92. True Statement about Mitochondria is –
(1) Change in shape and size and division both occur
(2) Do not change shape but division occurs
(3) Do not change shape and size and division not occurs
(4) Change shape but division does not occur

93. E. R. is not related with –
(1) Plamalaemma (2) Golgbody
(3) Mitohondria (4) Nucleus

94. Which cell irganelle reduces the number or E. R. and Mitochondria-
(1) Lysosome (2) E. R.
(3) Mitochondria (4) Golgibody

95. Which of thefollwing is the site of lipid syntheaia- [RPMT-2002]
(1) Rough E. R. (2) Smooth E. R.
(3) Golgi bodies (4) Ribosome

96 .The main organelle incolced in modification and routing of synthesized proteins to their destinations is –
(1) Endoplamic Reticulum(2) Lysosome
(3) Mitochondria (4) Chioroplast

97. Chlorophyll in chlorolasts is located in-
(1) Grana (2) Pyrenoid
(3) Strome (4) Both grana and stroma

98. Which of thefollowing statements regarding mitochondrial membrane is not cerrect?
(1) The outer membrane resmbles a sieve
(2) The outer membrane is permeable to all kinds of molecules.
(3) The enzyles of electrone transfer chain areembedded in the outer membrane.
(4) The inner membranand is highly convoluted forming a series of infoldings .

99. Polusome is formed by: -
(1) A ribosome with several subunits
(2) Ribosomes attacched to each other ina linear arragenment
(3) Several ribososoes attached to a single mRNA
(4) Many ribosomes attached to a strand of endophasmic reticulumm

100. Vacuole in plant cell: -
(1) Lacks membrane and contains air
(2) Lacks membrane and contains water and excretory substances
(3) Is membranebound and contains storage proteins and lipids
(4) is membrane –bound and contain water and excretory substances

101. In germinating seeds fatty acids are degraded exclusivelyinthe:-**[CBSE . 2008]**
(1) Peroxisome (2) Mitochondria
(3) Proplastids (4) Glyoxysomes

102. Keeping in view the fluid mosaic model for the structure of cell membrane , which one of the follwing statements is correct with reapect to the movement of lipids and proteins from one lipid moolayer to the other (described as flipflop movement) ?
(1) Which proteins can flip-flop, lipids can not
(2) Neither lipds, nor proteins can flip-flop
(3) Both lipids can rarely flip- flop
(4) Which lipids can rarely flip-flop, proteins can not

EXERCISE-3

PLASTIDS, CILIA, FLAGELLA, CENTRIOLES[CENTROSOME], RIBOSOME MICROBODIES, MICROTUBULES AND MICROFILAMENTS

1. The chlorophyll pigment is readily soluble in: -
(1) Water (2) Acids (3) Alkalies (4) Acetone

2. Centrioles are found in: -
(1) Chromosomes (2) Nucleus
(3) Centrosome (4) Centromere

3. Site of Calvin Cycle is –
(1) Chloroplast (2) Cytoplasm
(3) Mitochondria (4) Glyoxisome

4. Enzymes are synthesizd on : -
(1) Dictyosomes (2) Ribosomes
(3) Mitochondria (4) None

5. Larger subuit of ribosome is dome shaped and attached to ER by : -
(1) Ribophorins (2) Aminoacid
(3) Ca+2 (4) Hydrogen bonds

6. Which is not true about sphaerosnoes: -
(1) Involved in photorespiration
(2) Arise from E. R.
(3) Related to fat metbolism
(4) Single membane bound

7. Bacterial ribosomes are called: -
(1) Episome (2) Polysomes
(3) Mesosomes (4) Centrosome

8. Episome absent in: -
(1) **Potato** (2) Cocos nucifera
(3) Arachis hypogea (4) Helianthus

9. In higher plants, the chloroplast are : -
(1) Discoidal or oval (2) Spiral
(3) Cupshaped (4) Reticulate

10. Which ion holds the ribosomal subunits togeter-
(1) Ca+2 (2) Mn+2 (3) Mg+2 (4) Na+

11. DNA is not found in : -
(1) Nucleus (2) Mitochondria
(3) Chloroplaaaaaaast (4) Ribosome

12. Mitochondria and chloroplast are considered to be endosymbionts of cell because they: -
(1) Posses their own nucleic acid
(2) Have capacity of ATP synthesis
(3) Do not reproduce (4) All the above

13. Per xysome contain: -
(1) Hydrolytic enzyme
(2) Transferase
(3) Isomerase (4)xidisingenzyme (Oxidase)

14. Sphaerosome are involved in : -
(1) Synhaerosome and storage of lipid
(2) Synthesis of proteein
(3) β -oxidation of fatty acids
(4) Synthesis and storage of carbohydrate

15. Which are called " Botder-bodies" : -
(1) Glyoxysome (2) Peroxsome
(3) Lomasome (4) Sphaerosome

16. Factory of ribosome in a cell is: -
(1) Endoplasmic reticulum(2) Nucleolus
(3) Mitochondria (4) Golgi body

17. What is the angle between two centriole of a centrosome : -
(1) 300 (2) 450 (3) 600 (4) 900

18. Self duplication does not occur in: -
(1) Mitochoondria (2) Centrioles
(3) Chloroplast (4) Ribosome

19. Ribosome attacherd with rough E. R. by the help of
(1) Protein
(2) Carbohydrate
(3) Glycoprotein (Ribbophorin)
(4) Phosphoprotein

20. In which tublin protein is not present: -
(1) Plasma membrane (2) Cilia
(3) Flagella (4) Microtubules

21. In which of ht following cell centriole is absent-
(1) Epithelial cell (2) Gland cell
(3) Liver cells (4) Nerve cell

22. Ribosomes ar: -
(1) Positively charged
(2) Negatively charged
(3) Amphoteric (4) Neutral

23. Sphaerosomes are formed from: -
(1)Lipiochondria
(2)Endoplasmic reticulum
(3) Ribosome
(4) Mitochondria

24. On which concentration of Mg^{+2} ions dimer ribosome is formed : -
(1) 0. 0001 M (2) 0. 001 M
(3) 0. 01 M (4) 0. 10 M

25. The peroxisomes areassociated with the phenomenon of : -
(1) Oxidativa anabolism
(2) De –gradation of H_2O
(3) Anaerobic respiration
(4) Photorespiration and degradation of H_2O_2

26. Factory for syntesis of sugars in autotrophic eukaryotes is –
(1) Mitochondria(2) Ribosome
(3) Chloropast (4) Endopasmic reticulum

27. Which of the following is not a mechanical cell organelle: -
(1) Glyoxysomes (2) Centriole
(3) Diplosome (4) Blepheroplast

28. Plastids which store fats and oils are called: -
(1) Aleuroplast (2) Amyloplast
(3) Erioplast (4) Elaioplast

29. Reticulate chloroplast occur in : -
(1) Ulothrix (2) Oedogonium
(3) Spirogyea (4) Chlamydomonas

30. Biogenesos of eucaryotic Ribosomes takes place in-
(1) Mitochondria (2) Chloroplast
(3) Both(1) and(2) (4) Nic;ep;is

31. . Which of the following termed as highly specialisedperoxisomes : -
(1) Glyoxysomes (2) Mitochondria
(3) Golgibody (4) Sphaerosomes

32. " Palade particles" are : -
(1) Ribosome (2) Golgi vesicles
(3) Lysosomes (4) Sphaerosomes

33. Ribosomes are center of : -
(1) Lipid synthesis
(2) Crabohydrate synthesis
(3) Protein synthesis (4) All the above

34. Red colour of tomato and chilly is due to:
(1) Lycopene in chloroplast
(2) Xanthophylls in chromoplast
(3) Lycopene in chromoplast
(4) Anthocyanin in leucoplast

35. Polysome is a chain of : -
(1) Pinesomes (2) Phagosomes
(3) Microsomes (4) Ribosomes

36. By loss of rbosomes RER converts in : -
(1) SER (2)Golgibody
(3) Lysosome (4) Microtubules

37. DNA of chloroplast discovered by : -
(1)Randadand Disprey(2) Nash and Margit
(3) Ris and Plaut (4) Benda

38. Anthocyanin pigment occus in : -
(1) Chromplasts (2) Amyloplasts
(3) Cytoplasm (4) Cell sap

39. Which of the cilia proein is analogous tomyosin of muscles: -
(1) Tublin (2) Dynien
(3) Flagellin (4) None of the above

40. Maximum substance in ribosome is : -
(1) RNA (2) ATP (3) NAD (4) NADPH

41. Function of centrosome is: -
(1) Initiation of cel div.
(2) Inhibition of cell div.
(3) Termination of cell div. (4) Cytokinesis

42. Blepheroplast is a type of : -
(1) Centriole (2) Plastid
(3) Cilia (4) Mitochondria

43. Water soluble yellow pigment present in petals of Tageetes and sunflower is : -
(1) Carotene (2) Xanthophyll
(3) Anthoclor (4) Lycopene

44. Procaryotic Ribosomes are 70 s, s refers to: -
(1) Svedberg unit (2) Smallest unit
(3) Smooth (4) Speed

45. Rhizoplasts or rootles are part of : -
(1) Centriole (2) Root hairs
(3) Ciliary apparatus (4) Spindle

46. Glyoxylate pathway takes place in: -
(1) Peroxisomes (2) Sphaerosomes
(3) Lysosomes (4) Glyoxysomes

47. Pericarp and petals contain: -
(1) Chlorolpast (2) Chromoplast
(3) Leucoplast (4) Etioplast

48. Arrangement of microtubules in centriole is : -
(1)9+2 (2) 2+9 (3) 11+0 (4) 9+0

49. How many longitudinal perpheral fibres found in a centriole: -
(1) 2 (2) 9 (3) 5 (4) 7

50. Smallest cell organelle is : -
(1) Lysosome (2) Centrosome
(3) Ribosome (4) Golgibody

51. Non pigmented part of chlorplast is called : -
(1) Thylakoids (2) Grana
(3) Stroma (4) Lamellae

52. Which of the following plastids are helpful in starch formation and storage: -
(1) Chromoplast (2) Leucoplasts
(3) Chloroplast (4) Lycopene

53. Lamellae of chloroplast are known as : -
(1) Granum (2) Frets
(3) Thylakoids (4) Stroma lamellae

54. Which of the following enzymes are found in matrix of peroxisome : -
(1) NASH cytochrome reductase
(2)Glyoxidases and malate dehydrogenase
(3) Acid phosphatases and isocitric lyase
(4) Catatases and oxidases

55. 70s type of ribosomes found un : -
(1) Prokaryotic cells
(2)Prokaryotic cells , chlorolasts and mitochondria
(3)Mitochondria(4) Nucleus, mitochondria

56. Cilia and flagella arise from : -
(1) Basal bodies (2) Basal granules
(3) Blepharoplasts (4) All of the above

57. Mitoplast is : -
(1) Outer memberane less chloroplast
(2) Outer membrane less mitochondria
(3) Granum less chloroplast
(4) Well developed nucleus

58. Grana and stroma lamellae are the parts of : -
(1) Mitochondria (2) Chloroplast
(3) Endoplasmic reticulum (4) Vacuoles

59. Sedimentation coefficient of mitoribosomes of higher plants is : -
(1) 80s (2) 70s (3) 65s (4) 55s

60. Which of the following subtances are stored in Aleuropladt-
(1) Starch (2) Oil and Lipids
(3) Proteins (4) Water and Oil

61. Smallest cell organelle which called cell engine is
(1) Ribosome (2) Lysosome
(3) Vacuoles (4) Endoplasmic reticulum

62. The Ribosomes are made up of =
(1) DNA+ p rotein (2) RNA+ Protein
(3) DNA+RNA (4) None of these

63. Stroma Functionalunit of /chloroplast is
(1) Stroma (2) Quantasome
(3) Oxysomes (4) Peroxysomes

64. Cilia and flagella both have –
(1) 9+2 arrangement of microtubules
(2) Protective structure of cells
(3) Only present in protozoa Animals
(4) Only outgrowth structure of cytolplasm

65. Centriolws and centrosomes are presente in cells of : -
(1) Animals (2) Bactria
(3) Green cells (4) Cyanobacteri

66. Similarity bet , plant and animal flagella microtubules-
(1) 9+3 (2) 9+2 (3) 9+6 (4) 9+1

67. Ribosomesareproduced in: -**[CPMT-2007]**
(1) Nucleolus (2) Cytoplasm
(3) Mitochondria (4) Golgibody

68. Which of the following pair lack the unit membrane: - **[RPMT-2002]**
(1) Nucleolus & E. R.
(2) Ribosome & chioroplast
(3) Ribosome & nucleolus
(4) Golgi body & lysosome

69. Golgibody is concerned with : - **[RPMT 2004]**
(1) Respiration (2) Secretion
(3) Excretion (4) Degradation

70. Three of the following satements regarding cell organelles are correct while on is wrong . Which one is wrong?
(1) Lysosmes are double membraned vesicles budded off form golgi apparatus and contain digestive enzymes.
(2) Endoplasmic reticulum conisits of a network of membranous tubules and helps in tranport, synthesis and secretion .
(3)Leucoplasts are bound by two membranes lack pigment but contain their own DNAand protein synthesizing machinery.
(4)Spharosomes are single memrane bound and storage of lipids.

71. In which one of the following would you expect to fond glyoxysomes ? [AIIMS2006]
(1) Endosperm of wheat
(2) Endosperm of castorr
(3) Palisade cells in leaf (4) Rooot tairs

72. Which of the following statements Regardingceliis not correct ?**[CBSE 2006]**
(1) Cilia contin an outer of nina doublet microtubules. surrounding two single microtubules.
(2) The organized beation of cilia is controlled by fluxes of Ca^{2+} across the membrane.
(3) Cilia are hair –like cellular appendages.
(4) Microtubules of cilia are composed of tubulin.

73. The contractile protein of skeletal muscle involving ATPase activity is **[CBSE 2006]**
(1) α-Actinin (2) Troponin
(3) Tropomyosin (4) Myosin

74. Select the wrong statement from the following : **[CBSE 2007]**
(1) Both chloroplasts and mitochondria contain and inner and outer membrane.
(2) Both chloroplasts and mitochondria have an intermal compartment , the thylakoid space bounded by the thylakoid membrane.
(3) Both chloropasts and mitochondria contain DNA .
(4) The chloroplasts are generally much larger than mitochondria

EXERCISE-4

NUCLEUS AND CHROMOSOMES

1 . Nuclear pores are guarded by : -
(1) DNA (2) Annulus
(3) Protein (4) None

2. Lampbrush chromosomes are observed in : -
(1) Insect larva (2) Oocytes
(3) Sperms (4) Salivary giands

3. Who proposed the chromosomal theory: -
(1) Bateson and punnet
(2) Menndel
(3) Morgan (4) Sutton and Boveri

4. Which of the following stimulates balbiani ring formation in polytene chromosomes:
(1) Dynien (2) Juvenile harmone
(3) Ecdysson 4) Histone

5. Small chromosomes which do not produce any detectable phenotypic expression are termed
(1) Heterochromatic chromosomes
(2) Supernumerary chromosomes
(3) Nonsense chromosomes
(4) Nuleoids

6. Genome is : -
(1) Pary of chromosome
(2) Half chromosome
(3) Total DNAin cell
(4) A complete set of chromsomes

7. Nucleolar organizer is a : -
(1) Primary constriction
(2) Secondary constriction
(3) Tertiary constriction
(4) Centriole

8. Kinetochore is present in : -
(1) Mitochondria (2) Sphaerosome
(3) Chromosome (4) Flagella

9. True chromosomes absent in prokaryotes due to the absence of : -
(1) Nucleus (2) Nucleolus
(3) Histone (4) All the above

10. Acomplete set of chromosomes inherited as an unit from one parent is knows as :
(1) Karyotype (2) Gene pool
(3) Genotype (4) Genome

11. Nucleolus in Eukaryotic cell is : -
(1) Nonliving
(2) Visble at Metaphase
(3) Bounded by membrane
(4) The site of packaging of r-RNA with proteins

12. Site of m-RNA synthesis in Lampbrush chromosomes is: -
(1) Balbiani rings (2) Lateral loops
(3) Dstk bsnds (4) Light bands

13. Chromosomes composed of : -
(1) DNA . RNA, Histones , Non histones
(2) DNA and Histones
(3) DNA andRNA
(4) DNA, RNA and Histones

14. Role of nucleus in morphology of plant was first discovered in : -
(1) Acetabularia (2) Maize
(3) Pea (4) Neurospora

15. Most diagnostic character of centromere is ;-
(1) Kinetochore (2) Kinetosome
(3) Setellite body (4) Chromonems

16. Diploid number of chromosomes in Man , Black molish and Privet Hedge is : -
(1) 44 (2) 48 (3) 46 (4) 42

17. Nucleomema is part of : -
(1) Chromosomes (2) Nucleolus
(3) Nucleus (4) Ribosome

18. Acccording to multi stranded theory each chromoaome composed of : -
(1) 16 DNA (2) 32 DNA
(3) 2DNA (4) 1DNA

19. Which of the following character is not taken into consideration while prepaaring a karyotype
(1) Chromosome length
(2) Arm ratio
(3) Position of sec. Constriction
(4) Length of chromonemata

20. The total herditary material which occur out side the chromosome is called as : -
(1) Cistron (2) Plasmon
(3) Mutron (4) Intron

21. The non-sticky chromosomal ends are known as
(1) Chromatids (2) Centromere
(3) Chromomere (4) Telomere

22. Lampbrush chromosome contain: -
(1) One chrmatid (2) Two chromatid
(3) Three chromatid (4) Several chromatid

23. Highest arm ratio occur in which chromosome
(1) Telocentric (2) Metacentric
(3) Submetacentric (4) Acrocentric

24. which chromosome does not provide attachment site for spindle fibers: -
(1) Acrocentric (2) Metacentric
(3) Submeta centric (4) Acentric

25. The nucleolar chromatin contains gene for : -
(1) B-DNA (2) Z-DNA
(3) r-RNA (4) Satellite-DNA

26. The heterochromatin is condensed in the following region of the chromosome: -
(1) Secondary constriction-I
(2) Secondary constriction -II
(3) Both the above
(4) Telomere

27. One solenoid com posed of : -
(1) 8-nculeosome (2) 6-nucleosome
(3) 10-nucleosome (4) 16-nucleosme

28. Exceptionally large chromosome: -
(1) Lampbrush chromosome
(2) Polytene chromosome
(3) Megachromosomes
(4) All of the above

29. Solenoid structure related with : -
(1) Chromatin fibre (2) Nucleolus
(3) Nucleus (4) All of the above

30. The chromosomes appear as beaded structures at : -
(1) Leptotene (2) Pachytene
(3) Diakinesis (4) Telophase-I

31. Histone which links the nucleosomes together is called: -
(1) H1 (2) H2 A (3) H 2 B (4) H4

32. Secondary constriction –II of chromosome is generally concerned with the : -
(1) Synthesis of r-RNA
(2) Syntresis of t-RNA
(3) Syntresis of m-RNA
(4) All the above

33. Which chromosome remains condense furing interphase : -
(1) Sormal X-chromosome
(2) X-chromosome of Bar body
(3) Autosomes
(4) None of the above

34. Megachromosomes are seen in : -
(1) Tobacco (2) Pea
(3) Wheat (4) Brinjal

35. Lampbrush chromosomes are observed in : -
(1) Mitotic metaphase
(2) Meiotic prophase
(3) Meiotic prophase
(4) Meiotic interphase

36. Who first proved that heredity is controlled by nucleus: -
(1) Strasburger (2) Hammerlilng
(3) Mendel (4) Hugo de veries

37. False nucleolus rcieves which type of stain: -
(1) Acidic stain (2) Basic stain
(3) Neutral stain (4) Any stain

38. Nucleus controls the activiy of cytoplasm by sending : -
(1) Enzymes (2) cAMP
(3) Hormones (4) RNA

39. Which of the following chromoaomes are called diplotene chromosomes : -
(1) Polytene chromosomes
(2) Super nmerary chromosomes
(3) Sex chromaosomes
(4) Lamp brush chromosomes

40. The protein nucleoplasmin occus in : -
(1) Nuclear pore complex
(2) Sieve cells
(3) Nucleolus
(4) Heterochromatin

41. A swelling in the band of a polytene chromosome is and indication of : -
(1) Gene action (2) Gene inaction
(3) Mutation (4) Gene damage

42. Nucleus stores energy in the form of :
(1) ATP (2) GTP
(3) TTP (4) CTP

43. Ribonucleic acid occurs in : -
(1) Nucleus
(2) Cytoplasm
(3) Nucleus and cytoplasm
(4) Mitochondria and chloroplast

44. Nucleus was discovered by : -
(1) Leuwenhock (2) Robert Brown
(3) Porter (4) Palade

45. The chromatin material which takes darker stain in intephase is called : -
(1) Euchromatin
(2) Heterochromatin
(3) Primary constriction
(4) Satellite body

46. Lowest number of chromosomes is found in : -
(1) Radiolaria (2) Amoeba
(3) Ascris meglocphala (4) Aggrgata

47. Outer most covering of chromomsome is called : -
(1) Tonoplast (2) Pellicle
(3) Unit membranne (4) Mesosome

48. Nucleus is : -
(1) Single layered structure
(2) Three layered structure
(3) Four layered structure
(4) Two layered structure

49. Bands and interbands are charecteristics of : -
(1) Lamphrush chromosome
(2) Polytene chrososome
(3) Glant chromosome
(4) Heterochromatin chromosome

50. In human being secondary contriction II found on : -
(1) X-chromosome
(2) Y-chromosome
(3) 12, 14, 15, 21, 22, chromosome
(4) 1, 10, 13, 16, & y-chromosome

51. Which enzyme act as chromosomal breaks: -
(1) DNA –polymerase
(2) DNAase
(3) DNA ligase
(4) DNA polymerase II

52. Nucleolus is made up of : -
(1) DNAand RNA (2) Lipid +Protin
(3) RNA and Protein (4) Phospholipid

53. Nucleolus is made up of : -
(1) Deoxy Ribonucleoprotein
(2) Lipoptotein
(3) Ribonucleoprotein
(4) m-RNA and r-RNA

54. Arm ratio in metacentrin codition is : -
(1) 1 : 1 (2) 1 : 2
(3) 1 : 3 (4) 2 : 3

55. Bead kike structure found on chromosome are called: -
(1) Chromomeres
(2) Chromonemata
(3) Chromonema
(4) Centriole

56. Chroomosome trem given by -
(1) Waldeyer (2) Strasbuger
(3) Morgan (4)Suttonand Boceri

57. Part of chomosome after secondary constriction is called: -
(1) Chromsoere (2) Telomer
(3) Satellite (4) Nucleolar organiser

58. Nucleosome is made up of : -
(1) Nonhistone protein + RNA
(2) Histone protein and DNA
(3) Non – histone and histone protein
(4) Phospholipid and protein

59. Linker DNApresent in between : -
(1) Two nucleosome (2) Two chromtid
(3) Two solenoid (4) Chromomere

60. Chromatin is made up of : -
(1) Nucleoprotein
(2) Nucleoside
(3) Pentose sugear
(4)Nitrogenous base

61. Term heterovhromatin and euchromatin were first coined by : -
(1) Heitz (2) Balbiani
(3) Painter (4) Kostoff

62. The two ends of chromatid are called : -
(1) Nucleosomes (2) Satellite DNA
(3) Telomeres (4) Kinetochores

63. General length of chromosome is : -
(1) $5\mu - 10\mu$ (2) $0.2 - 2\mu$
(3) $0.1 - 30\mu$ (4) $0.1\mu - 4\mu$

64. Chromosomes are made up of : -
(1) Microsome (2) Nucleosome
(3) Microtubules (4) Chondriosome

65. Who is the controller of cell: -
(1) Mitochondria
(2) Nucleus
(3) Golgi bodies (4)Endoplasmic reticulum

66. If the centromere is sub-median the two arms are unequal then the chromosome is called as
(1) Metacentric (2) Submetacentric
(3) Acrocentric (4) Telocentric

67. Chromonemata embedded in a : -
(1) Stroma (2) Matrix
(3) Sugar (4) Mucilage

68. Nucleosome model proposed by : -
(1) Du- Praw
(2) Kornberg and Thomas
(3) Sleffensen
(4) Waldeyer and Taylor

69. Structure which provide shape to chromosome is called : -
(1) Telomere (2) Satellite
(3) Cintromer (4) Chromomere

70. Nucleolus is formed by -
(1) Mitochondria
(2) Nucleus and Ribosome
(3) Primary constriction
(4) Secondary constriction

71 . Chromatin is mainly complex of : -
(1) RNA & DNA
(2) RNA & Histone
(3) Ribozyme & RNA
(4) DNA & Histone

72. Who first Synthesized artificial Gene in laboratory : -
(1) Mendle (2) Khorana
(3) Sutton (4) Kornberg

73. The person who first desceribed polyene chromosomes was : -
(1) Balbini (2) Walker & Allen
(3) Golgi (4) Waldeyer

74. Hetero-chromatin is : -
(1) Darkly stained part of chromatin
(2) Lightly stained part of cristae
(3) Lighty stained part of grana
(4) Scattered Lobes in cytoplasm

75. Chromosome with centromere at one End: -
1) Metacentric (2) Submetacentric
(3) Telocentric (4) Acrocentric

76. Hereditary characters are due to : -
(1) Chromosomes (2) Gene
(3) Blood (4) Placenta

77. Which one is synonymous to gene-
(1) Recon (2) Muton
(3) Cistron (4) Genome

78. One genome is which type of set of Chromosomes-
(1) Haploid (2) Diploid
(3) Triploid (4) Golgi body

79. Which structure is present in Chromosomes-
(1) Nucleus (2) Centromere
(3) Chromomer (4) Centromere

80. Part of Chromosome which joins with spindle fibres is -
(1) Chromatid (2) Chromonema
(3) Chromomere (4) Centromere

81. Discovery of Chromosome in Salivary gland of Chironomous Larca by Balbiani which Identify by presence of Chromosomal-
(1) Bands
(2) Coils
(3)Bandsand coils both
(4) All of theabove

82. Which of the following occurs more than one and less than five in a chromosomr: - **[CPMT-2002]**
(1) Chromatid (2) Chromomere
(3) Centromere (4) Telomere

83. The cells without are present in: - **[RPMT -2002]**
(1) Vascular cambium
(2) Root hair
(3) Companion cell
(4) Members of seve tube

84. In Karyogram. Sex chromosomes should placed at the end, but exception is -
(1) Drosophila (2) Homo sapience
(3) Pisum (4) Ginkgo

85. The telomeres of eukaryotic chromosomes consist of short sequences of – **[CBSE 2004]**
(1) Cytosine rich repeats
(2) Adenine rich repeats
(3) Guanine rich repeats
(4) Thymine rich repeats

86. If you are provided with root –tips of onion in your class and are asked to count the chromosomes which of the following stages can you most conveniently look into : - [**CBSE 2004]**
(1) Telophase (2) Anaphase
(3) Prophase (4) Metaphase

87. Plant with minimum number of chomosomes is : -
(1) **Haplopappus gracillis [RRMT 2004]**
(2) **Salix tetrasperma**
(3) **Poa**
(4) **Cynodon**

88. Heteropycnosis is exhibited by : - **[RPMT 2004]**
(1) Autosome (2) Chromatoid body
(3) Nucleolus (4) Sex-chromosome

89. Potein synthesis in an animal cell occus - **[CBZE 2005]**
(1) On ribosomes present in cytoplasm as well in itochondria
(2) On ribosomes present in the nucleolus as well as in cytoplasm
(3) Only on ribosomes attached to the nuclear envelope and endoplasmic reticulum
(4) Only on the ribosomes present in cytosol

90. Telomerase is an enzyme which is a – **[CBSE 2005]**
(1) RNA
(2) Ribonucleoprotein
(3) Repetitive DNA
(4) Siple protein

91. The length of DNA molecule greatly exceeds the dimensions of the nucleus in eukaryotic cells. How is the DNA accommodated? **[CBSE 2007]**
(1) Deletion of non –essential
(2) Supper – coiling in nucleosomes .
(3) Dnase digestion .
(4) Through elimination of repetitve DNA

EXERCISE -1 ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	**1**	**2**	**3**	**1**	**1**	**2**	**4**	**2**	**1**	**3**	**2**	**4**	**1**	**1**	**3**
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	**1**	**2**	**2**	**4**	**3**	**4**	**2**	**2**	**1**	**4**	**1**	**3**	**2**	**1**	**2**
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	**1**	**3**	**1**	**3**	**4**	**1**	**2**	**2**	**4**	**4**	**4**	**3**	**3**	**4**	**1**
Que.	46														
Ans.	**3**														

EXERCISE -2 ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	**3**	**3**	**2**	**2**	**1**	**1**	**2**	**3**	**3**	**2**	**4**	**4**	**1**	**4**	**1**
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	**1**	**1**	**1**	**2**	**4**	**2**	**3**	**4**	**1**	**4**	**4**	**3**	**2**	**1**	**3**
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	**1**	**4**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**4**	**2**	**2**	**1**	**3**
Que.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	**1**	**4**	**1**	**3**	**4**	**2**	**4**	**2**	**2**	**1**	**1**	**1**	**3**	**1**	**1**
Que.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Ans.	**4**	**4**	**1**	**1**	**1**	**4**	**1**	**1**	**2**	**3**	**3**	**2**	**2**	**2**	**1**
Que.	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Ans.	**2**	**4**	**2**	**3**	**3**	**4**	**2**	**3**	**2**	**2**	**3**	**4**	**2**	**3**	**2**
Que.	91	92	93	94	95	96	97	98	99	100	101	102			
Ans.	**2**	**1**	**3**	**1**	**2**	**1**	**1**	**3**	**3**	**4**	**4**	**4**			

EXERCISE -3 ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	**4**	**3**	**1**	**2**	**1**	**1**	**2**	**1**	**1**	**3**	**4**	**1**	**4**	**1**	**3**
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	**2**	**4**	**4**	**3**	**1**	**4**	**2**	**2**	**3**	**4**	**3**	**1**	**4**	**2**	**4**
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	**1**	**1**	**3**	**3**	**4**	**1**	**3**	**4**	**2**	**1**	**1**	**1**	**3**	**1**	**3**
Que.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	**4**	**2**	**4**	**2**	**3**	**3**	**2**	**3**	**4**	**2**	**4**	**2**	**2**	**2**	**3**
Que.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	
Ans.	**1**	**2**	**2**	**1**	**1**	**2**	**1**	**3**	**2**	**1**	**2**	**2**	**4**	**2**	

EXERCISE - 4 ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	**2**	**2**	**4**	**3**	**2**	**4**	**2**	**3**	**3**	**4**	**4**	**2**	**1**	**1**	**1**
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	**3**	**2**	**2**	**4**	**2**	**4**	**2**	**4**	**4**	**3**	**3**	**2**	**4**	**1**	**1**
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	**1**	**2**	**2**	**1**	**3**	**2**	**2**	**4**	**4**	**1**	**1**	**4**	**3**	**2**	**2**
Que.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	**3**	**2**	**4**	**2**	**4**	**2**	**3**	**3**	**1**	**1**	**1**	**3**	**2**	**1**	**1**
Que.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Ans.	**1**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**4**	**4**	**2**	**1**	**1**	**3**
Que.	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Ans.	**2**	**3**	**1**	**2**	**4**	**3**	**4**	**4**	**1**	**3**	**4**	**1**	**4**	**1**	**2**
Que.	91														
Ans.	**2**														

CELL DIVISION

Introduction:

Rudolf Virchow proposed the cell lineage theory states " **omnis cellula e-cellula** " i. e. new cells arise from pre existing cells . Rudolf Virchow failed to prove the theory .
Kari Nageli : -New cells arise by **division** of pre existing cells.
Starsburger : -New nuclei arise by division of pre existing nuclei.

Cell division : - 3 main types.
(1) Motpsis (2) Mriosis (3) Amitosis

MITOSIS

Mitosis name proposed by **Flemming** & its detail study was given by A. Scheiden. Mitosis produced genetically identical cells , which are similar to mother cell.

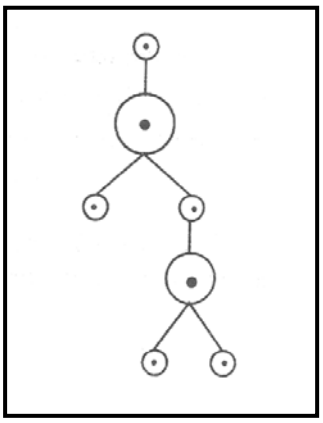
Cause of mitosis: -

(I) Kern plasma theory : Hertwig proposed kern plasma . According to this theory mitosis is due to disturbance in Karyoplamic Index (KI) of cell.

Karyoplasmic Index:

$$KI = \frac{V_n}{V_c - V_n}$$

Vn =Volume of nucleus
Vc =Volume of cell
V_C –Vn =Volume of cytoplasm



Karyoplasmic index of small cell is high as they have less cytoplasm.
Nucleus efficiently controls the acitivity of cytoplasm in small cells.
In a large cell nucleus fail to control the acitivity of cytoplasm. To attain the control of nucleus on metabolism a large cell divides into two cells.

(II) Surface –volume Ratio:

- Surface –volume ratio of a cell plays an important role in starting cell division .
- A cell draws all the materials needed for its maintenance & growth from is surface.

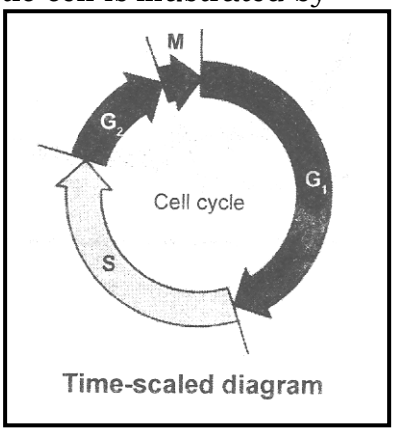
When a cell grows in size its volumes increases more than its surface . So a stage will reach when the surface area becomes insufficient to draw the material . At such critical stage , division of cell started.

CELL CYCLE

- Complete life cycle of a cell is called as cell cycle . A typical eukaryotic cell is illustrated by human cell in culture.
  These cells divide once in approximately every 24 hours.
- Yeast can progress through the cell cycle in only about 90 minutes.

Cell cycle involves two stages.
(1) Interphase
(2) Division phase /M-phase

1. Interphase : -This is middle stage of cell cycle , because there occurs one interphase between two division phase . In interphase cell grows in size and prepares itself for next division. Interphase is **most active phase** of cell cycle.



- In interphase. Metabolism of cell increases. A series of metabolic changes occurs during interphase in cell. These changes are not visible under Microscope, So some scientist termed interphase as resting phase. But now it's known that it is the most active phase of cell cycle.
- **Howaed and pelc** classified interphase into three sub stages: -

(i) G1 –phase or Pre DNA synthesis phase (Ist Gap phase) (Longest phase of cell cycle 12 hr) During G1 -number of cell organelles increases in cell and cell rapidly synthesizes different **types of RNA and proteins.** Due to availability in G1stage.

(ii) S-phase (DNA Synthesis phase 6 -10 hr) :

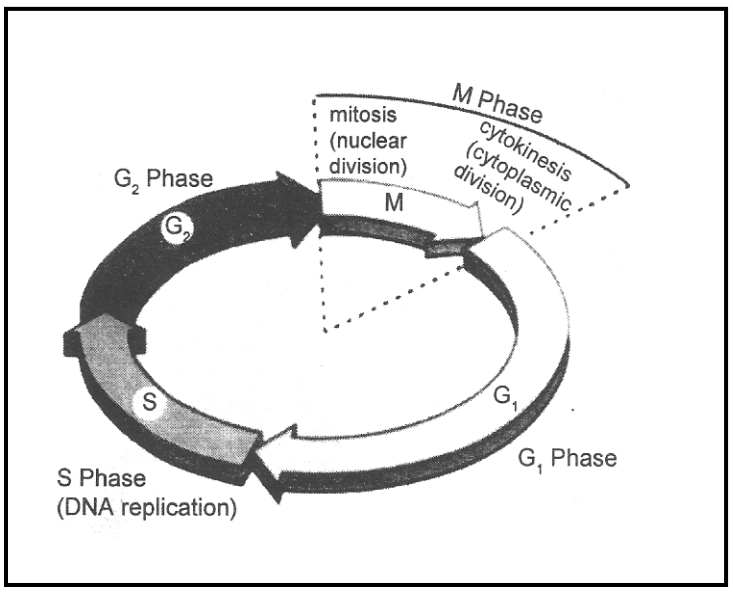
- Replication of nuclear DNA and synthesis of **histone protein** takes place in s-phase . Replication of cytoplation DNA may occur in any stage of cell cycle . Centriole replicates in late s-phase.
- Cell cycle can remain **arrested only in G1 phase. Then G1 is called as G0 phase G0 phase is found in** cells of permanent tissue .
- **Cell cycle is running** by a group of special proteins **" Cyclins and Cdks** (MPF) . (Nurse. T. Hunt & Hartmann **2001** studies on saccharomyces (Baker yeast)) .

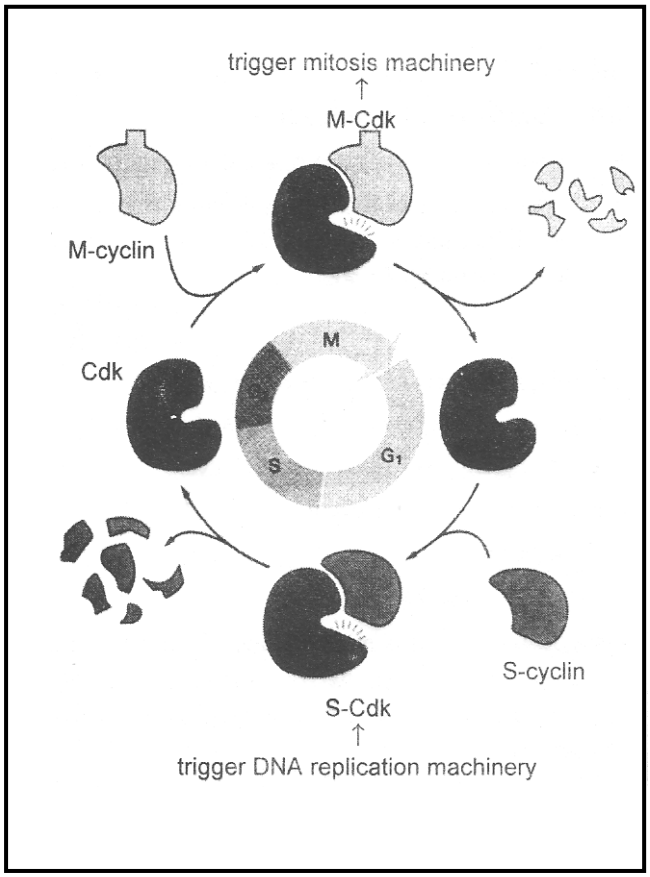
(iii) G1 –phase (2nd Gap phase) or Post DNA synthesis phase (3-12 hrs) : (Pre mitposis phase)

- Number of cell organelles increases in cell. Actual preparation (**Final preparation**) of cell division occurs during this phase. Special materials required for cell division are synthesized in G2 phase . e. g. **Tubulin protein.** - (Required for formation of spindle fibres) .
- Cell division involves enormous expenditure of energy thus cell stores ATP in G2 phase.
- After G2 phase cell enters in division or M- phase.

How the cell cycle is controlled

- A cell reproduces by performing an orderly set sequences of irreversible events , In which it duplicates it's contents & then divides into two , these events are known as **cell cycle**.





- Molecular biologists, have made remarkable progress in identifying the biomolecules, That control or drive the cell cycle, many biologists , some of whom worked with invertebrate of frog egg's others with yeast cell or cell culture. Scientists concluded that the activity of enzymes, known as **cyclin dependant . (Cdk's)** regulates the cell kinases involved in the cell cycle are called **Cdks** because they are activated when they combined with key protein called **cyclin.**
- At some check pints & & a kinase enzyme combines with cyclin & & this moces the cell cycle forwardly .

S-kinase is capable of starting the replication of DNA after it combined with **S-cyclin.** After some time s-cycllin is destroyed & **S-kinase** is no longer active. **M-kinase** is capable of turning on mitosis after it has bind with **M-cyclin .** The detail of cell cycle varied from organism & different time in an organism. However certain characteristice are universal component of cell cycle control.

Genes

CDC2 , CDC28 designated Budding yeast	Cdc2, cdc -28 designted In fission yeast

2 Division phase :

- **Division phase** or **M-phase** or mitotic phase (1hr) . It is the phase of shortest time in cell cycle.

Karyokinesis: -Division of cytoplasm. Name proposed by **Schleicher.**

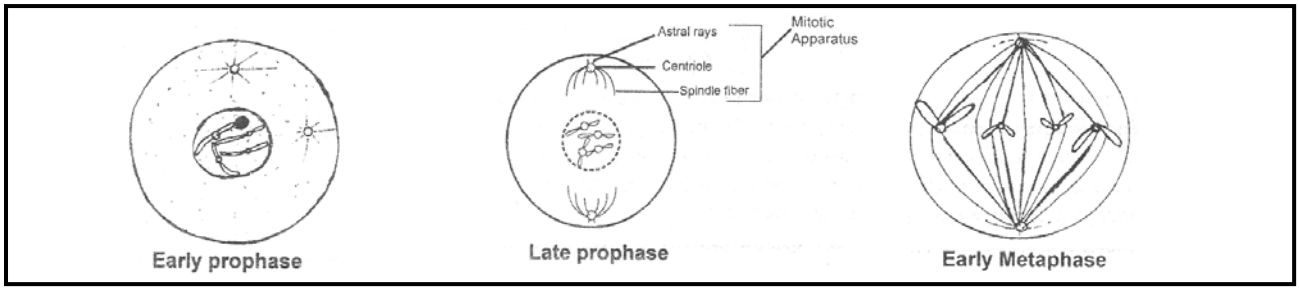
Cytokinesis: -Division of cytoplasm. Name proposed by **Whitemen.**

Karyokinesis: -Dicisiov of nucleus occurs by sequential change in nucleus and cytoplasm.

Division of nucleus in mitosis and meiosis is **indirect.**

.(1) Prophase (Longest stage) : Metabolism of cell decreases , cytoplasm becomes **visco refractive and pale**. Chromatin threads condenses to form chromosomes . Centrioles start moving towards the opposite poles. Astral ray forms due to gelation of proteins around centrioles. **In late prophase** (Prometaphase) **nuclear membrane and nucleolus disappear .** Spireme stage of chromosome.

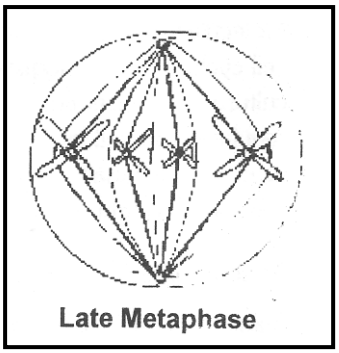
Anastral and Amphiastrl Mitosis : In plants, centrioles are absent and no asters are formed . Mitosis without astere is known as **anastral mitosis .** In animals, the asters are present and the mitosis is described as **amphisatral , or astral mitosis.**



(2) Mitaphase:

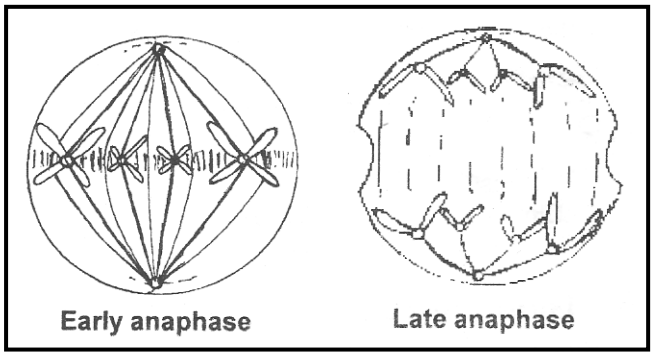
- Chromosomes arrange on equator to form metaphase plate (Metakinesis) or equatorial plate.
- Chromosomal (discontinuous) fibres. (which run from pole to centrmere and) and supporting comtinous) , fibres (which run from pole) , arrange in cell.
- spindle fibre are composed of 97% Tublin protein and 3% RNA.
- In metaphase plate large chromosomes lie towards periphery and small chromosomes forwards centre **.**

- Centromere lies at equator and arms remain directed towards poles.
- Chromosomal fibres have polarity i. e. +end at equator and –end at the pole , In metaphase each chromosome splits lenghwise upto the centromere (division of matrix of chromosome) . Thus replicated chromatids clearly visible at metaphase stage .
- Two chromatids of a chromosome repulse each other and the arms of chromosomes are directed towards the oppsite poles.

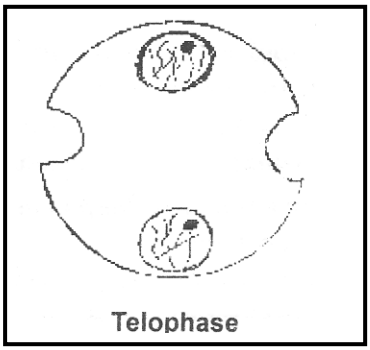


(3) Anaphase : (Smallest stage)

- In early anaphase interzonal fibres (small and contracted) appears at equator of cell.
- Centromere of each chromosome splits lengthwise (**division of centromere**) .
- Number of chromosome becomes double in cell during miltotic anaphase.
- Interzonal fibres expands and they push chromosomes towards the opposite poles, **(Pushing)**
- Chromosomal fibres contract and they pull chromaosome towards opposite polies . **(Pulling) .**
- By pulling and pushing mechanism chromosome rapidly towards the opposite poles.
- Approximately 30 ATP are required to carry a chromosome to pole. Chromosomes reach at poles is late anaphase.

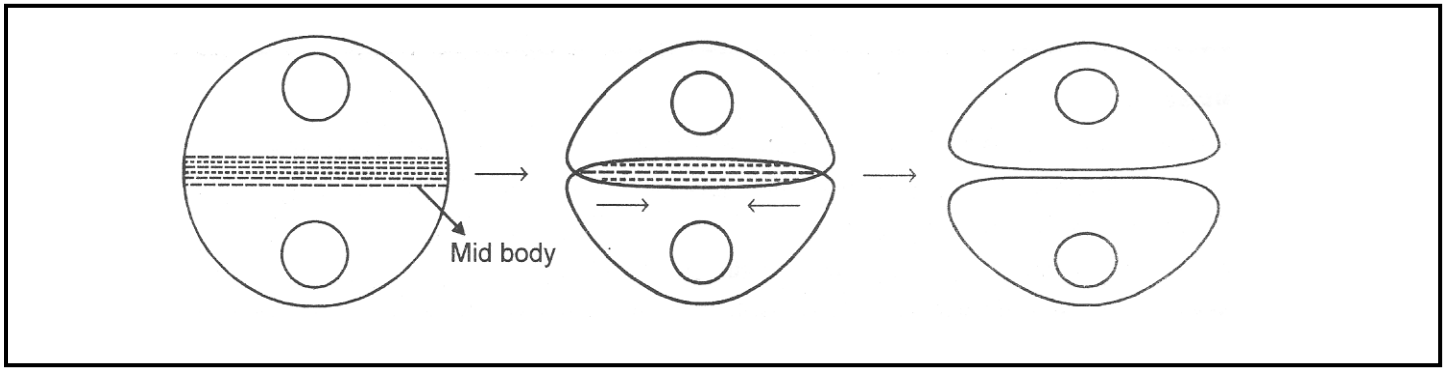


(4) Telophase (Reverse prophase) : During the telophase metabolism of cell increases . Nuclear membrane and Nucleolus reappears . Chromosomes **decondense** to form chromatin net .

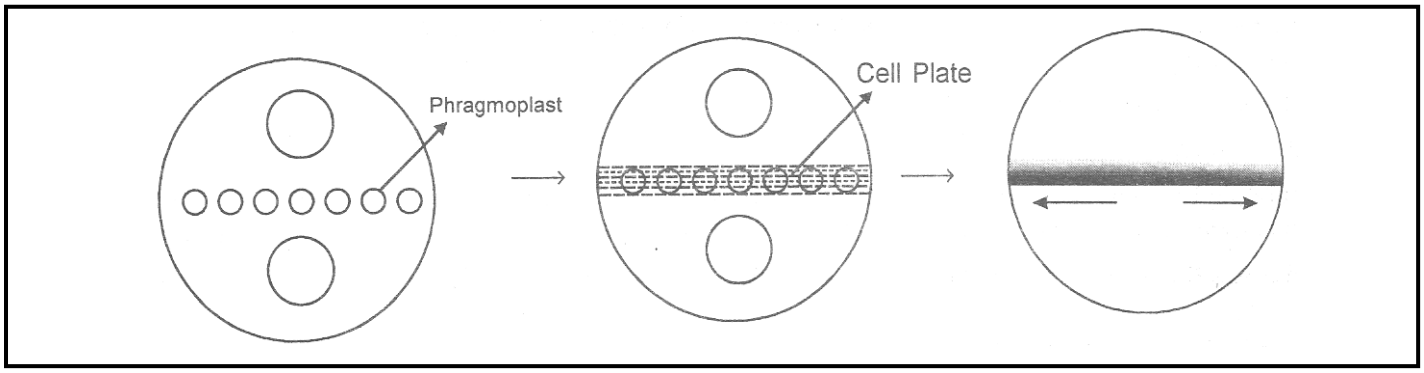


Cytokinesis

Cytokinesis Starts in **late anaphase . In animals** cytokinesis occurs by **constriction & furrow formation .** Microtubules and microfilaments arrange on equator to form midbody , Contraction occurs in midbody and Plasma membrane starts constricting to form **contratil** ring. Thus a furrow forms from the out side to inside in cell. Furrow deepens continuosly and ultimately a cell divides into two daughtr cells In animals cytokinesis occurs in centripetal order.



Cytokinesis in plants= Takes place by **cell plate formation** because constriction is not possible due to presnce of the rigid cell wall.



☞ Many golgi vesicles arrange themselves on equator to form **phragmoplast.** ER and Fragments of spindle fibres also collect on rquator. Collectively this structure is known as **ceel plate.** Gogi vesicles secrete calcium and magnesium pectat. Further cell plate is modified into middle lamella. in plants, cytokinesis occurs in centerifugal order (cell plate formation is from to periphery) .

SIGNIFICANCE OF MITOSIS

1. **Devlopedment of an organism** occurs by mitosis. Evry organism start its life from a single cell i. e. zygot. reeated mitosis in zygote leads to the formation of the whole body.
2. **Growth in body** of organism occurs by mitosis.
3. **Repairing and regeneration** in body occurs by mitosis. 5×10^9 cells form per day in man.

MODIFICATION OF MITOSIS

1. **Cryptomitosis or promitosis:** it is a primitive type of mitosis. In this type of division, nuclear membrane dose not disappear but remain intact throught the division. All the changes of karyokinesis occurs inside nucleus even the foramation of spindle (**called as intranuclear spindle**) such division is found in some protozoans (amoeba) during binary fission.

2. **DINOMITOSIS: -**Dinomitossis founds in dinoflagellates, which are **mesokaryotes,** In mesokaryotic cells histones are absent , Because of this , the chromosomes fail to condense properly and not disitnctly visible during cell division. Nuclear membrane persists throughout the cell division and so spindle formed is intranuclear typ .

☞ Normal mitsis is termed as Eumitosis. Spindle which forms during normal is termed as " **"Nuclear spindle".**

3 **Free nuclear division: -** Karyokinesis is not followed by cytokinesis so such divisions lead to coenocyyic condition. eg. endosperm, fungi of plycomycetes group.

4. **Endomitosis : -**This is duplication of chromosomes without divisionlead to polyploidy . i. e. Increase in number of sets of chromosome . Colchicine induces polyploidy in plants . Cplchicine is a mitotic poison as it arrests the formation and arrangement of spindle fibres.

Endoreduplication: Endoreduplication is a modification of endomitosis . The polytene chromosomes form by proces **endoreduplication. in** endoreduplication, the chromonema replicate but donnot get seperated . This process is also known as **polyteny.**

☞ **Mustard gas and Ribonucleases** are also mitotic poisons.

MEIOSIS

" Term **meiiosis**" was proposed by **Farmer and Moore.** Meiosis produces genetically different type of cells. All the four daughter cells produced by meiosis are genetically different from each other and also differ from the mother cell.

Meiosis includes 2 division of cell

(i) Meiosis -I (ii) Meiosis -II

- **Meiosis I: -** Heterotypic division or reduction dicision. It leads to reduction in chromosome numbers. Division of chromosome does not occurs in meiosis-I and only segregation of homologous chromosomes takes place.
- **Meiosis II: -** This is a homotypic divison or equational division . It does not leads to any change in chromosome number .
- **Meiosis II is just like mitosis .** Dicision of centromere occurs during meiosis II.

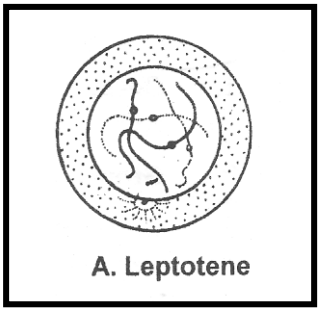
In meiosis, division of nucleus takes place **twice** but divison of chromosome occurs only **once.**

Interphase - same as in mitosis

Stages of meiosis I

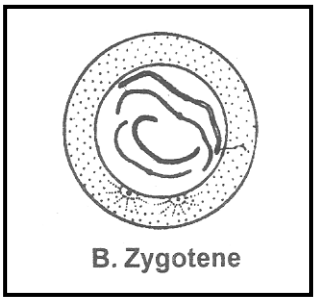
1. Prophene –I : This is longest and most complex stage of meiosis . Prophase is classified in five substages:

(a) Leptotene ⇒ Chromatin threads condense to for chromosomes , chromosomes are **lonest & thinest.**


A. Leptotene

- On Chromosome**,** bead like structures are present i.e. chromosomes. All the chromosomes in nucleus remain directed towards centrioles , so group of chromosomes on nucleus appears like a bouquet in animal cell. (**Bouquet stage**) . At this stage organism shows a peculiar type of orientation of chromosomes- animals show bouquet type while plants synizesis type.

(b) Zygotene of Synaptotene- Zygotene is characterized by pairing of homologous chromosomes **(Synapsis) .** Psits of homologous chromosomes ara called **Bivalents.** There devleops a structure in between homologous chromosomes Which is termed as **synaptonemal complex.** Synaptonemal compex is composed of three thick lines of **DNA** and proteins . According to **Mosses (1956)** synaptonemal complex helps in pairing and chiasmata formation.

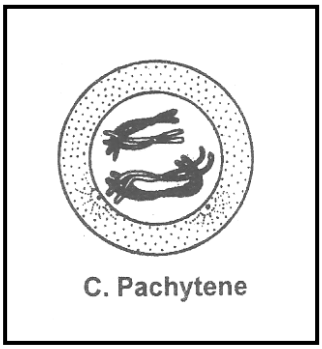

B. Zygotene

- About 0. 3% DNAis synthesized in Zygotene substage . This DNA is used in chromosome pairing or synapsis (Zyg. DNA)

Three type of synapsis or pairing takes place in chromosomes :

- **Proterminal pairing : -** The two homologous chromosomes start pairing at the terminals, which gradually progresses towards the centromere.
- **Procentric pairing : -** The pairing starts at the centromere and proceeds towards the ends.
- **Random or Intermediate pairing : -** The pairing may start at any point.

(c) Pachytene (Thick thread) – Due to increased attraction , homologous chromosomes tightly coil around each other .


C. Pachytene

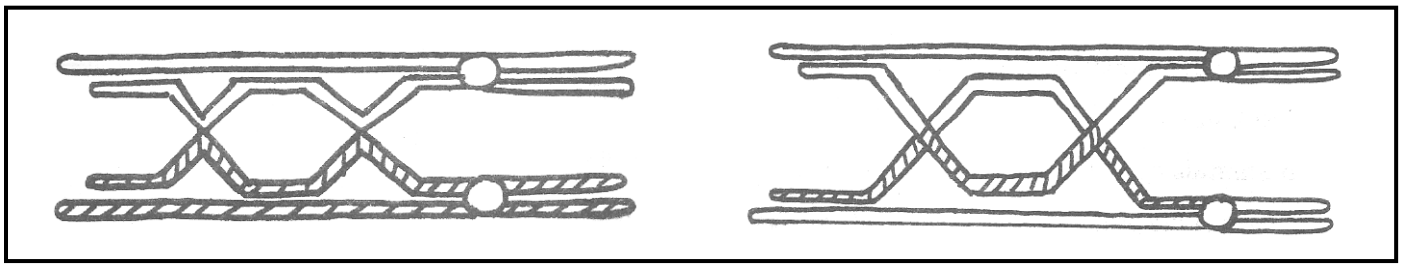
- Both chromatids of each chromosome become distinct.
- Each chromosome in a bivalent at pachytene stage has two chromatids, as a result of which bivalent really consists of four chromatids and is called **a tetrad.** Both the chromatids of a chromosome are called **sister chromatids.**
- Bivalent is called **tetrad** and each chromosome is called **Dyad.**

☞ Nonsister chromatids of homologous pair develops **recombination nodules** and exchange their parts i. e. crossing over . Crossing over was discovered by **Morgan** and **Castle** in **Drosopila .**

Theories of crossing over –

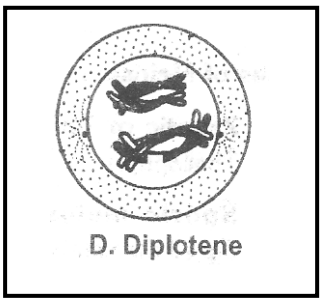
(i) Copy choice theory ⇒ Belling , Laderberg.
(ii) Breakage first theory ⇒ Muller
(iii) Strain theory ⇒ Darlington **(iv) Breakage and reunion theory ⇒ Stern and Hotta**

☞ Breakage and reunion theory is appropriate theory for crossing over which is explained with the help of a most accepted model **(Hybrid DNA model)** of **Holiday** and **Whitehouse.**



☞ **Endouclease** first reaks the nonsister chromatids at the pace of recombination nodule.
☞ Nonsister chrmatids reunite after exchanging their parts (by Ligase) As the result of crossing over cross like structures –**chiasmata (discovered by janssen)** form in bivalent
☞ Number of chiasmata (singular – chiasma) per bivalent depends on the length of chromosome.

(d) Diplotene - Homologous chromosomes start repulsing each other so **chiasmata** become **visible .** Due to repulsion (**desynapsis**) chiasmata begin to move along the length of chromosome and towards the end of chromosome. This event is called **Terminaization.**

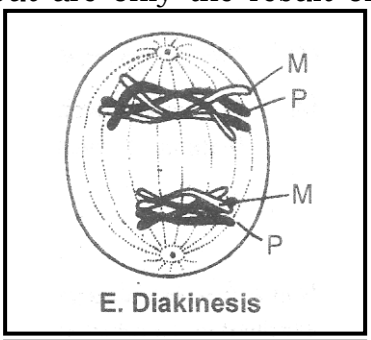

D. Diplotene

☞ In diplotene, chiasmata move toward the end of chromosome in a zip like manner .
☞ **Diplotene** (Dictyotene) may last long up to month or years (12 to 15 years in Humam Female)
☞ According to modern scientists chiasmata are not the cause but are only the result of crossing ocer.

(e) Diakinesis –Terminalisation completes.

Homologous chromosomes remain attach to each other only at the ends , Centrioles move towards the opposite polies.

☞ Nuclear membrane and nucleolus disappear.

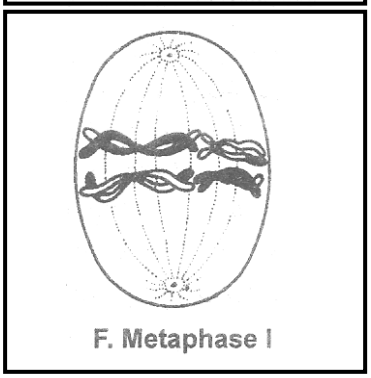


E. Diakinesis

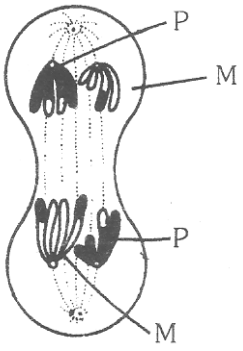
2. Metaphase I:

Bivalents arrange on equator (**congressin**) of cell to form metaphase plate. Three types of spindle fibres appear in the cell.

(i) Chromosomal/Kinetochore Spindle fibres
(ii) Supporting /Continuus Spindle fibres
(iii) Interzonal Spindle fibres.


F. Metaphase I

3. Anaphase I :



G. Anaphase I

- Chomosomal fibre contracts and intezonal fibre expands. So homololgous chromosomes segregate from each other and move towards the opposite poles.
- Anaphase I is characterized by **segregation** or **disjunction** of chromosomes . **Division fo centromere** is absent . Anaphase I is responsible for reduction in chromosome number in daughter cells.

4. Telopase I:
Just like the telophase of mitosis
Cytokinesis I :

- **In animals** by constriction & furrow formation (successive) .
- In most of the plants cytokinesis does not occur after meiosis I.
- In plants , all the four daughter cells are produced **simultaneously.** Group of four cells produced simltane-ously is called **tetrad.** (Tetead of pollen grains ,)
- Gap between meiosis I and meiosis II is called **Interkinesis .** Preparations of meiosis II occur during interkinesis. It can't be termed as interphase because replication of DNA is absent in interkinesis.

Meiosis-II –Just like mitosis.

Types of Meiosis: -

- **Zygotic or initial meiosis : -** When the neiosis in life cycle of an organism occurs in zygote cell. Eg. In Thallophyta.
- **Sporic meiosis or Intermediate Meiosis : -** Meiosis takes place during spore formation . Eg. all the plants except thallophyta.
- **Gametic or Terminal Meiosis : -** Meiosis during the gamete formation , Eg. Animals.

Significance of Meiosis : -

(1) The meiosis maintains constant number of chromosomes in sexually reproducing organisms.
(2) By crossing over , meiosis provides an opportunity of exchange of genes (variations) & thus meiosis is raw material for process of evolution.

AMITOSIS

- Name 'Amitosis ' was given by **Remake** and detail of amitosis is given by **Flimming .** It most primitive type of cell division . Condensation of chromosomes not occus in amitosis. Chromosomes are not visible during division . It is a process of division **without recognizable chromosomes .** Amitosis does not involve the formation of spindle. Division of nucleus is direct . i. e. without sequential changes (prophase , metaphase, anaphase & telophase) . In amitosis, sivision of cytoplasm and mucleus occur simultaneously by the constriction. In amitosis division may be equal or unequal . Amitosis is **fastest cell division** which may complete in 20 – 30 minute . Amitosis is cell division of prokaryotes . But exceptionaly also occurs in some eukaryotes.
  Eg. Yeast – budding occurs by amitosis.
- In amoeba multiple fission occurs by amitosis.
- In Paramecium division of meganucleus .
- In mammals –growth of foetral membranes (amnion , chorion , allantois , yolk sac)
- Division of mitochondris and chloropasts.

Difference between mitosis and meiosis. .

S.No.	Mitosis	Meiosis
	1. GENERAL	
1.	The division occurs in somatic cells.	It occurs in reproductive cells.
2.	Both diploid and haploid cells show mitosis.	Meiosis is found only in diploid cells. (or in 4n, 6n , 8n)
3.	It is a single division.	It is a double division .
4.	Mitosis produces two cells	Meiosis produces four cells.
5.	It does not introduce variation.	Meiosis introduces veriations due to gene exchange.
6.	Number of chromosome same as mother cells.	Chromosomes number reduced (halved) .
7.	It is required for growth , repair and healing .	Meiosis involved in only sexual reproduction.
	2. PROPHASE	
8.	It is simpler.	Prophase – I is complicated .
9.	Bouquet stage and synapais absent.	Bouquet stage (sninzesis in plants) and synapsis occurs.
10.	Crossing over and chiasma not seen.	Crossing over and chiasma formation occurs.
	3. METAPHASE	
11.	Chromosome remain as monovalent and has two chrmatids	Chromosome as bivalet and four chromatids.
12.	Centromeres are present over the equator or metaphase plate while arms facing towards the poles.	Centromeres projects the poles.
	4. ANAPHASE	
13.	Centromere devides during anaphase.	Division of centromere is absent in anaphase-I
14.	Chromosomes are single chromatided.	Chromosome has two chromatids.
15.	The two chromatids of a chromosome separate and become as daughter Chromosomes.	Chromosome do not separate in Anaphase-I
16.	Chromosomes moving towards the opposite poles are similar	Chromosomes are dissimilar.
	5. TELOPHASE	
17.	It is an essential in which nucleolus and NM reapppears	Telophase –I may be absent .
18.	Nucleolus appears.	Nucleoli are not formed in Telophase –I
	6. CYTOKINESIS	
19.	Cytokinesis takes place.	Not compulsory (simulteneous after both the divisions in plants)
20.	Daughter cells posses same genetic constitution.	All four daughter cells are differ.

S. No	Mitosis	Msiosis-II
1.	An interphase occre prior to mitosis.	Interphase may or may not persent priot to meiosis –II if present then celled **interkinesis.**
2.	S-phase present .	**S-**phase absent.
3.	Daughter cells formed after mitosis resemble to mother cell.	Differ from mother cell, qunsntitativrly and qualitatively.
4.	Longer	Shorter.

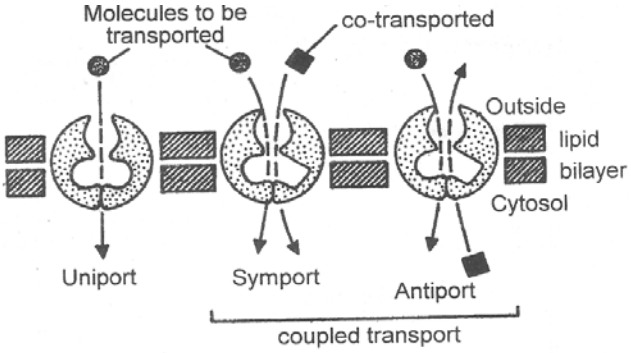
SPEIAL POINTS

- **Robert Sovion change : -** Conversion of a metacentric cheomosome in to two telocentric chromsomes.
- According to research , cell wall is censidered as dynamic , porous and capable of recognizing signals of cells.
- **Symplast : -** Path in body . which is made up of living components or cytoplasm (or through plamodesmata) is called as symplast.
- **Apoplast : -** Path in plant body , which is made up or nonliving spaces is callled as Apoplast.
- **Intermediate filaments** has size /diameter in between microfilaments and microtubules. These fillaments form **basket like** structure around the nucleus . These are made upof **actin.**
- Cadherins called as cell adhesion molecule .
- Human myelin has 20% protein & 79% lipids.
- **Spectein** : - (Responsible for structural integrity & biconcave shape of RBC membrane) deficiency or mutation in spectrin makes humans anaemic, leading to abnormality in shape of RBC which become sperical instead of concave.
- **Gangliosides : -** The most complex glycolipid are gangliosides.
  (i) A variety of membrane protein may present in or on the membrane are called as **cell adhesion moleculle** (CAMs) .
  eg, '**Cadherins** (in cell adhesion) , **integrins** and **selectins** (work inflammatory response) .
- **Gorter and Grendel (1926) : -** Suggested that plasma membrane consists of double layer of lipil molecule.
- Carrier protein are mainly involved in facilitated diffusion and active transport but rarely some carrier proteins involved in simple diffusion . Carrier (tunnel) proteins may be following type

(1) Uniporter carrier proeins : - When a carrier transports on it single solute form one side of membrane to other side.

(2) Symporters : - When carriers transport one solute which depends on transport of simultaneously second solute in same direction.

(3) Antiporter carrier protein : - When carrier transports one solute which depends on simultanously second solute in the opposite direction.



Three types of carrier mediated transport (uniport, symport and antiport)

- Active transport is always facilitated by carrier proteins or pumps . Although passive transport may or may not involve carrier protein . **Ion channels are never involved in active transport.**

- **Freeze ecthing E. Microscopy : -** In this technique first of all, living cell is frozen in liquid nitrogen at temperature =1960 C in the presence of antifreeze (or ctyoprotectant) . Frozen block is sliced with a knife/ blade and studied under E. M.

- For the structure of **membrane , membrane skeleton fence model** proposed by **(Kusmi 1993) .**

- **Hydrogenosome** is a recently discovered eukaryotic **cell organelle** in **Nyctotthermus ovalis.** This is a double membranous cell organelle which can produce ATP only by substrate level phosphorylations because cytochromes (ETS) and TCA cycle is absent . This organelle produces high amount of **hydrogen** by anaerobic process. Thus named as **Hydrogenosome.**

- **Endosome (receptosome)** is also recently discoveredcell organelle which consists of tubules and vesicles and involved in intracellular traffic.

- In certain plants (**Lilium**) during leptotene , all chromosomes of a cell are densely clumped to one side and rest of the nucleus has no chromatin material . This event is called **synizesis.** Its significance is subject of future research.

- During the leptotene stage each chromosome is attached to nuclear envelope by **attachment plate** which is made up of by specific proteins . At this time, chromosomes directed to centrosome and appear as **Bouquet.**

- Chiasma formation is theresult of crossing over, this is explained by **F. F. Janssen** With chiasma type theory (or one plane theory)

- Protein **transferrin** which works in iron transport helps in mitosis division.

Satellite DNA : - Repeatitve sequence used to know relation among species because two Important features of stellite DNA are

(i) Remarkable relative uniformity within the same species.
(ii) Genes for **5-s RNA** presents separately than NOR.

- Genes for **5-s r-RNA** present separately than NOR.
- In active state of mitochondria , (metabolically busy state) number of cristae is high and matrix is small (condensed state)
- When mitochondria , metabolically relax, then size of matrix is large and less number of cristae this is called **orthodox state** of mitochondria.
- Metabolically active cell have more dense . developed E. R.
- **Porin.** Proteins form pores in outer mitochondria and bacterial membranes.
- Erythrocyte membrane in human contain about 40% phospholipds and 52% proteins .
- Generally root tip of onion used for study of mitosis (2n=14)
- Chromosome doubling without division of cell can induce by colchicine . This event is called **C-mitosis**
- Telomer is concern with ageing of organisms.
- Chloroplast and mitochondria not included in endomembrane system of eukaryotic cell.