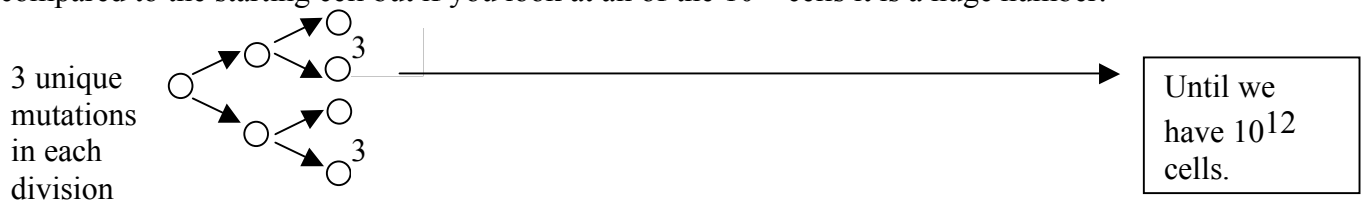


**ANSWER KEY EXAM 2, SPRING 2007 Mean = 67.1 +/- 12.7, Median = 67, STDEV = 13.24
Range = 22-94**

1	D	5	B	9	B or D	13	C	17	E	21	D	25	C	29	A
2	A	6	E	10	B or D	14	C	18	E	22	D	26	A	30	E
3	B	7	C	11	E	15	E	19	Any	23	C	27	E	31	B
4	D	8	E	12	D	16	E	20	D	24	E	28	D	32	D

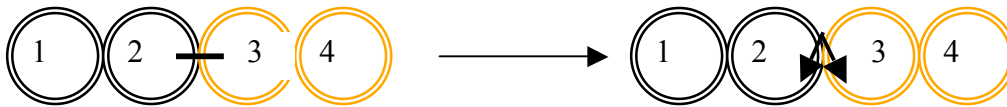
Most commonly missed questions.(25% or more)

- 1) Since conjugation is interrupted only a subset of genes will transfer and recombination can occur.
- 8) This question addresses “good alleles” and “bad alleles” staying together. If they tend to stay together then in a cross like E you would expect more w+m+ and more w-m- but you don’t which disproved this idea.
- 9) Since D and the E loci are on different chromosomes they must assort independently. You should expect 25% of each of the four types. About 31% of the students selected E. This is definitely wrong because if there is no recombination then linked traits would assort dependently 100% of the time.
- 10) Either B or D were accepted.
- 11) There are actually several different ways that a single nucleotide mutation can affect two different amino acids in the same protein—you could affect a splice site; you could cause the creation of a stop codon (also known as a nonsense mutation),
- 12) This was difficult. It required that you make connections from several lectures and from the book.. The nucleus does not contain mitochondria so the mitochondria must come from the oocyte. Telomeres shorten with each cell division (telomerase activity in germ line cells or cancerous cells extend the length of telomeres). Dolly would not be homozygous for all SNPs unless Dollys grandparents (remember her grandparents provided genes to her mom) were homozygous for all SNPs (highly unlikely). X inactivation occurs in a population of cells that are developing but if you take an adult cell as the source then you have already had X inactivation--- the resulting clones of that cell have identical X inactivation patterns.
- 13) There are 100 phage released after 20 minutes. At 40 minutes each of those 100 (10^2) phage release 100 (10^2) making 10,000 (10^4) and those 10,000 each release 100 (10^2) for a grand total of 10^6 .
- 14) All of the cells are pretty much at 4C which means they have completed S but not undergone mitosis. Thus they must be blocked between the S and M phase which would be due to a functional G2 checkpoint.
- 15) You were asked to read this in the book. Avery et. al purified various components of an extract from the smooth strain of Streptococcus and tested for transformation.
- 16) You had to pick the FALSE choice. DNA replication in cells requires the RNA primer (with ribonucleotides) but PCR uses deoxyribonucleotides.
- 17) DNA polymerase is active in most somatic cells (repairing DNA). Telomerase only extends one strand, not both and telomerase uses an RNA template (a component of telomerase).
- 19) We decided to give everyone credit for this question. With each cell division the telomeres shorten, but not significantly. NO cell should be unique. With each cell division you expect to find 3 **unique** mutations in those daughter cells (i.e 3 base pair changes). To go from one cell to 10^{12} you need about 40 cell divisions. Thus you expect to find about 120 base pair differences in one of those 10^{12} cells versus the original cell. That isn’t clear in the question. When examining all of the 10^{12} cells you find a huge number of differences (each cell division creates 3 unique mutations, thus it becomes a very large number. No cell, of the 10^{12} should be identical to the starting cell. One of those cells should have about 120 differences compared to the starting cell but if you look at all of the 10^{12} cells it is a huge number.



- 20) You were asked to do this calculation. It also was in the lab exam reader but a different pH.
- 21) If the nascent polypeptide chain is transferred to puromycin which is released from the ribosome then you stop translation. Note that in 22 you end up with the same phenotype (stop in translation) but due to an entirely different mechanism.
- 23) If you inhibit initiator tRNA binding then you would allow any translation to continue to completion but you couldn't start another round of translation. The question indicates there are polysomes which means there is continued initiation of translation without any inhibitors.
- 24) Make a drawing. Nothing is affected since there is no recombination in mitosis.

25) Make a drawing. The following drawing is two dimensional but hopefully it illustrates the problem.



A single crossover (shown as a single line) as shown above links chromosome 2 & 3 together via phosphodiester bonds. 2 & 3 effectively becomes a figure 8 (not clearly shown in the figure).



A double crossover (shown as two single lines) results in the exchange of a portion of chromosome 2 to 3 and 3 to 2 but chromosome 2 & 3 are no longer linked via phosphodiester bonds. 2 and 3 are each circular but they have an insert from the other chromosome. The exchanged DNA is looped out to make it more visible.

This question may sound pretty bizarre but it is based upon actual science (some fungi chromosomes in the presence of topoisomerase).

30) This is applying Hardy Weinberg equilibrium. Since a/a is 0.09 then the square root of 0.09 is 0.3. Thus the frequency of A must be 0.7. The carriers are $2Aa$ so it becomes $2 \times 0.3 \times 0.7 = 0.42$, about half the class of 600. E is the best answer.

31) This question involves synthesizing a lot of material. There are around 30,000 genes and hence 60,000 promoters. Only 46 kinetochores (one per chromosome) and this leaves introns versus nucleosomes. How many introns? Certainly not more than an average of 100 per gene (actual average is about 7.8 introns). Thus there might be 3×10^6 introns. But since there are nucleosomes about every 150 base pairs that would mean there are $(3 \times 10^{12}) / 1.5 \times 10^2$ which is about 2×10^{10} . For introns to be correct you would need to have about 1 million introns per gene.

9, 10, 11, 12, 14, 19, 21, 23, 25, 31. The class as a whole did very poorly on these questions. You should make sure you know the underlying concepts to these questions. For those of you who missed these, you should learn from your mistake. You can expect to see similar questions on the final that address the underlying concepts required to answer each of these questions.