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Cell Biology: Meiosis & Genetic Variation

Printable Flashcards — Pre-Med Biology

Meiosis I and II, crossing over, independent assortment, and comparisons with mitosis.

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125 cards — Printable Flashcards

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1

Meiosis: what's the point (one sentence)?

2

Meiosis happens in somatic cells or germline cells?

3

Meiosis has how many divisions, and how many DNA replications?

4

Meiosis starts with a diploid cell (2n). What does it end with?

5

Why does meiosis create genetic variation? Name the big two mechanisms.

6

Meiosis I is called reductional division because...

7

Meiosis II is called equational division because...

8

Meiosis vs mitosis: which one makes genetically identical cells?

2

Germline cells (cells that make gametes).

1

Make haploid cells (gametes) from a diploid cell, and shuffle genes so each gamete is different.

4

Four haploid cells (n) (in males, usually 4 sperm; in females, 1 egg + polar bodies).

3

Two divisions (meiosis I and II) but only one DNA replication (S phase) beforehand.

6

It reduces chromosome number: homologous chromosomes separate (2n -> n).

5

Independent assortment and crossing over (recombination).

8

Mitosis.

7

It separates sister chromatids (like mitosis), so chromosome number stays n -> n.

9

Meiosis vs mitosis: how many daughter cells do you get from one starting cell?

10

Meiosis happens in plants too: what does it produce first (high-level)?

11

When exactly is DNA replicated for meiosis?

12

Meiosis has {{c1::two divisions}} but only {{c2::one}} DNA replication.

13

Homologous chromosomes: what are they?

14

Sister chromatids vs homologous chromosomes: what's the difference?

15

When do homologous chromosomes pair up (synapsis)?

16

What is synapsis?

10

Haploid spores (which then give rise to gametophytes that produce gametes).

9

Mitosis: 2. Meiosis: 4 (usually).

12

Meiosis has two divisions but only one DNA replication.

11

During S phase before meiosis I.

14

Sister chromatids are identical copies of one chromosome. Homologs are the maternal and paternal versions of a chromosome pair.

13

A pair of chromosomes with the same genes in the same order (one from mom, one from dad).

16

The pairing of homologous chromosomes during prophase I.

15

Prophase I.

17

What is a tetrad (bivalent)?

18

In metaphase I, what lines up at the equator: chromosomes or tetrads?

19

Crossing over happens between which chromatids?

20

What is a chiasma (plural chiasmata)?

21

Why do chiasmata matter for chromosome segregation?

22

Synaptonemal complex: what is it (concept)?

23

If a question says 'tetrads' or 'synaptonemal complex', are you in mitosis or meiosis?

24

Crossing over occurs between {{c1::non-sister chromatids}} of {{c2::homologous chromosomes}}.

18

Tetrads (paired homologs).

17

A paired set of homologous chromosomes: 2 homologs, each with 2 sister chromatids -> 4 chromatids total.

20

The visible point where crossing over occurred; it physically holds homologs together.

19

Non-sister chromatids of homologous chromosomes.

22

A protein scaffold that holds homologs tightly aligned during prophase I for crossing over.

21

They help homologs stay connected so they can line up and separate correctly in meiosis I.

24

Crossing over occurs between non-sister chromatids of homologous chromosomes.

23

Meiosis (prophase I).

25

A {{c1::tetrad}} (bivalent) contains {{c2::4 chromatids}}.

26

Prophase I is long. What's the ONE big thing that happens here (high yield)?

27

Crossing over happens in which prophase I substage (if they get picky)?

28

Chiasmata become clearly visible in which prophase I substage?

29

Zygotene (prophase I): what's happening?

30

Leptotene (prophase I): what's the simplest description?

31

Diakinesis (late prophase I): what's the exam-level clue?

32

If they ask for it: crossing over happens in {{c1::pachytene}}, and chiasmata are obvious in {{c2::diplotene}}.

26

Homologs pair and crossing over happens.

25

A tetrad (bivalent) contains 4 chromatids.

28

Diplotene.

27

Pachytene.

30

Chromosomes start condensing.

29

Synapsis begins (homologs start pairing).

32

If they ask for it: crossing over happens in pachytene, and chiasmata are obvious in diplotene.

31

Chromosomes are very condensed and the nuclear envelope breaks down to prepare for metaphase I.

33

Meiosis I: prophase I key events?

34

Meiosis I: metaphase I key event?

35

Meiosis I: anaphase I key event?

36

Meiosis I: telophase I result?

37

In meiosis I, do sister chromatids separate?

38

In metaphase I, how do sister kinetochores attach?

39

In anaphase I, what breaks: cohesin on arms or at centromere? (concept)

40

In anaphase I, {{c1::homologous chromosomes}} separate while {{c2::sister chromatids}} stay together.

34

Tetrads line up at the equator with random orientation.

33

Synapsis + crossing over, chromosomes condense, spindle forms.

36

Two haploid cells (each chromosome still duplicated).

35

Homologous chromosomes separate to opposite poles (sisters stay together).

38

They attach to the same pole (co-orientation), so sisters move together.

37

No.

40

In anaphase I, homologous chromosomes separate while sister chromatids stay together.

39

Cohesion on chromosome arms is released so homologs separate; centromere cohesion stays to keep sisters together.

41

Meiosis II is most similar to what?

42

Meiosis II: metaphase II key event?

43

Meiosis II: anaphase II key event?

44

At the end of meiosis II, each cell is...

45

Meiosis I separates {{c1::homologs}}; meiosis II separates {{c2::sister chromatids}}.

46

Independent assortment: what is it?

47

Independent assortment happens in which stage?

48

Crossing over vs independent assortment: what's the difference?

42

Single duplicated chromosomes line up (not tetrads).

41

Mitosis.

44

Haploid with unduplicated chromosomes (one chromatid each).

43

Sister chromatids separate.

46

Random orientation of homologous pairs at metaphase I, mixing maternal and paternal chromosomes into gametes.

45

Meiosis I separates homologs; meiosis II separates sister chromatids.

48

Crossing over swaps DNA between homologs; independent assortment mixes whole homologs.

47

Metaphase I (set up), with the outcome seen after anaphase I.

49

How many different chromosome combinations can you get from independent assortment alone?

50

Humans: independent assortment alone gives how many possible gamete chromosome combos (ignoring crossing over)?

51

Crossing over increases variation because it...

52

Gene linkage idea (exam-level): genes close together on a chromosome tend to...

53

Crossing over happens in mitosis: true or false?

54

Counting trap: in G1, a human cell has 46 chromosomes. After S phase (before meiosis), how many chromosomes and chromatids?

55

Same human setup: after meiosis I, each cell has how many chromosomes and chromatids?

56

Same human setup: after meiosis II, each gamete has how many chromosomes and chromatids?

50

8,388,608 (2^{23}).

49

2^n, where n is the haploid number.

52

Be inherited together, unless crossing over separates them.

51

Creates recombinant chromosomes with new allele combinations on the same chromosome.

54

46 chromosomes, 92 chromatids.

53

False (in the normal way tested).

56

23 chromosomes, 23 chromatids.

55

23 chromosomes, 46 chromatids.

57

If a cell is diploid with 2n=8, how many chromosomes are in a gamete?

58

2n=8 organism: after S phase, how many chromatids are there?

59

2n=8 organism: after meiosis I, how many chromosomes per cell?

60

2n=8 organism: after meiosis II, how many chromosomes per gamete?

61

Chromosome number 'doubles' briefly in meiosis when?

62

If you mess up and say 'chromosomes double in S phase,' what's the correct fix?

63

Nondisjunction: what is it?

64

Meiosis I nondisjunction: what's the mistake?

58

16 chromatids.

57

n=4.

60

4 chromosomes (unduplicated).

59

4 chromosomes per cell (still duplicated).

62

Chromatids double in S phase; chromosome count stays the same until chromatids separate.

61

During anaphase II inside a cell, when sister chromatids separate and count as separate chromosomes.

64

Homologous chromosomes fail to separate in anaphase I.

63

Failure of chromosomes to separate properly during meiosis.

65

Meiosis II nondisjunction: what's the mistake?

66

Exam trap: meiosis I nondisjunction affects how many gametes?

67

Exam trap: meiosis II nondisjunction affects how many gametes?

68

Aneuploidy: what does it mean?

69

Trisomy means...

70

Monosomy means...

71

Nondisjunction is more likely to happen when the wrong thing fails: spindle attachment or DNA replication?

72

Meiosis I nondisjunction = homologs fail to separate in {{c1::anaphase I}}; meiosis II nondisjunction = sisters fail in {{c2::anaphase II}}.

66

All 4 gametes are abnormal.

65

Sister chromatids fail to separate in anaphase II.

68

Abnormal chromosome number (extra or missing chromosomes), not a whole extra set.

67

2 normal, 2 abnormal.

70

One missing chromosome (2n - 1).

69

One extra chromosome (2n + 1).

72

Meiosis I nondisjunction = homologs fail to separate in anaphase I; meiosis II nondisjunction = sisters fail in anaphase II.

71

Spindle attachment/segregation.

73

Meiosis I nondisjunction -> {{c1::4 abnormal}} gametes; meiosis II nondisjunction -> {{c2::2 normal + 2 abnormal}} gametes.

74

Spermatogenesis vs oogenesis: what's the main outcome difference?

75

Why does oogenesis produce polar bodies?

76

In males, meiosis produces cells that become...

77

In females, meiosis produces the...

78

Oogenesis arrest trap: primary oocytes are arrested in which stage (for years)?

79

Second arrest trap: the secondary oocyte is arrested in which stage (until fertilization)?

80

When is meiosis II completed in human females?

74

Spermatogenesis makes 4 functional sperm; oogenesis makes 1 functional egg + polar bodies.

73

Meiosis I nondisjunction -> 4 abnormal gametes; meiosis II nondisjunction -> 2 normal + 2 abnormal gametes.

76

Sperm.

75

To dump extra chromosomes while keeping most cytoplasm/resources in the egg.

78

Prophase I.

77

Egg (ovum) (plus polar bodies).

80

After fertilization.

79

Metaphase II.

81

Maternal age and nondisjunction: what's the basic relationship?

82

Spermatogenesis timing (broad): continuous or finite?

83

Common trap: 'females make new oocytes every month from scratch.' True or false?

84

Meiosis vs mitosis: which one includes synapsis and crossing over?

85

Metaphase: mitosis vs meiosis I (what lines up)?

86

Anaphase: mitosis vs meiosis I (what separates)?

87

Meiosis II vs mitosis: what separates?

88

Mitosis makes {{c1::2}} genetically {{c2::identical}} cells; meiosis makes {{c3::4}} genetically {{c4::different}} cells (usually).

82

Continuous after puberty (ongoing production).

81

Risk increases with maternal age (especially for meiosis I errors).

84

Meiosis (prophase I).

83

False.

86

Mitosis: sister chromatids. Meiosis I: homologous chromosomes.

85

Mitosis: individual duplicated chromosomes. Meiosis I: tetrads (paired homologs).

88

Mitosis makes 2 genetically identical cells; meiosis makes 4 genetically different cells (usually).

87

Sister chromatids (in both).

89

Spot the clue: you see homologs paired up with chiasmata. What phase are you in?

90

Spot the clue: you see tetrads lined up at the equator. What phase?

91

Spot the clue: chromosomes move apart but each one still has two chromatids. What phase?

92

Spot the clue: chromatids are separating in a haploid cell. What phase?

93

Spot the clue: cell is haploid but chromosomes are still duplicated. Where are you?

94

Interkinesis: what is it?

95

Crossing over happens before homologs separate. Why is timing important?

96

Independent assortment only works if what is random?

90

Metaphase I.

89

Prophase I (or late prophase I).

92

Anaphase II.

91

Anaphase I.

94

A short pause between meiosis I and II with NO DNA replication.

93

After meiosis I (telophase I / interkinesis).

96

Which way each homolog pair faces at metaphase I.

95

Because recombination requires homolog pairing (tetrads) which only exists in prophase I.

97

Why can crossing over break gene linkage?

98

What is recombination (in the meiosis context)?

99

If there is NO crossing over between a homolog pair, can meiosis still happen?

100

Order of meiosis I phases?

101

Order of meiosis II phases?

102

Meiosis I: {{c1::prophase I}} (pair + crossover) -> {{c2::metaphase I}} (tetrads line up) -> {{c3::anaphase I}} (homologs split).

103

Meiosis II is like mitosis: {{c1::metaphase II}} lines up single chromosomes and {{c2::anaphase II}} separates sister chromatids.

104

Why must gametes be haploid?

98

New combinations of alleles created by crossing over between homologs.

97

It can separate alleles on the same chromosome by swapping segments between homologs.

100

Prophase I -> metaphase I -> anaphase I -> telophase I.

99

Sometimes, but proper segregation becomes riskier (crossovers help homologs orient and separate correctly).

102

Meiosis I: prophase I (pair + crossover) -> metaphase I (tetrads line up) -> anaphase I (homologs split).

101

Prophase II -> metaphase II -> anaphase II -> telophase II.

104

So fertilization restores diploid number instead of doubling it every generation.

103

Meiosis II is like mitosis: metaphase II lines up single chromosomes and anaphase II separates sister chromatids.

105

Fertilization combines what two things?

106

Mini boss: You see 23 tetrads lined up at the equator (human). What stage is that?

107

Mini boss: A cell is haploid, but each chromosome is still two chromatids. What division has finished?

108

Mini boss: You observe sister chromatids separating, but the cell only has one copy of each chromosome set. Where are you?

109

Mini boss: A mistake causes all gametes to have abnormal chromosome number. Error was in meiosis I or II?

110

Mini boss: A mistake causes 2 normal gametes and 2 abnormal gametes. Error was in meiosis I or II?

111

If a stem says 'crossing over increases genetic variation by creating new allele combos on the same chromosome', what's the keyword concept?

112

If you answered 'metaphase II' when the question showed tetrads, what did you confuse?

106

Metaphase I.

105

Two haploid gametes to form a diploid zygote.

108

Meiosis II (anaphase II).

107

Meiosis I has finished.

110

Meiosis II.

109

Meiosis I.

112

You confused meiosis I with meiosis II.

111

Recombination.

113

If you answered 'sister chromatids separate in anaphase I', what did you confuse?

114

If you answered 'crossing over happens in metaphase I', what's the fix?

115

Phase where homologous chromosomes separate: _____.

116

Phase where sister chromatids separate in meiosis: _____.

117

Meiosis produces genetically different gametes even from the same parents because... (one line)

118

Identical twins: meiosis made different gametes, so why are identical twins identical?

119

Bivalent is the same thing as...

120

Chiasmata vs synaptonemal complex: what's the difference?

114

Crossing over happens in prophase I (before metaphase I).

113

You confused meiosis I with mitosis/meiosis II.

116

Anaphase II

115

Anaphase I

118

Because they come from the same zygote that split after fertilization.

117

Independent assortment and crossing over create new combinations of alleles.

120

Synaptonemal complex helps align homologs; chiasmata are crossover points that remain as links.

119

A tetrad (paired homologs).

121

Meiosis I is reductional. Meiosis II is equational. Translate that into plain words.

122

What is a recombinant chromosome?

123

Crossing over happens between homologs. Independent assortment happens between...

124

If a question uses the word 'ploidy', what is it asking about?

125

DNA content vs ploidy: can a cell be haploid but have doubled DNA content?

122

A chromosome that contains DNA segments from both maternal and paternal homologs due to crossing over.

121

I halves chromosome number; II separates chromatids without changing chromosome number.

124

How many sets of chromosomes (n vs 2n vs 3n...).

123

Different homolog pairs (different chromosome pairs) orienting independently.

125

Yes (after meiosis I).