork
(B) Receptors
(C) Detoxification enzymes
(D) Tyloses

57 The two opposite graphs show some immune defenses in the plant before and after infection by a microbe. Study them, then answer:
What may the letter (A) refer to?



(A) Cutin
(B) Detoxification enzymes
(C) Receptors
(D) Tyloses

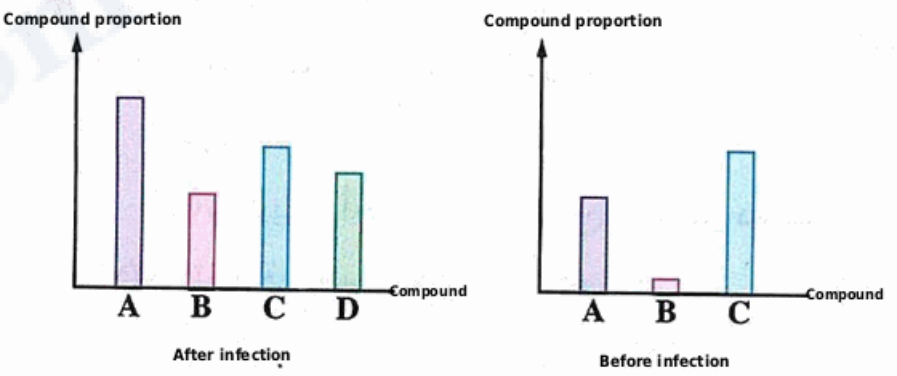
58 The two opposite graphs show some immune defenses in the plant before and after infection by a microbe. Study them, then answer:
What may the letter (B) refer to?



(A) Detoxification enzymes
(B) Gums
(C) Tyloses
(D) Canavanine

59 The two opposite graphs show some immune defenses in the plant before and after infection by a microbe. Study them, then answer:

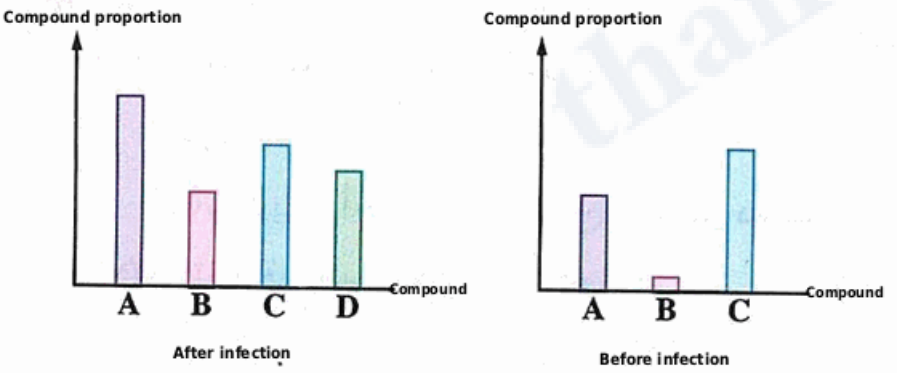
What does the letter (C) refer to?



(A) Cutin (B) Gums (C) Receptors (D) Tyloses

60 The two opposite graphs show some immune defenses in the plant before and after infection by a microbe. Study them, then answer:

What does the letter (D) refer to?



(A) Receptors (B) Thorns

(C) Lignin (D) Detoxification enzymes

61 What is the similarity between tyloses and detoxification enzymes?

(A) The kind of immunity

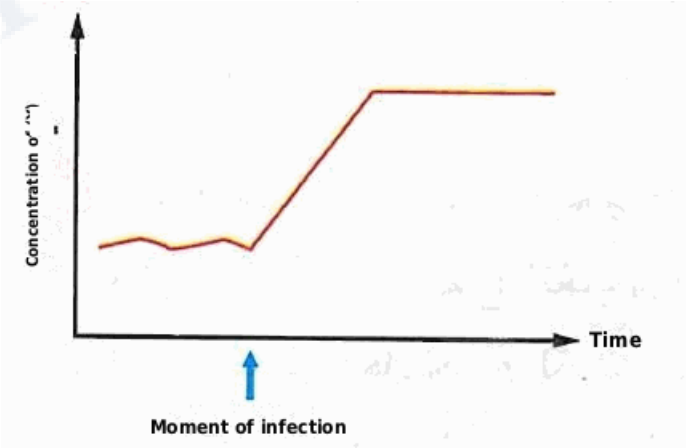
(B) Being present only after infection

(C) Preventing the pathogen from entering

(D) Being present before infection and increasing after it

62 The opposite graph shows the rate of change in the concentration of substance (Y) in the bean plant when it is infected by a microbe. Answer:

Substance (Y) is one of the ..... immune defenses in the plant.



(A) Innate

(B) Pre-existing structural

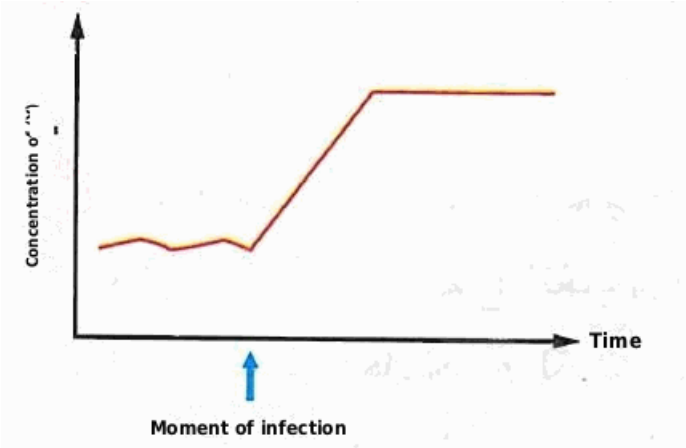
(C) Structural formed in response to infection by a microbe

(D) Biochemical

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63 The opposite graph shows the rate of change in the concentration of substance (Y) in the bean plant when it is infected by a microbe. Answer:

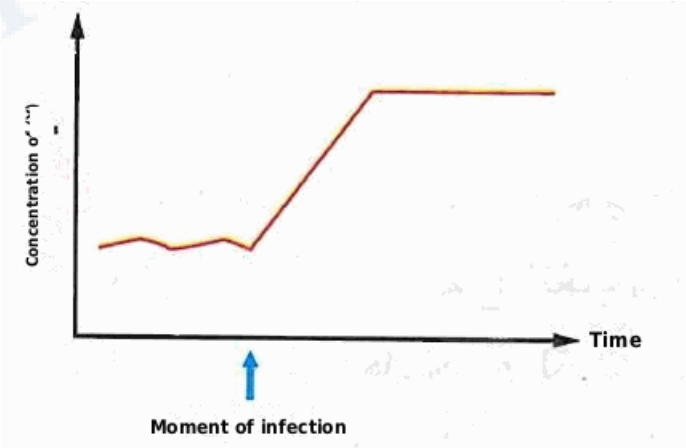
Which of the following do you expect substance (Y) to be?



(A) Tyloses (B) Gums (C) Lignin (D) Canavanine

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64 The opposite graph shows the rate of change in the concentration of substance (Y) in the bean plant when it is infected by a microbe. Answer:
Which of the following statements applies to substance (Y)?



(A) It is present in the plant and decreases after infection
(B) It is present in the plant and increases after infection
(C) It recognizes the microbe and activates its action
(D) It breaks down the toxins secreted by the microbe

---

65 A plant suffers from a clearly fast spread of infection by a virus, with loss of control over this spread. Which of the following immune defenses does this plant use?

(A) Formation of non-protein amino acids
(B) Formation of detoxification enzymes
(C) Formation of phenols
(D) Hypersensitivity

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66 From the two opposite figures, answer:
What chemical structure is shown by the letter (X)?



(A) Monosaccharides
(B) Fatty acids
(C) Nucleic acids
(D) Amino acids

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67 From the two opposite figures, answer:

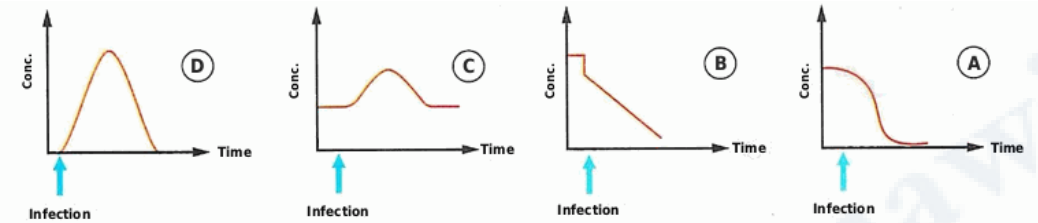
What may the letter (Y) show?



(A) Cellulose or lignin only
(B) Suberin or cellulose only
(C) Cutin or lignin only
(D) Lignin, suberin or cutin

---

68 Which of the following graphs shows the concentration of receptors in a plant when it is infected by a microbe?



Essay questions — 6 questions

1. If you know that a blood clot forms as a result of a wound or tearing of the blood vessels, which immune defense in the plant is similar in function to the blood clot?

2. A part of the plant was cut, then the effect of this on the rate of rise of water and salts inside the xylem tissue was observed, and no change was noticed. Which structural immune mechanisms may the plant use in this case?

3. When a plant is infected, it makes a certain immune response. The following table shows the change in the rate of water absorption by the plant flowing inside the xylem tissue after the infection:
   At the time of infection: 25 cm^3 / min, after 24 hours: 20 cm^3 / min, after 48 hours: 15 cm^3 / min, after 72 hours: 15 cm^3 / min.
   (1) What is the immune response of the plant? And what is its kind?
   (2) What is the importance of this immune response?

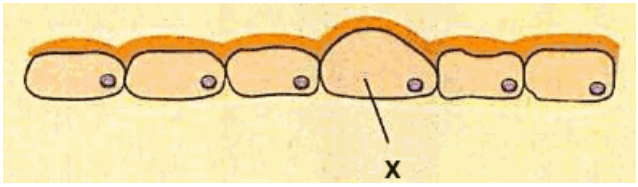
4. Although the pathogen penetrated the tissues of a plant and infection happened, this plant made no immune response. A defect in which immune defense is the reason for this? Explain your answer.

5. What is the first immune response the tomato plant uses when a fungus invades its leaves through the stomata?

6. What immune response does the bean plant use to prevent the spread of a pathogenic fungus that invaded its tissues some time after the infection started?

Past exam questions — 24 questions

1 The opposite figure shows part of the epidermis of a plant stem. What kind of immune response appears in (X)? (Trial exam / May 2021)



(A) Biochemical, formed after infection
(B) Biochemical, pre-existing
(C) Structural, formed after infection
(D) Structural, pre-existing

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2 All of the following result from the absence of cutin from the cuticle of clover stems except ..... (Sample exam 2025)

(A) Invasion of the cuticle cells by the pathogen
(B) Growth of fungi on the plant stem
(C) Formation of cork tissue to cover the stem
(D) Loss of a large amount of water

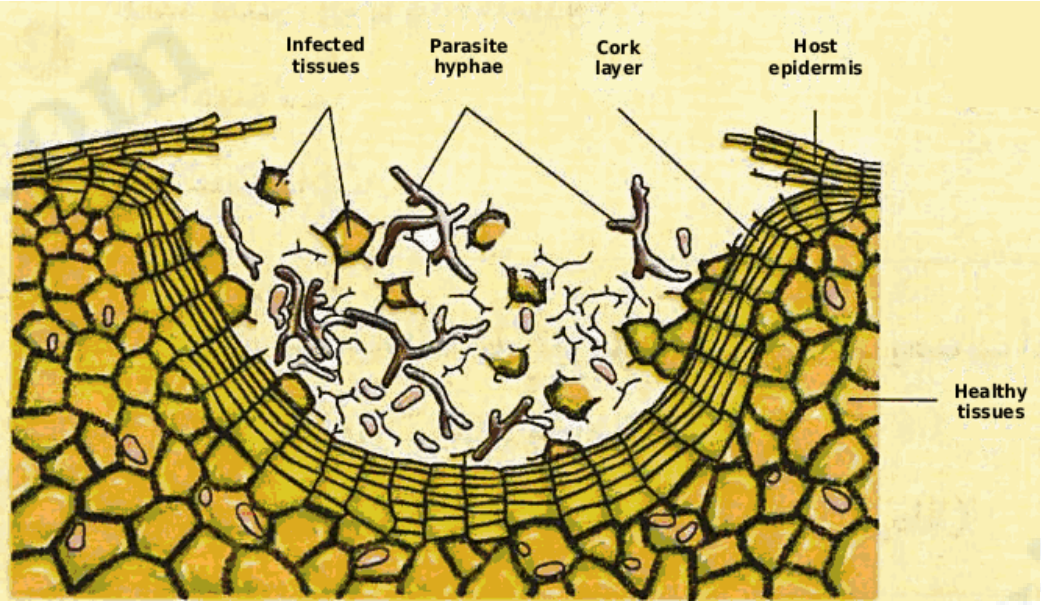
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3 Which of the following does NOT prevent the penetration of plant cell walls by the pathogen? (Sample exam 2025)

(A) Swelling of these walls
(B) Deposition of lignin on these walls
(C) Formation of tyloses on these walls
(D) Deposition of cutin or suberin on these walls

---

4 Which of the following is a scientific reason for the fungal hyphae not invading the plant tissues in the opposite figure? (Sample exam 2025)



(A) Adding more suberin to the cork cells

(B) Forming cork again in the infected area

(C) Swelling of the cell walls of the cork cells

(D) Weakness of the fungal hyphae

---

5 Which of the following does the plant do to prevent the spread of a fungus after failing to eliminate it? (2nd session 2025)

(A) Getting rid of the infected cells

(B) Increasing the thickness of the cell wall of the cuticle

(C) Deposition of gums

(D) Formation of cork

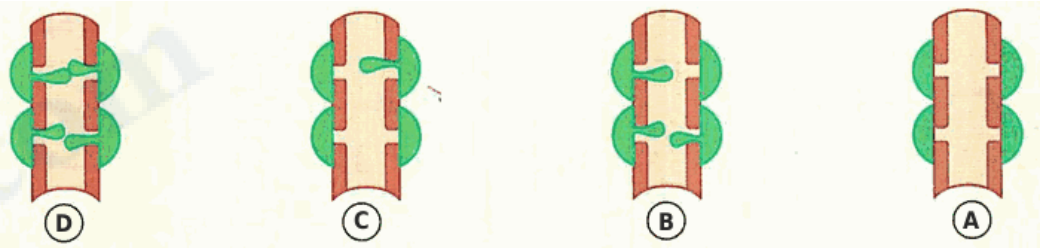
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6 Which plant tissue has a role in limiting the spread of microbes with the water stream inside the xylem vessels? (Sample exam 2026)

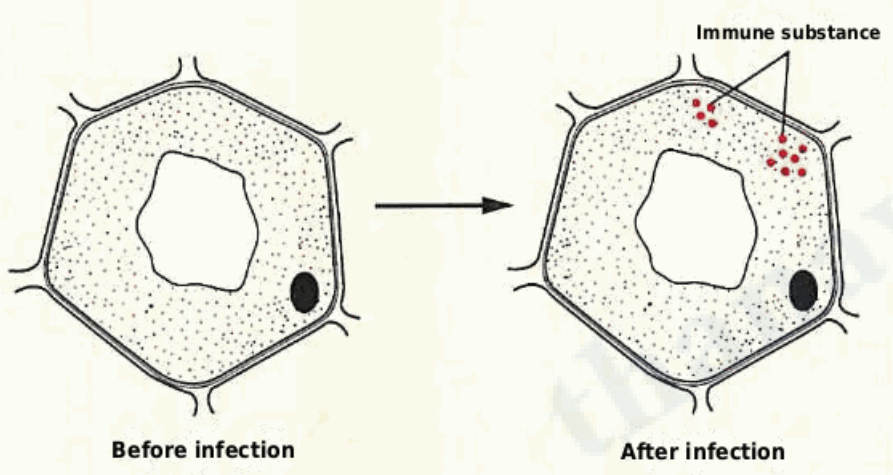
(A) Parenchyma (B) Collenchyma (C) Cork (D) Cuticle

---

7 Four plants of the same kind got a deep wound at the same time. Which of the following figures shows the cells of the plant that have no receptors? (Trial exam / May 2021)



8 The two opposite figures show a plant cell before and after infection. Study them, then deduce: what immune substances formed inside the cell? (Trial exam / May 2021)



(A) Antimicrobial proteins
(B) Receptors
(C) Cephalosporin
(D) Canavanine

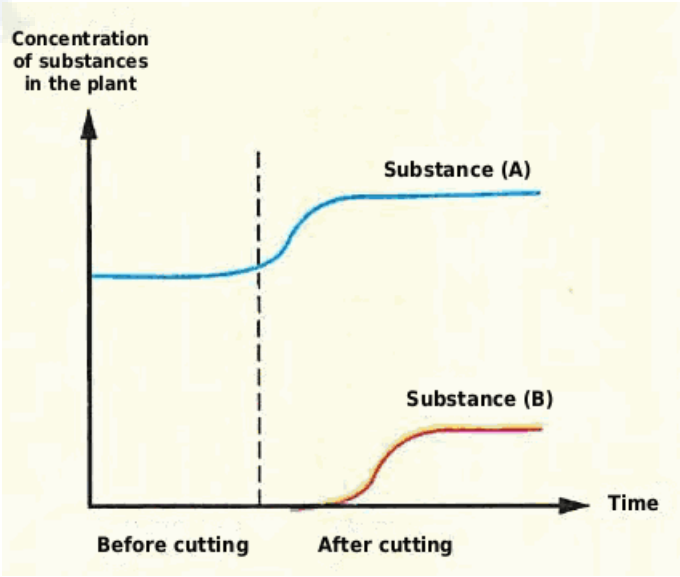
9 Some kinds of beans that resist fungi form a substance that prevents the germination of fungal spores. To which of the following immune mechanisms does this substance belong? (Trial exam / June 2021)

(A) Phenols
(B) Non-protein amino acids
(C) Receptors
(D) Detoxification enzymes

10 Which of the following immune methods has no effect on a microbe that infects the leaves of a plant through the stomata? (1st session 2021)

(A) Forming tyloses to close the xylem vessel
(B) Secreting toxic substances such as phenols
(C) Killing the infected leaf cells (hypersensitivity)
(D) Surrounding the microbe and preventing its growth

11 The opposite graph shows the concentration of substance (A) found in the cells of a plant and substance (B) that formed at the place where a branch of the plant was cut. What is the relation between substances (A) and (B)? (1st session 2021)



(A) (A) formed in response to the effect of (B)

(B) (A) and (B) are acquired structural immunity

(C) (A) and (B) are biochemical immunity

(D) (B) formed in response to the effect of (A)

---

12 The safe compound «chitosan» induces the immune response in the cells of potato tubers infected with dry rot. Which mechanism is similar in its action to the role of this compound? (2nd session 2021)

(A) Receptors

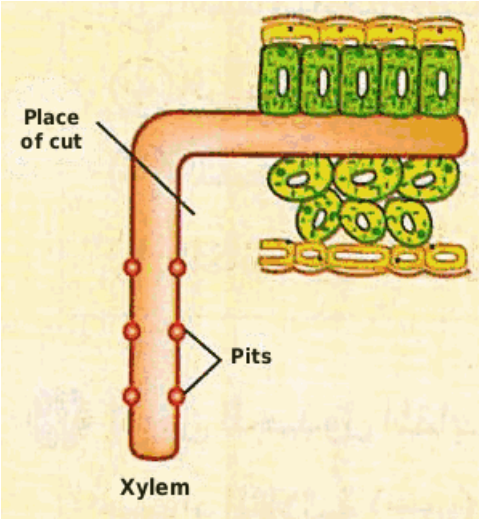
(B) Cephalosporin

(C) Defense boosting

(D) Detoxification enzymes

---

13 If you know that a plant leaf was cut as in the opposite figure, which of the following statements is NOT correct in this case? (2nd session 2021)



(A) An increase in the levels of receptors in the plant

(B) Swelling of the walls of the xylem vessels near the cut

(C) Tyloses form through the pits

(D) An increase in the secretion of glycosides and phenols

---

14 Which of the following is NOT affected by an increase in the concentration of receptors in the plant? (2nd session 2021)

(A) Formation of tyloses

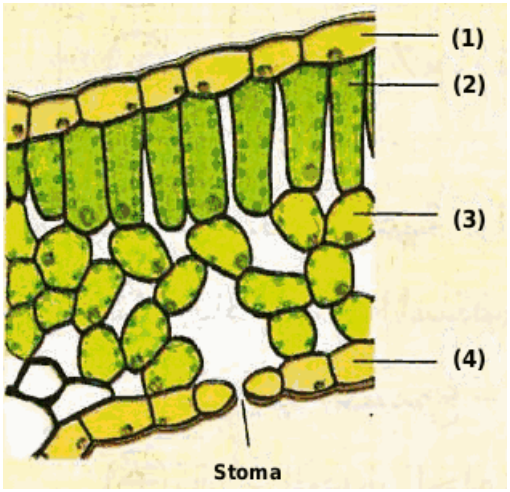
(B) The thickness of the cutin layer

(C) Getting rid of the infected tissues

(D) Swelling of the cell walls

---

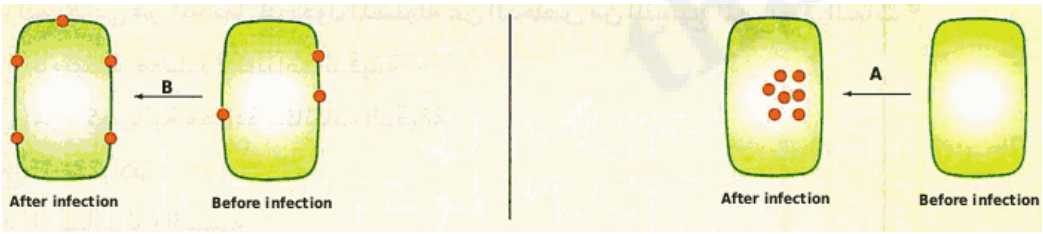
15 In front of you is a section in a plant leaf. Which of the following immune substances can be found in cells (2) and (3)? (1st session 2022)



(A) Cutin and phenols
(B) Cellulose and cutin
(C) Detoxification enzymes and cutin
(D) Receptors and cephalosporin

---

16 Notice the change in each of the two plant cells (A) and (B) as a result of infection:
What is the substance in (A) and (B), respectively? (2nd session 2022)



(A) Canavanine / antimicrobial proteins
(B) Phenols / cephalosporin
(C) Detoxification enzymes / receptors
(D) Cephalosporin / glycosides

---

17 A plant was cut in a certain area, which led to harmful bacteria entering the plant. When the rate of water flow inside the xylem tracheids was measured during 3 days after the infection, the results were as in the following table:
At the time of infection: 3 cm^3/min, day one: 2.5, day two: 3.5, day three: 3
Which mechanisms will be activated as a result of the infection? (2nd session 2022)

(A) Receptors, tyloses
(B) Detoxification enzymes, tyloses
(C) Receptors, cork formation
(D) Canavanine, the waxy layer

---

18 Study the following table, which shows the immune mechanisms of the three substances (X), (Y), (Z) that take place in plant cells, then decide: what is the correct order of the three mechanisms (X), (Y), (Z)? (Trial exam 2023)

(X): present before and after infection, its aim is stimulation.

(Y): not present before infection and present after it, its aim is neutralizing toxins.

(Z): present before and after infection, its aim is inhibiting growth.

(A) Receptors / antimicrobial proteins / glycosides

(B) Glycosides / antimicrobial proteins / receptors

(C) Antimicrobial proteins / glycosides / receptors

(D) Receptors / glycosides / antimicrobial proteins

---

19 Which of the following immune defenses happens before the other one? (Trial exam 2023, Sample exam 2025)

(A) Increasing the number of receptors - formation of the cell wall

(B) Deposition of gums - thickening of the stem epidermis with cutin

(C) Thickening of the cell wall with lignin - production of antimicrobial proteins

(D) Production of detoxification enzymes - swelling of the cell wall

---

20 Which substance is probably responsible for getting rid of the infected tissue in the plant? (1st session 2023)

(A) Antimicrobial proteins

(B) Antimicrobial chemical substances

(C) Receptors

(D) Detoxification enzymes

---

21 Which of the following is NOT one of the means of preventing the spread of pathogens to the cells and tissues of the plant? (2nd session 2023)

(A) Hypersensitivity of the plant

(B) Formation of tyloses

(C) Antimicrobial proteins

(D) Surrounding the fungal hyphae with an insulating cover

---

22 What is the similarity between the thorns covering the cuticle of the leaf and the receptors? (1st session 2024)

(A) They prevent pathogens from entering
(B) Their number increases after infection
(C) They are pre-existing in the plant
(D) They form after infection

23 Which of the following plant cells use both structural and biochemical immune mechanisms? (2nd session 2024)

(A) Leaf epidermis and sub-epidermis cells only
(B) Stem epidermis cells only
(C) The plant cell thickened with lignin only
(D) All living plant cells

24 Which of the following can be the difference between antimicrobial proteins and detoxification enzymes in plants? (1st session 2025)

(A) Their ability to react with toxins
(B) Their building units
(C) The plant species that produce them
(D) Their way of working against pathogens

Answer key and solutions

Multiple choice questions

1 D	2 D	3 B	4 B	5 D	6 D	7 C	8 D	9 B	10 D
11 D	12 B	13 B	14 D	15 B	16 B	17 B	18 C	19 C	20 B
21 B	22 D	23 A	24 D	25 C	26 B	27 C	28 A	29 D	30 B
31 C	32 A	33 B	34 C	35 C	36 A	37 D	38 C	39 B	40 C
41 B	42 D	43 C	44 D	45 D	46 B	47 C	48 C	49 B	50 A
51 B	52 A	53 D	54 B	55 C	56 C	57 C	58 D	59 A	60 D
61 B	62 D	63 D	64 B	65 D	66 D	67 D	68 C		

1 **Answer (D)**

Secreting toxins is the work of the microbe, not a stage of immunity.

2 **Answer (D)**

Cork cells form a layer that prevents the microbe from entering.

3 **Answer (B)**

The cell wall is always present, while tyloses and gums form after infection.

4 **Answer (B)**

Hairs are a structural barrier; they do not sense the presence of microbes.

5 **Answer (D)**

The cuticle (cutin) supports the plant and is structural immunity present before infection.

6 **Answer (D)**

The cell wall swells when the pathogen penetrates it directly.

7 **Answer (C)**

Letting water pass is not an immune role of the cell wall.

8 **Answer (D)**

Tyloses form inside the xylem vessels, which means the microbe reached the inside of the plant.

9 **Answer (B)**

Cracks are an open route; the microbe does not need to penetrate anything.

10 **Answer (D)**

Gums close the wounds, so they prevent the microbe from entering.

11 **Answer (D)**

Plant (3) has a thicker cuticle than plant (1), so its resistance is greater.

12 **Answer (B)**

The outer layer is treated by cork or gums, while tyloses form in the xylem.

13 **Answer (B)**

Gum forms only after infection.

14 **Answer (D)**

Root hairs have thin walls and no waxy cuticle.

15 **Answer (B)**

The cactus is protected by cutin and thorns.

16 **Answer (B)**

Gums and cork both isolate the infected area.

17 **Answer (B)**

The thick cuticle prevents the microbe from entering.

18 **Answer (C)**

Cutin covers the apple fruit, hairs the peach, and thorns the cactus.

19 **Answer (C)**

(X) is a xylem vessel, (Y) is tyloses inside it, and (Z) is the parenchyma cells around it.

20 **Answer (B)**

Tyloses block the vessels, so less water reaches the leaves and the stomata close.

21 **Answer (B)**

Part (4) concerns the direct penetration of the cell wall, so it is related to the cell wall.

22 **Answer (D)**

Tyloses appear inside the xylem vessels in the cross section of an infected stem.

23 **Answer (A)**

A cut in the xylem tissue stimulates the formation of tyloses, which block the tracheids.

24 **Answer (D)**

Tyloses form only after infection.

25 **Answer (C)**

Cork is found in healthy trunks and also forms after infection.

26 **Answer (B)**

Cork closes the cut area, so it prevents the microbe from entering through it.

27 **Answer (C)**

Both form only after infection.

28 **Answer (A)**

Cork forms in response to cutting, and the walls of its cells contain suberin (cell A).

29 **Answer (D)**

The plant cell surrounds the fungal hypha with an insulating sheath.

30 **Answer (B)**

The plant sacrifices the infected cells (hypersensitivity) to prevent the disease from spreading.

31 **Answer (C)**

The wall is present beforehand as a barrier, and it also responds by thickening and changing its shape during invasion.

32 **Answer (A)**

Cutinase breaks down the cuticle, so the plant isolates the fungal hyphae with a sheath.

33 **Answer (B)**

Tyloses block the vessel after the cut, so the volume available for water decreases.

34 **Answer (C)**

Hairs are a pre-existing defensive structure and are not affected by the receptors.

35 **Answer (C)**

The concentration of receptors increases with any infection, whatever the way the microbe enters.

36 **Answer (A)**

Receptors detect the microbe and stimulate the natural immunity.

37 **Answer (D)**

A microbe carried by water is inside the vessels, so it does not penetrate the cells to be surrounded by a sheath.

38 **Answer (C)**

Phenols are biochemical immunity of the second line of defense.

39 **Answer (B)**

Receptors detect the pathogen, so they activate the biochemical immunity against it.

40 **Answer (C)**

Phenols are toxic substances that kill the microbe.

41 **Answer (B)**

The receptor activates the formation of antimicrobial proteins; it does not inhibit it.

42 **Answer (D)**

Glycosides and canavanine are two substances with different chemical structures.

43 **Answer (C)**

Glycosides are toxic substances that kill the bacteria directly.

44 **Answer (D)**

Phenols increase with hypersensitivity, so they kill the infected cells.

45 **Answer (D)**

Detoxification enzymes form only after infection, when the toxin is present.

46 **Answer (B)**

Phenols are toxic to microbes, but they are also found in the healthy plant.

47 **Answer (C)**

Receptors bind to the surface proteins of the microbe, so they stimulate the immune response.

48 **Answer (C)**

Detoxification enzymes break down the toxins without affecting the microbe itself.

49 **Answer (B)**

The concentration of both receptors and detoxification enzymes rises during infection.

50 **Answer (A)**

Receptors are pre-existing; their concentration increases on infection and then decreases.

51 **Answer (B)**

The concentration starts rising at point B, and this is the moment of infection.

52 **Answer (A)**

First the cuticle, then isolating the fungus with a sheath, then detoxification enzymes inside.

53 **Answer (D)**

Detoxification enzymes break down the microbe's toxins but do not affect the microbe.

54 **Answer (B)**

Germination inhibitors affect the spores of fungi.

55 **Answer (C)**

Tannic acid is a chemical compound already present in the plant.

56 **Answer (C)**

Detoxification enzymes disappear when the danger is over, while cork and tyloses remain.

57 **Answer (C)**

A is present before infection and increases after it, like receptors.

58 **Answer (D)**

B is very small before infection and increases after it, like canavanine.

59 **Answer (A)**

C is almost constant before and after infection, like cutin.

60 **Answer (D)**

D appears only after infection, like detoxification enzymes.

61 **Answer (B)**

Both form only after infection.

62 **Answer (D)**

The concentration of substance (Y) rises after infection, and this is biochemical immunity.

63 **Answer (D)**

Canavanine is a biochemical substance, and the others are structural.

64 **Answer (B)**

Its concentration is low before infection and rises after it.

65 **Answer (D)**

Hypersensitivity kills the infected cells, so the spread of the virus stops.

66 **Answer (D)**

Cephalosporin and detoxification enzymes are both built of amino acids.

67 **Answer (D)**

(Y) is a substance that gives both support and structural immunity: lignin, suberin or cutin.

68 **Answer (C)**

Receptors are present in the healthy plant; their concentration rises on infection and then goes back to its level.

Essay questions

1 **Model answer**

Deposition of gums.

2 **Model answer**

Formation of cork or deposition of gums.

3 **Model answer**

(1) Formation of tyloses / a structural immune response formed in response to infection by a pathogen.

(2) It hinders the movement of pathogens from the infected parts to the other parts of the plant.

4 **Model answer**

The receptors, because they failed to detect the presence of the microbe and did not activate the plant's defenses.

5 **Model answer**

The receptors, as they detect the presence of the microbe and activate the plant's defenses; then the fungal hyphae attacking the plant are surrounded by an insulating sheath to prevent their spread from one cell to another.

6 **Model answer**

Hypersensitivity, by getting rid of the infected tissues.

Past exam questions

1	2	3	4	5	6	7	8	9	10
C	C	C	B	A	A	A	A	A	A
11	12	13	14	15	16	17	18	19	20
D	A	B	B	D	C	C	A	C	C
21	22	23	24						
C	C	D	C						

1 **Answer (C)**

(X) is a swelling in the wall of an epidermis cell, which is structural immunity formed after infection to inhibit the penetration of the pathogen.

2 **Answer (C)**

The absence of cutin makes it easier for the pathogen to invade and for fungi to grow, and increases water loss.

Formation of cork happens after infection and does not result from the absence of cutin.

3 **Answer (C)**

Tyloses form inside the xylem vessels to prevent the spread of the pathogen with the water stream; they do not prevent the penetration of the walls.

4 **Answer (B)**

The plant forms the cork layer again around the infected area, so it prevents the spread of the fungal hyphae.

5 **Answer (A)**

When the plant fails to eliminate the fungus, it gets rid of the infected cells (hypersensitivity), so it prevents its spread.

6 **Answer (A)**

The parenchyma cells next to the xylem vessels expand, forming tyloses that limit the spread of microbes.

7 **Answer (A)**

Without receptors the plant does not detect the infection, so no immune reaction forms, as in figure (A).

8 **Answer (A)**

The substance that formed inside the cell after infection is the antimicrobial proteins.

9 **Answer (A)**

Beans produce phenols that prevent the germination of fungal spores.

10 **Answer (A)**

A microbe that enters the leaves through the stomata does not reach the xylem vessels, so forming tyloses has no effect on it.

11 **Answer (D)**

(A) is found in the plant cells before the cut and its concentration increases after it (receptors).
(B) was not present and formed after the cut in response to (A) activating the plant's defenses.

12 **Answer (A)**

Chitosan induces the immune response like the receptors, which detect the infection and activate the plant's defenses.

13 **Answer (B)**

When the leaf is cut, receptors increase, tyloses form, and glycosides and phenols increase.
Swelling of the walls happens to the epidermis and sub-epidermis cells, not to the xylem vessels.

14 **Answer (B)**

The thickness of the cutin layer is pre-existing structural immunity and is not affected by the receptors.

15 **Answer (D)**

Cell (2) is an epidermis cell and (3) is a palisade cell; both are living cells that contain receptors and cephalosporin.

16 **Answer (C)**

In (A) a substance formed inside the cell after infection: detoxification enzymes.
In (B) a substance on the cell membrane whose number increased after infection: receptors.

17 **Answer (C)**

The change in the rate of water flow after infection shows that the receptors were activated, with a structural reaction, which is cork formation.

18 **Answer (A)**

(X) is present before and after infection for stimulation: the receptors.
(Y) forms after infection: the antimicrobial proteins.
(Z) is present before and after infection to inhibit growth: the glycosides.

19 **Answer (C)**

Thickening of the wall with lignin is pre-existing, while the production of antimicrobial proteins happens after infection.

20 **Answer (C)**

Receptors detect the presence of the microbe and activate the plant's defenses, including getting rid of the infected tissue.

21 **Answer (C)**

Antimicrobial proteins kill the pathogen or inhibit its growth; they do not work to prevent its spread between cells.

22 **Answer (C)**

Thorns and receptors are both present in the plant before infection.

23 **Answer (D)**

All living plant cells can use both structural and biochemical immune mechanisms.

24 **Answer (C)**

Antimicrobial proteins and detoxification enzymes differ in the plant species that produce them.