Protein Modeling Event

School Name: _____

School Number: _____

Team Member 1: _____

Team Member 2: _____

Team Member 3: _____

For Judges Use Only:	
Pre-Build Score:	
On-Site Build Score:	
Test Score:	
Tie Breaker:	
Total:	
Final Rank:	

Part I: Pre-Build (40% of total score)

Your Pre-Build Model should have been impounded the morning of the competition. You may pick up your Pre-Build model at the end of the competition after all models have been scored. Unclaimed models will be thrown away.

Part 2: On-Site-Build (30% of total score)

The workstation should have the On-Site Model Competition Environment open on the computer. Using the 176cm and 166cm Mini-Toobers provided, construct a model of chains A and B of 2kt0.pdb. The scale should be 2 cm per amino acid. A meter stick/ruler has been provided for you. Your Mini-Toober model of chains A and B of 2kt0.pdb should include the following:

A: Four amino acids: Arg215, Leu267, Arg914 and Leu967 (use metal clips to connect amino acids to your Mini-Toober)

B: Two blue end caps indicating the amino termini (N-terminal end) of the two chains

C: Two red end caps indicating the carboxylic acid termini (C-terminal end) of the two chains

Part 3: On-Site Exam (30% of total score)

The On-Site Exam consists of both multiple choice and short answer questions. You may use any materials provided at your work station as well as the five sheets you brought with you to answer these questions. You may NOT use the Internet to answer these questions.

There are ten multiple choice questions on the On-Site Exam (each worth 1 point for a total of 10 points). Clearly print the letter of the one BEST answer to each question in the blank provided for that question. Illegible answers will be incorrect.

There are also short answer questions on the On-Site Exam. The point value for each question is given in parentheses at the end of the question (20 pts total). The points for the tie-breaker questions (identified with ★ Tie Breaker) will be included in the final score but may be used to determine team placement in case of a tie.

On-Site-Exam

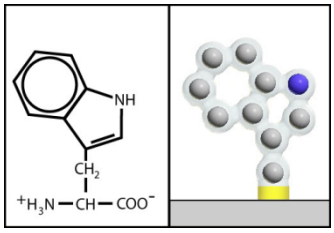
Multiple Choice Questions:

_____ 1. How many nitrogen atoms are found in the backbone of each amino acid?

A. 1
B. 2
C. 3
D. 4

_____ 2. The amino acid sidechain shown below is best characterized by which of the following chemical properties:

A. Hydrophobic
B. Negatively-charged
C. Positively-charged
D. Can form a covalent disulfide bond



_____ 3. What is the name of the reaction in which a peptide bond is form?

A. Oxidative-reductive Reaction
B. Combustion
C. Dehydration Synthesis
D. Hydrolysis

_____ 4. Which of the following amino acids contains sulfur?

A. Tryptophan
B. Methionine
C. Glutamic Acid
D. Histidine

_____ 5. Induced pluripotent stem cells have the same developmental potential as

A. Hematopoietic stem cells
B. Neuronal stem cells
C. Embryonic stem cells
D. Dental pulp stem cells

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Score for this page:

_____ 6. Which of the following proteins has NOT been shown to be essential in the reprogramming of somatic cells?

A. Klf4
B. Oct4
C. Sox2
D. Mad2

_____ 7. If you are discussing the sequence of amino acids in a polypeptide chain then you are talking about a protein's

A. Primary sequence
B. Secondary sequence
C. Tertiary sequence
D. Quaternary sequence

_____ 8. If a protein is membrane bound, where would you expect to find hydrophilic amino acids?

A. On the surface of the protein, interacting with the phospholipids.
B. Buried in the protein, thereby avoiding interaction with the phospholipids.
C. Only in the alpha helices of the protein.
D. Alternating with the hydrophobic amino acids.

_____ 9. Which of the following motifs can be found in the Myc-Max protein?

A. Zinc finger
B. EF hand
C. Basic helix-loop-helix
D. Beta barrel
E. Cysteine and Glutamine

_____ 10. What is the difference between a totipotent stem cell and an induced pluripotent stem cell?

A. An induced pluripotent stem cell can become any cell of the developed organism, but cannot produce trophoblast and placenta to support organismal development, whereas a totipotent stem cell can produce anything.
B. A totiptent stem cell can give rise to multiple, but limited number of lineages. An induced pluripotent stem cell can give rise to any cell within the organism.
C. An induced pluripotent stem cell can give rise to a single directed cell lineage whereas a totipotent stem cell can give rise to multiple, but limited number of cell lineages.
D. A totipotent stem cell can become any cell of the developed organism, but cannot produce trophoblast and placenta to support organismal development, whereas an induced pluripotent stem cell can produce anything.

Short Answer Questions:

1. For your onsite model of Myc-Max, you added Leucine 267, Leucine 967, Arginine 215 and Arginine 914. What role do these amino acids play in the structure and/or function of Myc-Max? (4 pts)

2. When researchers use the phrase "introduced a protein in a cell", they are referring to the techniques needed to get the cell to produce the protein when it normally would not. How do researchers introduce a protein into a cell? (4 pts) ★ Tie Breaker

3. What are two fundamental properties that distinguish all stem cells from other somatic cells? Explain why these properties are unique to stem cells. (4 pts)

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4. One of the steps in the process of developing induced pluripotent stem cells is the need to determine whether the cell line is indeed pluripotent. One assay that has been used to determine the state of pluripotency is a teratoma forming assay. (4 pts) ★ Tie Breaker

   What is a teratoma? (1 pt)

   Why is the formation of a teratoma indicative of a pluripotent state? (3 pts)

5. The selected proteins that you have modeled this year for the Protein Modeling event are involved with reprogramming cells to regain pluripotency and they are all transcription factors. (4 pts)

   What is transcription?

   What are transcription factors?

   Why is transcription an important part of reprogramming cells?

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Score for this page:

Survey Questions for 2011 Science Olympiad National Tournament

We value your feedback. Could you please take a couple of minutes to complete this survey? Your answers will remain anonymous and will not be counted in your final score. Please have each team member complete his/her own survey. There should be two copies of this survey attached to your exam. If you need another copy, please let us know. If you have any questions, please let the event supervisor know. Thank you for your comments!

1. How much time did you spend preparing for this event?

A few hours 1-5 days A week 2-3 weeks More than a month

2. Which resources did you use in your preparation? Circle the ones that you used. Star the 2 that were most useful to you in your preparation.

Center for BioMolecular Modeling website resources
David Goodsell's Molecule of the Month articles about Sox2 and Oct4
Stem Cell School website
Proteopedia
Primary citation journal articles
Protein Data Bank
Textbook
Wikipedia
Other (please specify)

3. How many years have you competed in Science Olympiad?

4. How many times have you competed in the Protein Modeling event?

5. Compared to other Science Olympiad events in which you have participated, please rate the Protein Modeling event:

	Easier				Same				More difficult	
Difficulty Level	1	2	3	4	5	6	7	8	9	10
	Not Enough				Same				More available	
Resources available	1	2	3	4	5	6	7	8	9	10
	Boring				Same				More interesting	
Interest to you	1	2	3	4	5	6	7	8	9	10
	Less time				Same				Way more time	
Time spent preparing	1	2	3	4	5	6	7	8	9	10

(Please turn over…)

5. Do you plan to participate in this event next year? (If you are a graduating senior, would you participate in this event if you were not graduating?)

6. In preparing for this event, did you learn something that you would not have learned in your classes? If so, please specify.

Additional comments?

Thank you for taking the time to complete this survey. We appreciate it!

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