


Faculty of Science Botany & Microbiology Department		كلية العلوم قسم النبات والميكروبيولوجي
Actinomycetes (472 B) Time: Two hours Total degree: 50 marks	Second semester exam - the academic year 2020/2021 Fourth Level Exam date: Friday, 17/6/2022	

Q1: Select the most correct answer of the following [20 Marks "One mark for each"]

- Actinomycetes are long chain-forming bacteria resembles in structure with:
A. Fungi B. Algae C. Gymnosperm D. angiosperm
- The habitat for the actinomycetes:
A. anal canal B. genital tract C. oral cavity D. skin
- Actinomycetes are known as:
A. fungi B. algae C. true bacteria D. eubacteria
- The Actinomycetes that caused abscesses in the brain and kidney in immunodeficient patients are:
A. *Actinomycetes israelii* B. *Nocardia asteroides* C. *M. marinum* D. *M. leprae*
- Which of the following is not one of the infections discussed in class of actinomycetes genera?
A. Dental plaque B. Nocardiosis C. Vaginosis D. Actinomycosis
- Actinomycetes form branches or filaments called
A. Pili B. Hyphae C. Glycocalyx D. Flagella
- Which of the following are not true regarding actinomycetes?
A. Sometimes called thread bacteria
B. In composting they give off an earthy smell
C. Are primary decomposers of woody stems, newspapers and bark
D. Actinomyces is the most numerous of all actinomycetes
- Actinomycosis is mainly caused by
A. *Actinomyces asteroides* B. *Nocardia asteroides*
C. *Actinomyces israelii* D. *Actinomyces viscosus*

9. What is the most common type of actinomycosis?
 A. Thoracic B. Abdominal C. Cervicofacial D. Genital
10. Which type of actinomycosis is caused by aspiration into lung and is an extension of cervicofacial form?
 A. Lower jaw B. Thoracic C. Genital D. Abdominal
11. Which of the following is/are used in the treatment of actinomycosis?
 A. Surgical debridement B. Tetracycline C. Penicillin G D. Sulfamethoxazole
12. Nocardiosis is caused by which of the following?
 A. *Actinomyces nocardia*
 B. *Nocardia asteroides*
 C. *Actinomyces asteroides*
 D. *Nocardia actinomyces*
13. Which of the following is/are risk factors for nocardiosis?
 A. Chronic steroid therapy B. Cancer C. Organ transplant D. HIV/AIDS
14. Which of the following are appropriate treatments for nocardiosis?
 A. Cotrimazole B. Surgical debridement C. Penicillin G D. Sulfadiazine
15. *Actinomyces viscosus* attach to enamel surface via
 A. Pili B. Extracellular polysaccharides C. Fimbriae D. Sugars on the teeth
16. Colonies resembling molar teeth are produced by
 A. *Nocardia brasiliensis*
 B. *N. asteroides*
 C. *Actinomyces israelii*
 D. *Actinomadura madurae*
17. *Frankia* in liquid culture produce:
 A. Vegetative hyphae. B. Multilocular sporangia. C. Spores D. All the above
18. *Frankia* produce glutamate as a final product from the operation of:
 A. Nitrogenase B. Glutamine synthetase C. Glutamate synthase D. All the above
19. Classical approaches for classification of actinomycetes:
 A. Aerial Mass colour.
 B. Reverse side pigments
 C. Spore chain morphology.
 D. All these

20. Streptomyces are:

- A. All strict anaerobes
- C. 1.5-5.0 μm in diameter

- B. Cell wall type III
- D. Predominantly found in soil

Q2: Answer by True (T) or False (F)

[30 Marks "One mark for each"]

- 21. *Streptomyces somaliensis* cause actinomycetoma infection of subcutaneous tissues in humans. ()
- 22. Tetracyclines bind to the 30S subunit of microbial ribosomes. They inhibit protein synthesis by blocking the attachment of charged aminoacyl-tRNA to the B site on the ribosome. ()
- 23. Actinomyces require CO_2 for best growth. ()
- 24. Thoracic actinomycosis commences in the lung, because of aspiration of *Streptomyces* from the mouth. ()
- 25. Pelvic actinomycosis may be mistaken for malignancy. ()
- 26. Diagnosis of actinomycosis occur by open biopsy or needle aspiration. ()
- 27. *Actinomyces israelii* form spider colonies that resemble molar teeth. ()
- 28. *Actinomyces* are sensitive to many antibiotics, because the penetration of drugs into the densely fibrotic diseased tissue is high. ()
- 29. Antibiotics in actinomycetes as aminoglycosides and metronidazole required when concomitant organisms are present. ()
- 30. *Corynebacterium diphtheriae* reproduce by binary fission and snapping division. ()
- 31. *Arthrobacter* spp. are soil inhabitants coccoid when well fed and rods cells when hungry. ()
- 32. Actinomycetes play important role in mineralization of inorganic matter. ()
- 33. Diphtheria produces exotoxin that damages organs and causes of dead tissue in mouth. ()
- 34. Tetracycline used to treat acne and cholera. ()
- 35. *Streptomyces* play a majore role as plant pathogens. ()
- 36. Nocardiosis has a low mortality rate. ()
- 37. *Mycobacterium leprae* cause leprosy to human an animal. ()
- 38. Tubercules are small, soft nodules formed when macrophages surround. ()

39. Streptomycin was the first effective antibiotic against TB. ()
40. Mycobacteria all produce mycosides- long-chain fats, very hydrophilic and wax-like. ()
41. Cord factor is one long chain alcohol groups hooked together by a disaccharide. ()
42. *Actinomyces naeslundii* can produce sulfur granule. ()
43. *Nocardia* has wide infection range colonize, mycetoma, systemic, pulmonary. ()
44. *Streptomyces* produce antifungal compounds including nystatin from *Streptomyces nodosus*. ()
45. Scab symptoms are usually roughly circular, raised, tan to brown, corky lesions. ()
46. Chloramphenicol is a bactericidal antimicrobial. derived from *Streptomyces venezuelae* and It is active against *Pseudomonas aeruginosa*. ()
47. Frankia is a versatile N₂ fixing actinobacteria. ()
48. Actinomycetes colonies are opaque, dark in the center, and have an irregular, fuzzy edge of hyphal appearance. ()
49. *Streptomyces* require a lower water potential for growth like other soil bacteria. ()
50. The main risk factors for nocardiosis are weakened immune system or chronic lung disease. ()

Good luck

Dr. Amal Danial

**Part I: Fungal Symbiosis: Answer the following questions: Q1, Q2****Q1: Choose the correct answer: (10 marks) (20 questions)**

- Monotropoid plants obtain carbon from photosynthetic plants through.....
 (A) Mycorrhizal hyphae (B) Mycoheterotrophic plants (C) Mantel
- Reproductive hyphae that develop after colonization of roots.
 (A) Entry points (B) Arbuscules (C) Fertile spores
- Endomycorrhiza are included
 (A) Arbutoid (B) Ericoid (C) Ectendomycorrhiza
- Asexual reproduction in lichen as a small outgrowth of the thallus is called.....
 (A) Isidia (B) Soredia (C) Perithecium
- The genus do not form intraradical vesicles.
 (A) *Gigaspora* (B) *Scutellospora* (C) Both A and B
-fungi can be characterized by presence of a thin mantle and intracellular penetration into root cortical cells.
 (A) Orchids (B) Ectomycorrhizal (C) Ectendomycorrhizal
- Root of ericoid mycorrhiza consists of vascular cylinder and.....
 (A) Cortical cells (B) Enlarged epidermal layer (C) Both A and B
- The level of association in facultative mycorrhizal plants is dependent on.....
 (A) Soil fertility (B) Mycorrhizal species (C) Both A and B
- The development of hyphae between root cells to form a complex highly branched structure called
 (A) Mantel (B) Hartig net (C) Extraradical mycelium
- The host cell nucleus in ectendomycorrhizal plants is usually surrounded by.....
 (A) Intercellular hyphae (B) Golgi-bodies (C) Hyphal complex
- Ericoid fungi can obtain that bound in organic matter.
 (A) Nitrogen (B) Carbon (C) Phosphorus
- Mycorrhizal fungi colonizing achlorophlous plants the host cell walls.
 (A) Never penetrate (B) Degrade (C) Colonized
- In *Paris*-type of arbuscules, spread intracellularly.
 (A) Coiled hyphae (B) Fine branched (C) Both A and B
- is present in one or more layers of mycorrhizal spores and often exists in a complex arrangement of fibrils.

- (A) Lipids (B) Chitin (C) Proteins
 15. The middle structure of foliose lichen is composed of
 (A) Medulla (B) The algal layer (C) Both A and B
 16. It describes interactions where the health of one species has absolutely no effect whatsoever on that of the other.
 (A) Neutralism (B) Commensalism (C) Mutualism
 17. Monotropoid mycorrhizal peg forms from that enters the cell through the outer tangential wall.
 (A) Outer mantle (B) Inner mantle (C) Intracellular hypha
 18. The asymbiotic stage is sometimes referred to as the of the AM fungal cycle.
 (A) Resting stage (B) Dormancy period (C) Both A and B
 19. It is possible that nutrients might be released from the mycorrhizal fungus into the root cell at the time of arbuscule
 (A) Degeneration (B) Degradation (C) Both A and B
 20.edges flat, unlobed and closely attached to substrate.
 (A) Crustose (B) Fruticose (C) Foliose

Q2: True (✓)-False (X) Questions: (15 marks)(15 questions)

21. Commensalism is a non-mutual symbiotic relationship in which two organisms that are unrelated, usually co-exist over the lifetime of one of the individuals. ()
 22. Over 80% of plant species are associated with mycorrhizal fungi, of which shoot colonized by different mycorrhizal internal structure. ()
 23. In ectendomycorrhizal plants most of the cortex is occupied by Hartig net hyphae. ()
 24. Arbutoid mycorrhizal fungi have the ability to protect their hosts from toxic levels of heavy metals. ()
 25. Carbohydrates pass from conifer to *Monotropa* via their common mycorrhizal partner, as is termed a source-sink. ()
 26. Tripartite associations found in orchid plants, as they involve the orchid, the ectendomycorrhizal fungus and the ectomycorrhizal host plant. ()
 27. Arbuscular mycorrhizas were classified in the phylum Glomeromycota under the family Endogonaceae due to their resemblance with *Endogone* species. ()
 28. Fruticose lichens are either shrub-like small mounds, growing up from the ground, or beard-like, small tangles, attached to the substrate only at their bases. ()
 29. Hyphal bridges as extraradical mycelium occur between roots of adjacent plants and can act as a mechanism for the transfer of nutrients between hosts. ()
 30. Pegs of monotropoid mycorrhiza surrounded by finger-like projections of fungus-derived wall material. ()

31. The presence of rough endoplasmic reticulum and balloon-like golgi equivalents in AMF spores act as storage compartments. ()
32. The trehalose fungal sugar, is translocated to pelotons where it is metabolized into other carbohydrates, including glucose. ()
33. Soredia often originate in the fungal layer and emerge through cracks or pores in the thallus surface. ()
34. Mycorrhizal species that form ectomycorrhizas with both gymnosperm and angiosperm tree species also colonize roots of *Arbutus* and *Arctostaphylos* to form orchid mycorrhizas. ()
35. Spore production in some AM fungal species is influenced by the host species/fungal species combination. ()

Part II: Bacterial Symbiosis

(25 marks) (25 questions)

Q3: Choose the correct answer:

36. What are opines?

A) Bacterial nutrients	B) Plant chromosomes
C) Plant nutrients	D) T-DNA ends
37. Free living anaerobic nitrogen fixing bacteria.

A) <i>Rhizobium</i>	B) <i>Clostridium</i>
C) <i>Frankia</i>	D) <i>Azotobacter</i>
38. Which aquatic fern performs nitrogen fixation?

A) <i>Rhizobium</i>	B) <i>Nostoc</i>
C) <i>Azolla</i>	D) <i>Gunnera</i>
39. Cyanobacteria can form a unique endosymbiosis with.....

A) <i>Gunnera</i>	B) Herbs
C) Legume	D) Alder plants
40. Nitrogenase enzyme basically works as a.....

A) Oxidation	B) Both
C) Reduction	D) None
41. For function of nitrogenase enzyme requires.....

A) FAD	B) NADH
C) ATP	D) FADH
42. released by legume roots and consider signal to rhizobia in the soil that a legume is present and ready to nodulate.

A) Flavonoids	B) Nod factor
C) Nodulins	D) Photosynthesis products
43. slow-growing bacteria, whose N-fixation and nodulation functions are encoded on their chromosome.

A) <i>Bradyrhizobium</i>	B) <i>Agrobacterium tumefaciens</i>
C) <i>Rhizobium</i>	D) <i>Vibrio fischeri</i>

44.are cylindrical nodules with a persistent meristematic zone.
 A) Indeterminate nodules B) Determinate nodules
 C) Both A and B D) Neither A nor B
45.is a signal to a legume that *Rhizobia* are present in the soil and ready to live in nodules.
 A) Flavonoids B) Nodulins
 C) Nod factor D) Photosynthesis products
46. *Buchnera aphidicola* is located in specialised insect cells called.....
 A) Nodules B) Vesicles
 C) Bacteriocytes D) Sporangia
47.produced in plant wound sites and activate the virulence genes of *Agrobacterium tumefaciens*.
 A) T-DNA B) Nod factor
 C) Oligosaccharide D) Acetosyringone
48. *Buchnera aphidicola* represents an example of.....
 A) Free living bacteria B) Secondary symbiont
 C) Primary symbiont D) None of the above
49.totally depend on sulfide-oxidizing bacteria for obtaining their nutrients.
 A) *Perionyx excavates* B) *Wolbachia pipientis*
 C) *Baizongia pistacea* D) *Riftia pachyptila*
50. The relationship between the plant and *Agrobacterium tumefaciens* is.....
 A) Commensalism B) Amensalism
 C) Mutualism D) Parasitism
51. When *Rhizobium* contact with root hair, root hair.....
 A) Release chemicals B) Absorb water
 C) Curls D) Absorb minerals
52. What is the name of *Rhizobium* inside cortex cell?
 A) Bacteria B) *Agrobacterium*
 C) Bacteroid D) *Bradyrhizobium*
53. What are products formed in nitrogen fixation?
 A) Ammonia B) 16 ADP + iP
 C) Hydrogen D) All
54. Who provides 16 ATP required for nitrogen fixation by *Rhizobium*?
 A) Leguminous plant B) 16 ADP + iP
 C) Virus D) Bacteria
55. Non-biological nitrogen fixation is.....
 A) Rhizobial B) Atmospheric and industrial
 C) Cyanobacterial D) None of the above
56. Nitrogenase enzyme is a complex of.....
 A) Fe protein B) Dinitrogenase reductase
 C) Dinitrogenase D) Fe protein & Mo Fe protein

57. Which of the following statements is true about the structure of *Rhizobium* bacteria in root soil of plants?
- A) They are rod-shaped bacteria
 - B) They are comma-shaped bacteria
 - C) They are spherical shaped bacteria
 - D) They are T&Y shape
58. Skin Microflora.....
- A) Protect the host from pathogenic bacteria
 - B) Compete for nutrients, niches, and receptors
 - C) Produce antibiotics and toxic metabolites
 - D) All the above
59. When *Vibrio fischeri* are sheltered within a squid and the concentration of AHL increases leading to
- A) The binding and activation of luxr
 - B) Production of light directly
 - C) Inactivation of luciferase enzymes
 - D) None of the above
60. Which of the following steps are required in nitrogen fixation?
- A) Chemical recognition of roots and *Rhizobium*
 - B) Invasion, cortical cell divisions and formation of nodule tissue
 - C) Bacteria fix nitrogen
 - D) All the above

With My Best Wishes

Dr Nivien Allam Nafady

Dr Shimaa Ryhan



Assiut University
Fourth Levels
Food Microbiology
Two Hours



Botany & Microbiology Department
Microbiology and Chemistry & Microbiology
No. 498B
50 Marks



Faculty of Science
2nd Term
14-6-2022
Final Examination

I. Answer by True (T) or False (F) in the Following Statements [15 Marks "One mark for each"]:-

1. Anaerobes, they are that cannot grow in the presence of oxygen e.g. <i>Clostridium</i> species.	(T) & (F)
2. Some plants produce natural antimicrobial metabolites that can limit the presence of microbes.	(T) & (F)
3. Microorganisms important in foods are all live as only thermophiles.	(T) & (F)
4. The water activity (A_w) of food ranges from ca. 0.1 to 3.0.	(T) & (F)
5. Bioactive is a compound having a biological effect.	(T) & (F)
6. Commensal is a form of symbiosis in which one organism gets a benefit while the other is unaffected.	(T) & (F)
7. Coliforms, species can be used as an index of sanitation e.g. <i>Escherichia</i> and <i>Klebsiella</i> .	(T) & (F)
8. Kimchi is a Korean food made of vegetables, such as cabbage or radishes, which are salted, seasoned, and stored in sealed containers to undergo lactic acid fermentation.	(T) & (F)
9. On the basis of pH , foods can be grouped as high-acid foods and high-alkaline foods.	(T) & (F)
10. <i>Vibrio</i> species can cause foodborne infections associated with seafood and responsible for epidemic cholera	(T) & (F)
11. Infectivity is the ability to produce infection.	(T) & (F)
12. Single-Cell Proteins (SCPs) are used as microbial proteins source for human food only.	(T) & (F)
13. Coliforms are bacteria that most often inhabit the intestine and can grow only in absence of oxygen.	(T) & (F)
14. Terrestrial is refere to an organism which is living or growing in water; not land.	(T) & (F)
15. Ingestion of a food containing active toxin, not viable microbial cells, is necessary for poisoning.	(T) & (F)

Please see the next page

With All My Best Wishes and Good Luck

Dr. Khalid A. Hussein

Select the most correct answer in the following [10 Marks "One mark for each":-

16. Beneficial microbes are used in foods in several ways e.g.

- a) Growing microbial cells (yogurt) b) Metabolic by-products (lactic acid, acetic acid...)
c) Biotransformation (some types of cheese) d) all choices are correct

17. They produce gas (CO₂, H₂, and H₂S) during metabolism of nutrients.

- a) Aciduric Bacteria b) Gas-Producing Bacteria c) Slime Producers d) all choices are correct

18. Food ingredients and enzymes of microbial origin include.....

- a) Vitamin C b) vitamin D c) B vitamins d) all choices are correct

19. Microbial enzymes can be immobilized via

- a) Adsorption b) Absorption c) Biosorption d) all choices are correct

20. they synthesise polysaccharides e.g. Xanthomonas, Enterobacter, and Lactobacillus.

- a) Aciduric Bacteria b) Gas-Producing Bacteria c) Slime Producers d) all choices are correct

21. Molds, yeasts, bacteria, and algae are rich source of

- a) B-vitamins b) carotene c) carbohydrates. d) all choices are correct

22. is one of the microbial proteins and food additives.

- a) Single cell protiens (SCPs) b) Animal c) Equipments d) all choices are correct

23. is a source of microorganisms in food

- a) Sweage b) Plant c) Human d) all choices are correct

24. The significance of microorganisms in food spoilage depends on.....

- a) Microbial Type b) Food nutrients c) Microbial numbers d) all choices are correct

25. are beneficial intestinal microbes, when consumed, have health benefits and ferments lactose to produce L(+)-lactic acid

- a) Salmonella b) Anaerobes c) Probiotics d) all choices are correct

Please see the next page

With All My Best Wishes and Good Luck

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III. Answer by True (T) or False (F)**[10 Marks "One mark for each"]**

26. A food is considered spoiled when it loses its acceptance qualities.	(T) or (F)
27. Bacteria spoil foods with relatively low water activity.	(T) or (F)
28. In Food-borne Intoxications symptoms occur quickly, within 30 sec. after ingestion.	(T) or (F)
29. We need <i>Salmonella</i> to breakdown cellulose and assist in the absorption of vitamin K, the vitamin that helps blood clotting.	(T) or (F)
30. Ethylene oxide and ozone gases destroy vegetative cells but not spores.	(T) or (F)
31. Enterotoxigenic strains of <i>Staphylococcus aureus</i> produce different enterotoxins: A, B, C1, C2, C3, C4, D, and E.	(T) or (F)
32. Canning process designed to destroy endospores.	(T) or (F)
33. <i>Salmonella abortus</i> causing abortion in human, and <i>Salmonella gallinarum</i> cause fowl typhoid.	(T) or (F)
34. Mycotic food borne infections include <i>Candida</i> , <i>Sporothrix</i> , <i>Wangiella</i> and <i>Campylobacteriosis</i> .	(T) or (F)
35. Some lactic acid bacteria grow between 40 and 90°C.	(T) or (F)

IV. Select the most correct answer of the following**[15 Marks "One mark for each"]****36. All of the following cause food spoilage except:**

- (a) Enzyme activity (b) Radiation
(c) Growth and activity of microorganisms (d) Physical changes
-

37. Food preservation involves

- (a) Increasing shelf life of food (b) Ensuring safety for human consumption
(c) Both a and b (d) None of these
-

38. Which of the following statements are true regarding *Staphylococcus* food poisoning

- (a) Is produced by *Staphylococcus aureus* (b) Is an enterotoxin
(c) Causes gastroenteritis (d) All of these
-

39. Type of drying which achieved in a few seconds to a few hours, depending on the temperature and time of exposure, some microbial cells can die during drying.

- (a) Mechanical Drying (b) Natural Dehydration
(c) Freeze-Drying (d) a and c
-

40. Common causes of foodborne intoxication are

- (a) *Staphylococcus aureus* (b) *Clostridium botulinum*
(c) both a and b (d) Non of these

بأقي الأسئلة بالخلف

41. Pasteurization is a

- (a) Low temperature treatment (b) High temperature treatment
(c) Steaming treatment (d) Low and high temperature treatment

42. Which of the following statement are true regarding botulinal toxin:

- (a) Is a neurotoxin and enterotoxin (b) Water soluble exotoxin
(c) Is produced by *Clostridium botulinum*, a gram positive aerobic bacteria (d) None of these

43. *Clostridium botulinum* can resist all of the following except:

- (a) Heating (b) Freezing (c) Ionizing radiation (d) Autoclaving

44. Used to identify or analyze the hazards of critical control points:

- (a) HA (b) HAC (c) HACCP (d) HACPC

45. The lowering of pH can be achieved by

- (a) addition of acids (b) fermentation (c) both a and b (d) non of these

46. is the number of degrees the temperature has to be increased in order to reduce the thermal death time tenfold.

- (a) D- value (b) Z- value (c) F- value (d) none of these

47. causes bloody diarrhoe.

- (a) *E. coli* (b) *Bacillus cereus* (c) *Staph. aureus* (d) *Clostridium botulinum*

48. used as control access by cleaning and sanitation:

- (a) Sodium chloride (b) Iodophors (c) Ammonium sulphate (d) H_2O_2


49. Control by Irradiation involves radiation of food at a high dose (30 kGy) to destroy *Clostridium botulinum* spores.

- (a) Radurization (b) Radicidation (c) Radappertization (d) Radeppization

50. Levels of gases in a storage facility are continually monitored and adjusted as required.

- (a) CAP (b) MAP (c) VP (d) SAP

Good luck
Dr. Amal Danial
انتهت الأسئلة

Faculty of Science Botany & Microbiology Department		كلية العلوم قسم النبات والميكروبيولوجي
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19. Classical approaches for classification of actinomycetes:

- A. Aerial Mass colour. B. Reverse side pigments
C. Spore chain morphology. D. All these

20. Streptomyces are:

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- B. Cell wall type III
- C. 1.5-5.0 μm in diameter
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- 30. *Corynebacterium diphtheriae* reproduce by binary fission and snapping division. ()
- 31. *Arthrobacter* spp. are soil inhabitants coccoid when well fed and rods cells when hungry. ()
- 32. Actinomycetes play important role in mineralization of inorganic matter. ()
- 33. Diphtheria produces exotoxin that damages organs and causes of dead tissue in mouth. ()
- 34. Tetracycline used to treat acne and cholera. ()
- 35. *Streptomyces* play a majore role as plant pathogens. ()
- 36. Nocardiosis has a low mortality rate. ()
- 37. *Mycobacterium leprae* cause leprosy to human an animal. ()
- 38. Tubercules are small, soft nodules formed when macrophages surround. ()

39. Streptomycin was the first effective antibiotic against TB. ()
40. Mycobacteria all produce mycosides- long-chain fats, very hydrophilic and wax-like. ()
41. Cord factor is one long chain alcohol groups hooked together by a disaccharide. ()
42. *Actinomyces naeslundii* can produce sulfur granule. ()
43. *Nocardia* has wide infection range colonize, mycetoma, systemic, pulmonary. ()
44. *Streptomyces* produce antifungal compounds including nystatin from *Streptomyces nodosus*. ()
45. Scab symptoms are usually roughly circular, raised, tan to brown, corky lesions. ()
46. Chloramphenicol is a bactericidal antimicrobial. derived from *Streptomyces venezuelae* and It is active against *Pseudomonas aeruginosa*. ()
47. Frankia is a versatile N₂ fixing actinobacteria. ()
48. Actinomycetes colonies are opaque, dark in the center, and have an irregular, fuzzy edge of hyphal appearance. ()
49. *Streptomyces* require a lower water potential for growth like other soil bacteria. ()
50. The main risk factors for nocardiosis are weakened immune system or chronic lung disease. ()

Good luck

Dr. Amal Danial