KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI
COLLEGE OF SCIENCE

B. Sc. (Biological Sciences) First Semester Examination, 2010

First Year **(BC1, FST1, B1, OD1, HB1, Vet. Med.1, Med. Lab.1, SES1, Nursing1, Sonographyl & Meat Science I)**

ALTERNATIVE A **BIOL 151 CELL STRUCTURE**

DECEMBER, 2010 TWO HOURS

INDEX NUMBER: ..... Programme: .....

SECTION A: ANWSER ALL QUESTIONS IN THIS SECTION.
SELECT THE MOST APPROPRIATE ANSWER FROM THE ALTERNATIVES TO EACH QUESTION AND SHADE ON THE SCANNABLE SHEET. INDICATE YOUR ALTERNATIVE AT THE BOTTOM OF THE SCANNABLE SHEET. IN ADDITION CIRCLE THE CORRECT ANSWER ON THE PAPER.

1. **Assuming a numerical aperture of 1.5 and using a green light of 0.5μ, what is the theoretical limit of resolution?**

   (a) 0.02μ
   (b) 0.2μ
   (c) 20.0μ
   (d) 0.002μ
   (e) 2.0μ

2. **The greatest asset of the SEM offers over other microscopes is**

   (a) better contrast
   (b) increase in depth of field
   (c) increase signal to noise
   (d) better resolution
   (e) none of the above

3. **An increase in the working distance of the SEM will result in**

   (a) better contrast
   (b) larger depth of field
   (c) larger spot size
   (d) worse resolution
   (e) better resolution

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4. **Which has the greatest impact on the depth of field?**

   a) Accelerating voltage
   b) Wavelength of electrons used
   c) Spot size
   d) Working distance
   e) Aperture

5. **Which has the least impact on the depth of field?**

   a) Aperture
   b) Magnification
   c) Focal length
   d) Working distance
   e) Accelerating voltage

6. **How does the SEM differ from the TEM? It**

   a) uses an electron beam
   b) operates with a vacuum
   c) uses electromagnetic lenses
   d) maps images rather than optically projecting them

7. **Phagocytic organisms may contain a lot of**

   a) lysosomes
   b) ribosomes
   c) mitochondria
   d) rough endoplasmic reticulum

8. **Thylakoids and cristae are**

   a) part of the endomembrane system
   b) involved in energy transduction
   c) both a and b
   d) involved in the synthesis of organic materials

9. **Which of the following is not a component of a microbody?**

   a) Glyoxysomes
   b) Peroxisomes
   c) Hydrogenosomes
   d) L, α-hydroxy acids

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10. A cell homogenate contains only 3 organelles which have diameters and densities of 10μm, 1.30 gcm^{-3}; 1.3 μm, 1.20gcm^{-3}; and 1.0 μm, 1.24 gcm^{-3}, respectively. What centrifugal technique(s) would be used to separate these organelles?

a) Rate-zonal centrifugation,
b) Differential centrifugation,
c) Both a and b,
d) Analytical ultra-centrifuge

11. Gloria of Food Science I collected nectar from flowers of a particular plant and wishes to analyze it for the various sugars present. Which of the following method(s) would she use?

a) Partition Chromatography
b) Autoradiography
c) Spectrophotometry
d) Adsorption Chromatography

12. The analytical ultra centrifuge can be used for the study of

a) lipids
b) sugars
c) proteins
d) sugars, amino acids and pigments

13. Which of the following statements is true?

a) Adsorption chromatography relies on differences between solutes and the stationary phase
b) Partition chromatography makes use of similarities in the partition coefficient to separate components of mixtures
c) Adsorption chromatography is based on differences in the partition coefficient to separate components of solutes
d) Partition chromatography relies on differences in the partition coefficient to separate components of mixtures

14. Both the nucleus and smooth endoplasmic reticulum are

a) bounded by a double membrane
b) sites of RNA synthesis
c) sites of protein synthesis
d) in direct contact with rough ER

15. What do all of the components of the endomembrane system have in common?

a) Proteins made on ER
b) Phospholipids
c) Both a and b
d) Vesicles

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16. **Francis of Medical Laboratory Technology I fractionates a cell by differential centrifugation, causing the heavier substances to separate from the lighter ones. Which of the following cellular components would you expect to find closest to the bottom of the centrifuge cell?**

a) Cellular fragments
b) The nucleus
c) Lysosomes
d) Both **a** and **b**

17. **Trace the proper sequence in the life of a secretory protein:**

a) Golgi complex, ER and plasma membrane
b) ER, Golgi complex and plasma membrane
c) Plasma membrane, Golgi complex and ER
d) ER, plasma membrane and Golgi complex

18. **A cilium and a microfilament are both**

a) formed from actin
b) organized by centrioles
c) members of the cytosol
d) involved in cell movement

19. **The light transmission of an objective lens of a microscope depends on**

a) wavelength of the light used
b) angular aperture only
c) numerical aperture only
d) both **b** and **c**

20. **Resolving power of an optical instrument**

a) is the ability of the optical instrument to magnify an image
b) is a measure of an image's clarity
c) is the ability of an optical instrument to allow two objects as separate
d) both **a** and **c**

21. **Light microscopes**

a) use glass lenses to magnify an image and project the image into the viewers eye
b) can generally magnify objects about 10,000 times without blurring
c) cannot resolve detail finer than 100μm
d) work by reflecting light off the surface of an object being studied

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22. Which of the following statements is/are true about electron microscopes?

a) Electron microscopes use glass lenses to focus and magnify image
b) Scanning electron microscopes are used to study the details of internal structure
c) Electron beams are focused to create a magnified image of an object
d) Transmission electron microscopes are used to study the architecture of cell surfaces

23. Peter of Biological Sciences I wants to magnify a pollen grain 8,000 times and examine the ridges and pores on its surface. Which of the following instruments would be best?

a) A scanning electron microscope
b) A transmission electron microscope
c) An inverted light microscope
d) A transmission light microscope

24. Felicia of HBI wants to examine the way cells lining the respiratory tract use tiny hairs to remove dirt and mucus away from the lungs. Which of the following instruments would be best, and why? A

a) transmission electron microscope, because it has high resolving power
b) light microscope, because it allows observations of whole, live cells
c) UV/Fluorescence microscope, because the cells can be made to fluoresce
d) scanning electron microscope, because it can reveal structures on cell surfaces

25. The nucleoid region of a bacterial cell

a) is surrounded by a nucleoid membrane
b) separates the DNA from the cytoplasm
c) contains the cell's DNA
d) **a, b and c**

26. You are told that the cells on a microscope slide are plant, animal or bacterial. You look at them through a microscope and see walls and membrane-bound organelles. You conclude that the cells

a) are animal cells
b) are plant cells
c) could either be bacterial or plant cells
d) are bacterial cells

27. Compartmentalization

a) decreases the amount of surface area in eukaryotic cells as compared to prokaryotic cells
b) allows prokaryotic cells to isolate metabolic processes requiring very different chemical conditions from one another
c) causes eukaryotic cells to confine activities requiring membranes to the plasma membrane
d) in eukaryotic cells helps protect these cells from the damaging effects of hydrolytic enzymes produced within the cells and needed for various cell activities

28. Smooth endoplasmic reticulum

a) stores calcium ions in muscles
b) produces protein for cell membranes
c) produces antibodies
d) is the major site for carbohydrate synthesis in eukaryotic cells

29. The Golgi apparatus

a) is composed of stacks of membranous vesicles that are continuous with one another
b) stores protein and prepares them for transport out of the cell
c) strings together amino acids to produce proteins
d) forms fat from cholesterols and fatty acids

30. Owusu-Ansah of Meat Science I poisoned a cell with a substance that inactivates the Golgi apparatus. The cell would have immediate difficulty

a) absorbing nutrients
b) secreting antibodies
c) moving
d) digesting fat

31. Lysosomes

a) help to digest worn-out or damaged organelles
b) re-cycle materials within the cell
c) fuse with food vacuoles to expose nutrients to hydrolytic enzymes
d) all of the above

32. A child is hospitalized for a series of chronic bacterial infections and dies despite heroic efforts. At autopsy, the Physicians are startled to see that the child's white blood cells are loaded with vacuoles containing intact bacteria. Which of the following explanations could account for this finding?

a) A defect in the Golgi apparatus prevented the cells from processing and excreting the bacteria
b) A defect in rough ER prevented the synthesis of the antibodies that would have inactivated the bacteria
c) A defect in the cell walls of the white blood cells permitted bacteria to enter the cells
d) A defect in the lysosomes of the white blood cells prevented the cells destroying engulfed bacteria

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33. Insulin is a protein that is produced by the pancreatic cells and secreted into the bloodstream. Which of the following choices best describes the route of insulin from its production to its exit from the cell?

a) Rough ER, Golgi apparatus, transport vesicles and cell membrane
b) Rough ER, lysosomes, transport vesicles and cell membrane
c) Rough ER, Golgi apparatus, smooth ER and cell membrane
d) None of the above

34. Which of the following is not true statement about the cytoskeleton?

a) It helps to support cells
b) Once laid down, the elements of the cytoskeleton are fixed and remain permanently in place
c) It is composed of three types of fibres: Micofilaments, microtubules and intermediate filaments
d) It includes both fibrous and globular proteins

35. Indicate which of the following is/are true of light microscopes

a) Resolution may be increased to almost any extent by using magnetic lenses
b) Resolution may be increased to almost any extent by combining powerful lenses
c) Objects can be usually magnified only 1,000 to 2,000 times
d) Resolution is limited by the wavelength of light

36. Indicate which of the following is/are true of electron microscopes

a) magnetic lenses replace glass ones
b) allow researchers to see the inner structures of cell parts
c) objects can be usually magnified millions of times
d) all of the above are true of electron microscopes

37. In a centrifuge

a) the lightest materials settle to the bottom first
b) cell components initially become mixed up
c) materials spun around a central axis are separated by total weight
d) the densest materials stay in suspension longest

38. The gravitational force generated by a centrifuge depends on the

a) density of the particle
b) radius of the particle
c) distance of the sample from the axis of the rotor and the speed of the centrifuge
d) viscosity of the medium

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39. One key function of nuclear pores is to

a) form connections between different organelles
b) allow cell to cell communication
c) aid in the production of new nuclei
d) allow molecules like protein to move in and out of the nucleus ✓

40. Column chromatography separates molecules according to their

a) polarity
b) solubility
c) molecular size
d) both charge and molecular size

41. In column chromatography, molecules that are _____ move around the beads in the matrix and therefore move through the column _____.

a) Large, quickly
b) Small, slowly
c) Large, slowly
d) Small, quickly

42. In column chromatography, why is the buffer important?

a) It controls the pH of the sample so the shapes of the molecules would not change
b) It conducts the electrical charge
c) It is the membrane that supports the matrix in the column
d) It is the material that fractionates the chemicals in the sample

43. Paper chromatography separates molecules according to their

a) polarity
b) solubility
c) molecular size
d) both charge and molecular size

44. What is the maximum R_f value for any molecule in paper chromatography?

a) 0.01
b) 0.1
c) 1.0
d) infinity

45. Using paper chromatography, the R_f value for xanthophylls was 0.7 and the value for chlorophyll a was 0.3. What is true for these pigments?

a) Chlorophyll a travelled farther up the paper than xanthophylls
b) Chlorophyll a is more polar than xanthophylls
c) Xanthophylls are more soluble in the aqueous solvent than chlorophyll a
d) Chlorophyll a is a larger molecule than xanthophylls

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46. Which is not a characteristic of the fixative agent, glutaraldehyde?

a) An organic compound
b) A coagulant fixative
c) Soluble in water
d) Primarily reacts with proteins

47. Which of the following is a coagulant?

a) Ethanol
b) Formaldehyde
c) Glutaraldehyde
d) Osmium tetroxide

48. Section thickness for TEM is determined by

a) weight
b) size
c) ability of sections to form ribbon
d) nature of the embedding material

49. Which of the following is NOT usually visible with light microscopy?

a) Nucleus
b) Mitochondrion
c) Bacteria
d) virus

50. Which microscopy technique would you use in order to visualize the rough ER in a fixed section of tissue, so that the ribosomes are clearly visible?

a) SEM
b) Brightfield light microscopy, unstained section
c) TEM
d) Brightfield light microscopy, stained section

51. An ultra centrifuge is used to

a) separate organelles and macromolecules on the basis of size, shape and density
b) cut thin sections of tissue for use in the electron microscope
c) detect radioactivity
d) detect fluorescent molecules

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52. In microscopy, the limit of resolution refers to

a) the lowest magnification possible for a given microscope
b) the maximum diameter of the field of vision before the image begins to blur
c) how long a section may be observed under the microscope before it is destroyed
d) the minimum distance two objects must be located from each other in order to be distinguished as separate objects

53. Which microscopy techniques can be used on living cells?

a) Phase Contrast microscopy
b) TEM
c) Fluorescence microscopy
d) Scanning Electron microscopy

54. What limits cell size?

a) Surface area-to-volume ratio
b) Speed of movement of materials from the middle to the periphery of the cell
c) The bigger the cell, the less access there is from the interior of the cell to the external environment
d) All of the above limit cell size

55. Prokaryotic cells

a) are also referred to as acellular organisms
b) have no membrane-bound organelles
c) have a large nucleus containing hereditary information
d) comprise very complex individuals

56. Of the following microscopes, which one can resolve the smallest objects?

a) Brightfield
b) Phase contrast
c) TEM
d) UV/Fluorescence

57. A microscope with a X25 ocular lens and a X40 objective lens would yield a magnification of what power?

a) 100
b) 1000
c) 10000
d) 250

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58. **The use of oil immersion makes it possible to increase quantitatively which of the following?**

a) Contrast
b) Numerical aperture
c) Light transmitting ability of the objective lens
d) Resolving power

59. **Ribosomes**

a) are involved in the synthesis of sugars
b) are synthesized by endoplasmic reticulum
c) pass through cilia
d) are located on the endoplasmic reticulum or float freely in the cytoplasm

60. **Which of the following eukaryotic cellular organelles are made out of membranes?**

a) The endoplasmic reticulum
b) Mitochondria
c) The Golgi apparatus
d) All of the above

61. **Which of the following organelles is not membrane-bound?**

a) Dictyosome
b) Microbody
c) Ribosome
d) Endoplasmic reticulum

62. **Liquid nitrogen is a poor freezing agent for microscopy since it**

a) does not form crystals
b) freezes too quickly
c) has a high temperature range between its freezing and boiling points
d) readily forms a vapour upon contact with warm surfaces

63. **Fixation is the process by which the structures of the cells are preserved and fixed in position. An advantage of chemical fixation over heat fixation is that it**

a) does not destroy internal structures
b) provides a much greater resolution of specimen
c) provides good contrast
d) does not produce noise

64. **Which of the following objective lenses would give you the best resolution of small objects?**

a) 10X air, NA 0.25
b) 40X air, NA 0.65
c) 64X oil, NA1.4
d) 100X oil, NA1.25

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65. The component into which the lenses that observe the specimen are screwed is called the

a) ocular mount
b) nose piece
c) head
d) stage

66. Cells involved with resorption of themselves, such as those in the tail of a tadpole, would most likely contain many

a) Golgi apparatus
b) Mitochondria
c) ER
d) lysosomes

67. Mansah of Sonography I is viewing cells using a light microscope. In her observations, she views a nucleus and a cell wall. Which additional organelle is she most likely to observe using the light microscope in this observation?

a) Chloroplast
b) Lysosome
c) Endoplasmic reticulum
d) ribosome

68. Cyanide, a metabolic poison, interferes with the cellular aerobic production of ATP. Which cell organelle does cyanide most likely influence first in this situation?

a) Ribosomes
b) Nucleus
c) Mitochondria
d) ER

69. Resolution in a microscope is primarily determined by which lens?

a) Ocular
b) Objective
c) Projector
d) Condenser

70. The primary limiting factor for resolution in a light microscope is the

a) angle of illumination into the objective lens
b) refractive index of medium
c) numerical aperture
d) wavelength

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71. Darkfield microscopes are of value in detecting the

a) presence and behaviour of small particles such as bacteria
b) size and behaviour of small particles such as bacteria
c) shape and behaviour of small particles such as bacteria
d) size, shape and behaviour of small particles such as bacteria

72. Which of the following statements is not true about the electron microscope?

a) Permits the use of far higher effective magnifications
b) Limit the resolution of the electron microscope by several orders of magnitude lower than that of the light microscope
c) Quartz lenses are used instead of glass lenses
d) Electronmagnetic field acts on a beam of electrons in a way analogous to the action of a glass lens on a beam of light

73. Which of the following is a limitation of the electron microscope?

a) It is extremely costly
b) It is very complicated and requires highly trained personnel to operate it
c) Severe distortion of structure may occur due to the complicated preparatory procedures employed
d) The lenses suffer from various aberrations and so the theoretical limit of resolution cannot be attained

74. Phospholipid molecules in a membrane are arranged with their ____ on the exterior and their _____ on the interior

a) hydrophobic heads ---------- hydrophyllic tails
b) hydrophobic tails ---------- hydrophyllic heads
c) hydrophyllic heads ---------- hydrophobic tails
d) hydrophyllic tails ---------- hydrophobic heads

75. Which of the following does not agree with part of the cell theory?

a) Minerals are required for good health
b) Insects are composed of cells
c) *E.coli* from *E. coli*
d) Bacteria are the smallest possible organisms

76. What primarily determines the shape of cells that lack cell wall?

a) Cytosol
b) Cytoskeleton
c) Nucleus
d) Endoplasmic reticulum

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77. **Mensah of Nursing I made an interesting observation about a protein made by the rough ER and eventually used to build a cell's plasma membrane. The protein in the membrane was slightly different from the protein made in the ER. The protein was probably modified in the**

a) lysosome
b) nucleus
c) rough ER
d) Golgi apparatus

78. **If a nucleus is a cell's "control centre" and a chloroplast, it's "solar collectors", which of the following might be called the cell's combination of "food processor" and "garbage disposer"?**

a) Golgi apparatus
b) Nucleus
c) Lysosome
d) Mitochondrion

79. **The electron microscope has been particularly useful in studying bacteria, because**

a) bacteria are small
b) electrons can penetrate tough bacterial walls
c) they are not really alive, so it does not hurt to "kill" them for viewing
d) bacteria move so quickly that they are hard to photograph

80. **A plant cell was grown in a test tube containing radioactive nucleotides by Biological Sciences I students, the parts from which DNA is built. Later examination of the cell by the class showed the radioactivity to be concentrated in the**

a) mitochondria
b) rough ER
c) Golgi apparatus
d) Nucleus

81. **The internal skeleton of a cell is composed of**

a) cellulose, intermediate filaments and microfilaments
b) microtubules, intermediate filaments and microfilaments
c) microfilaments, intermediate filaments and centrioles
d) cellulose, microtubules and centrioles

82. **It is expected that a cell with an extensive Golgi apparatus**

a) stores large quantities of food
b) makes a lot of ATP
c) secretes a lot of material
d) moves actively

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83. **Why are virtually all microbiological dyes known as basic dyes?**

a) Because basic dyes are needed to neutralize the amino and nucleic acids
b) Because no other types of dyes will bind to the capsule of the cell of bacteria
c) Because the basic nature of the molecules is needed for the dye to penetrate the cell wall
d) Because the bacterial cell has an excess of negatively charged groups and basic dyes contain positively charged chromogenic groups

84. **Which part of the spectrophotometer is adjusted to select the desired wavelength?**

a) Filter
b) Sample
c) Light source
d) Photodetector

85. **To establish a standard curve for a chemical, the spectrophotometer wavelength is at which value?**

a) The lowest wavelength possible
b) The wavelength at which the chemical's absorption value if the lowest
c) The highest wavelength possible
d) The wavelength at which the chemical's absorption value if the highest

86. **A blank set used in a spectrophotometer contains the _____ but not the dissolved chemical**

a) solvent
b) solute
c) filter
d) absorbance spectrum

87. **The blank used to calibrate the spectrophotometer for testing the absorbance spectrum of chlorophyll is _____.**

a) Water
b) Chlorophyll solution
c) Acetone
d) Cobalt chloride

88. **Using a standard curve, if you know the absorbance of an unknown sample, what else can be determined about the unknown?**

a) The identity of the sample
b) The wavelength of maximum absorbance
c) The molecular weight of the sample
d) The concentration of the sample
e)

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89. **What is the path of light through a spectrophotometer?**

a) Meter, photodetector, filter, sample, light source
b) Light source, sample, filter, photodetector, meter
c) Meter, filter, sample, photodetector, light source
d) Light source, filter, sample, photodetector, meter

90. **What is the function of an absorbance spectrum?**

a) It is a graph of chemical relating the absorbance to concentration
b) It is the amount of radiation retained by a sample
c) It converts light energy into chemical energy
d) It is a graph of chemical relating the absorbance to wavelength

91. **When the objective lens is contaminated by an oil film, the specimen being viewed will appear**

a) in decreased resolution
b) to have fuzzy spots in the field
c) to move when the image is defocused
d) to have sharply focused spots in the field

92. **For maximum resolution a 100X oil lens is used. Where do you place the oil?**

a) Between the condenser and iris diaphragm
b) Between the specimen and the condenser
c) On the dry objective
d) Between the oil objective and the specimen

93. **Which of the following is the least significant function of the iris diaphragm?**

a) Contrast
b) Resolution
c) Brightness
d) Depth of field

94. **Patricia of Vet. Medicine I would like to film the movement of chromosomes during cell division. Her best choice for a microscope would be a**

a) light microscope, because the specimen is alive
b) transmission electron microscope, because of its magnifying power
c) light microscope, because of its resolving power
d) transmission electron microscope, because of its great resolving power

95. **The effectiveness of homogenization depends on**

a) the amount of fibrous tissue present only
b) the amount of vascular tissue present only
c) the amount of connective tissue present only
d) both b and c

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96. **The process of homogenization works best for tissues like**

a) liver and kidney
b) mammary glands
c) heart musle
d) all of the above

97. **_____ is used to separate a homogenate into subcellular fractions**

a) centrifugation
b) homogenizer
c) spectrophotometry
d) chromatography

98. **Dominic of Sports and Execise Science I wishes to separate the mitochondria of liver cells from those of the lysosomes and microbodies. Which of the following methods will be used?**

a) Isopycnic method of centrifugation
b) Analytical ultra centrifugation
c) Differential centrifugation
d) both a and b
e) Rate zonal centrifugation

99. **In a similar study, Agyenim-Boateng also wants to separate nuclei from lysosomes, mitochondria and microbodies in a homogenate, which of the following methods will he employ?**

a) Isopycnic method of centrifugation
b) Analytical ultra centrifugation
c) Differential centrifugation
d) both a and c
e) Rate zonal centrifugation

100. **A homogenizer best used to disrupt bacterial cells is**

a) potter homogenizer
b) pestle and mortar
c) waring blender
d) French Press

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SECTION B: Answer the following questions into your answer booklet provided. Marks will be awarded for clarity of answers and the use of large clearly labelled diagrams.

1. You have been provided with chlorophyll solution containing chlorophyll a, chlorophyll b, xanthophylls and carotenes. Describe in detail the method you would use to separate the mixture of pigments.

2. Make a large clearly labelled drawing of an animal cell prepared and viewed under the high power of the light microscope.

W. G. Akanwariwiak

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