



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 1: 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. **Please pick up your model no later than 4pm.** 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 348cm Mini-Toober provided, construct a model of the MHC – amino acids 1-174 of chain A of 1hsa.pdb. The scale should be 2 cm per amino acid. A meter stick/ruler has been provided for you. Your Mini-Toober model of amino acids 1-174 of chain A of 1hsa.pdb should include the following:

- A:** Two amino acids: Cys101 and Cys164 (use metal clips to connect amino acids to your Mini-Toober)
- B:** Blue end cap indicating the amino terminus (N-terminal end) of this region (amino acids 1-174)
- C:** Red end cap indicating the carboxylic acid terminus (C-terminal end) of this region (amino acids 1-174)

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 in 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 in 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. Which of the following amino acids contains an imidazole group?
- A. Arginine (Arg)
 - B. Glutamic Acid (Glu)
 - C. Tryptophan (Trp)
 - D. Histidine (His)
- _____ 2. Caspases cleave in a very specific location. Which of the following sequences of amino acids (using the one letter abbreviations) would be a potential substrate for caspase catalytic activity?
- A. AFGHDQRTPK
 - B. QEFGALKPIVE
 - C. MERTSHGEQP
 - D. ASMTHKLRCV
- _____ 3. In order to determine the cause of Nic Volker's symptoms, the doctors...
- A. ...sequenced all of the proteins within Nic's cells.
 - B. ...sequenced Nic's genome.
 - C. ...sequenced Nic's exome.
 - D. ...sequenced the introns in Nic's DNA.
- _____ 4. Which group of the 2nd amino acid is used to form its hydrogen bond in an alpha helix?
- A. N-H
 - B. C=O
 - C. C-H
 - D. Sidechain
- _____ 5. Which of the following proteins is a target of caspase function?
- A. Diablo
 - B. PARP
 - C. XIAP
 - D. MHC

For Judges Use Only

Score for
this page:

- _____ 6. Which two amino acids are involved in the catalytic activity of caspase-3?
- A. Histidine (His) and Cysteine (Cys)
 - B. Histidine (His) and Aspartic Acid (Asp)
 - C. Cysteine (Cys) and Glycine (Gly)
 - D. Glutamic Acid (Glu) and Serine (Ser)
- _____ 7. Which of the following characteristics describes necrosis?
- A. Shrinking of cytoplasm
 - B. Condensation of nucleus
 - C. Loss of membrane integrity
 - D. Fragmentation of cell
- _____ 8. Which amino acids are involved in stabilizing the transition state of the caspase-3/substrate complex?
- A. Histidine (His) and Cysteine (Cys)
 - B. Cysteine (Cys) and Glycine (Gly)
 - C. Glycine (Gly) and Histidine (His)
 - D. Cysteine (Cys) and Aspartic Acid (Asp)
- _____ 9. What is the name of the chemical reaction that catalyzes the cleavage of a peptide bond?
- A. Amide Hydrolysis
 - B. Oxidation-Reduction Reaction
 - C. Substitution Reaction
 - D. Dehydration Synthesis
- _____ 10. For your onsite model, you positioned two cysteines. What is the significance of these two amino acids in terms of structure and/or function of MHC?
- A. The cysteines form the active site for the protease activity of the MHC protein.
 - B. The cysteines stabilize the interaction between caspase and MHC.
 - C. The cysteines form a disulfide bond that stabilizes the MHC structure.
 - D. The cysteines form the binding site for the substrate interacting with MHC.

For Judges Use Only

Score for
this page:

Short Answer Questions:

1. Sequencing Nic Volker's genome identified a mutation in the XIAP protein. (4 pts)

What is the mutation at the DNA level? (1 pt)

What impact does this have on the amino acid sequence? (1 pt)

What is the functional significance of this mutation at the protein level? (2 pts)

2. For both a non-apoptotic and an apoptotic cell, describe the function, activity level, location and any protein interactions for the following proteins: Diablo, XIAP, Caspase, and PARP. (4 pts) ★ **Tie Breaker**

3. Caspases exist within our cells, poised to initiate the apoptotic response under appropriate conditions.

What is the inactive form of the caspase called?

What is the advantage to having this inactive form of caspase present within the cell? (3 pts)

4. In order to sequence Nic Volker's DNA, researchers used a technique called "Emulsion PCR" to create "hairy beads". This technique revolutionized the speed at which DNA sequencing was done. (4 pts) ★ **Tie Breaker**

How is emulsion PCR different from traditional, or standard, PCR? (2 pts)

How does this technique enable the Next-Generation sequencing technology used to sequence Nic Volker's DNA? (2 pts)

For Judges Use Only

Score for
this page:

5. Why is it critical to match MHC types prior to a tissue transplant? (4 pts)

For Judges Use Only

Score for
this page:

Survey Questions for 2012 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 three copies of this survey attached to your exam. 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?

A. Circle the ones that you used.

B. 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 Caspase and MHC
Proteopedia
Primary citation journal articles
Protein Data Bank
Textbook
Wikipedia
Other (please specify)

3. How many years have you competed in Science Olympiad? If you have competed in Science Olympiad in both middle/junior and high school, please indicate the years in each division.

4. How many years 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:

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

(Please turn over...)

5. If this event is offered again next year, would you plan to participate? (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!

Survey Questions for 2012 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 three copies of this survey attached to your exam. 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?

A. Circle the ones that you used.

B. 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 Caspase and MHC
Proteopedia
Primary citation journal articles
Protein Data Bank
Textbook
Wikipedia
Other (please specify)

3. How many years have you competed in Science Olympiad? If you have competed in Science Olympiad in both middle/junior and high school, please indicate the years in each division.

4. How many years 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:

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

(Please turn over...)

5. If this event is offered again next year, would you plan to participate? (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!

Survey Questions for 2012 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 three copies of this survey attached to your exam. 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?

A. Circle the ones that you used.

B. 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 Caspase and MHC
Proteopedia
Primary citation journal articles
Protein Data Bank
Textbook
Wikipedia
Other (please specify)

3. How many years have you competed in Science Olympiad? If you have competed in Science Olympiad in both middle/junior and high school, please indicate the years in each division.

4. How many years 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:

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

(Please turn over...)

5. If this event is offered again next year, would you plan to participate? (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!