Exam 5 Name:_____

Questions 1-4 are the cumulative portion of this exam: you will draw from the entire Bio200 course to construct your answers. The purpose of these cumulative 40 points is to catalyze big-picture thought on major themes of the course like regulation, structure/function, mutation and dynamic equilibria in current research.

These questions will refer to information in 1-2 articles for each of four topics, and each topic will be used for one question. You do NOT need to do any research beyond these articles. The articles go deeper into the topic than you would need to go for full credit. These topics are opportunities to think about course themes; do not focus on memorizing all of the details. Instead, look for nuggets of understandable information that you can use to answer the questions below.

Important note: Because you have everything you need to answer these questions, course staff (TAs, coordinators, etc.) will not answer questions about these scenarios. Use your understanding of Bio200 and your peers as resources! Focus on the Bio200-relevant parts of each resource (we will not be asking about concepts we haven't covered in class).

Topic A: A two-part cancer 'vaccine'

- Article: http://stm.sciencemag.org/content/10/426/eaan4488.full
- Summary: https://med.stanford.edu/news/all-news/2018/01/cancer-vaccine-eliminates-tumors-in-mice.html

Topic B: Creating new DNA and proteins using novel chemical structures

- Article: https://www.nature.com/articles/nature24659
- Summary: https://www.nature.com/news/alien-dna-makes-proteins-in-living-cells-for-the-first-time-1.23040?WT.ec_id=NEWSDAILY-20171130&utm_source=briefing&utm_medium=email&utm_campaign=20171130

Topic C: Human evolution and mental illness

- Article #1: https://www.nature.com/news/geneticists-are-starting-to-unravel-evolution-s-role-in-mental-illness-1.22914?WT.ec_id=NEWSDAILY-20171031 - /b3
- Article #2: http://www.biologicalpsychiatryjournal.com/article/S0006-3223(17)32143-1/pdf

Topic D: Transcriptome editing in cephalopods

- Article: http://blogs.plos.org/dnascience/2017/04/06/octopuses-squid-and-cuttlefish-rna-editing-instead-of-genome-evolution/
- Abstract/figure from Cell (no need to read full article): http://www.cell.com/cell/fulltext/S0092-8674(17)30344-6

1) From Topic #D, complete the diagram below with a few words or a phrase in each of the six blanks:

An individual *(organism:*_____ needs to regulate _____.

In this regulation, *(molecule:*_____and *(molecule:*_____interact to cause

the following molecular impact: _____.

If these genes are not regulated precisely,

then the fitness of the individual will decrease because: _____.

2) From Topic #*B*, describe how a specific aspect of the molecular shape of a specific enzyme is important for fitness at the multicellular level. *Do this in 2-3 sentences, maximum.*

Total: ____

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3) From Topic #C, draw a diagram that explains a mutation in *the gene encoding a microRNA that impacts expression of many genes important for mental function.* The best diagrams will make clear:

- The molecular basis of the mutation,
- How the mutation impacts the function of the cell-or-organism, and
- How a different allele would change the function of the cell-or-organism

Your diagram will not include all aspects of the articles, but should make clear that you understand the function of the gene and the molecular/cellular basis of biological function using specifics from the topic. Use 12 words in your diagram, maximum.

4) From Topic #A, describe what would happen if the expression of cancer-targeting markers happened to 1% of all cells in the body.

Your answer should be obviously specific to this article but does not need to include specific memorized names of molecules, cells, etc. Predict the outcome(s) of this change in 2-3 sentences, maximum. Use this question as a way to show that you understand the large numerical scale of the processes happening. In other words, show that you understand how this system is NOT just a single set of cells/molecules interacting but is instead the product of a dynamic equilibrium of many, many copies of these cells/molecules.

Total: ____