



# **Giant Panda Problem Kit for AP Biology:** A ThINQ!<sup>™</sup> Investigation

AP Biology

**Teacher Model Process**

# Teacher Model Process

This table is designed to highlight specific steps during protocol design (for Investigation 2), where students may require additional support. As students design their protocols, you may find it useful to support their thinking and writing by using the questions and prompts below. This table can be used in conjunction with the Experimental Planning and Design Worksheet ([bio-rad.com/PandaAPResources](http://bio-rad.com/PandaAPResources)) as a formative or summative assessment tool and during class time to support students in the protocol design process.

Inquiry Lesson Step	Suggested Questions and Prompts to Support Protocol Design for Investigation #2	Kit-Specific Applications
<b>Making Observations</b>	<p><b>Making observations that lead to an investigation question</b></p> <p>In Investigation 1 and/or the Digital Animation Activity, what is the role of the antigen in the wells?</p> <p>What is added to the positive control wells to achieve positive results (blue color)?</p> <p>What is missing from the negative control wells so that results are negative?</p> <p>Why do positive samples turn blue?</p> <p>What would happen if the secondary antibodies were not added to the wells?</p>	<p>Identifying the components of the ELISA and explaining their interactions</p>
<b>Defining the Purpose of the Investigation</b>	<p><b>Clarifying the purpose of the investigation</b></p> <p>What was the purpose of Investigation 1?</p> <p>How does the purpose of Investigation 1 differ from the purpose of this investigation?</p> <p>What small changes could you make to the protocol in Investigation 1 to meet the purpose of this investigation?</p> <p>What steps from the protocol in Investigation 1 can you use to design this investigation?</p>	<p>Tracking a particular hormone in panda urine to determine fertility</p>
<b>Hypothesis Formation</b>	<p><b>Clarifying goals for the investigation</b></p> <p>Can you explain in your own words what the investigation question is asking?</p> <p>What do you already know about how an ELISA works?</p> <p>Knowing this, how would you modify the protocol for Investigation 1 and/or the Digital Animation Activity to determine which pandas are about to ovulate?</p> <p>What evidence would you need in order to answer the investigation question?</p>	<p>Understanding how an ELISA for hormone detection can determine the fertility of female pandas</p>

**Determining Protocol Scope**

**Working within the constraints of classroom time and supplies**

What are the capabilities and limitations of the materials available to you?  
 What protocol could you use as a template to create a protocol for this investigation?  
 How could you revise the template protocol to achieve the goal of this investigation with the allotted materials/time/etc.?

Use of reagents such as panda urine samples, antibodies to panda hormone, and secondary antibodies

**Understanding “givens” and what may be assumed**

What are your assumptions about the hormone, about the antibodies, about the substrate, and about how they interact with each other?  
 What justifications validate your assumptions?

Assumptions about the interaction of reagents to produce reliable test results

Assumptions about reaction mechanisms

**Outlining Protocol Steps**

**Determining appropriate steps and detail**

What questions might one of your classmates have if they read your protocol (that is, too few or unnecessary details)?  
 How does step X meet the goal of the investigation (that is, unnecessary detail)?

How to set up an ELISA that is reliable and provides information about each sample and controls

**Understanding use of controls**

What is the purpose of a control?  
 What controls might be useful in this protocol?

Presence and absence of hormone of interest

**Analyzing Evidence**

**Identifying what counts as supportive evidence**

What is the investigation question?  
 Your classmates are trying to answer the investigation question; what pieces of evidence would you expect them to use?  
 How do you know whether evidence should or should not be used to answer the investigation question?  
 What justifications can you provide to support what counts as evidence in this investigation?

Presence or absence of blue color

What variables are relevant to antibody and antigen reactions; what variables affect antibody and antigen reactions

**Legal Notices**

Advanced Placement is a trademark of The College Board.



**Bio-Rad  
Laboratories, Inc.**

Life Science  
Group

**Web site** [bio-rad.com](http://bio-rad.com) **USA** 1 800 424 6723 **Australia** 61 2 9914 2800 **Austria** 43 1 877 89 01 177 **Belgium** 32 (0)3 710 53 00 **Brazil** 55 11 3065 7550  
**Canada** 1 905 364 3435 **China** 86 21 6169 8500 **Czech Republic** 420 241 430 532 **Denmark** 45 44 52 10 00 **Finland** 358 09 804 22 00  
**France** 33 01 47 95 69 65 **Germany** 49 89 31 884 0 **Hong Kong** 852 2789 3300 **Hungary** 36 1 459 6100 **India** 91 124 4029300  
**Israel** 972 03 963 6050 **Italy** 39 02 216091 **Japan** 81 3 6361 7000 **Korea** 82 2 3473 4460 **Mexico** 52 555 488 7670 **The Netherlands** 31 (0)318 540 666  
**New Zealand** 64 9 415 2280 **Norway** 47 23 38 41 30 **Poland** 48 22 331 99 99 **Portugal** 351 21 472 7700 **Russia** 7 495 721 14 04  
**Singapore** 65 6415 3188 **South Africa** 27 (0) 861 246 723 **Spain** 34 91 590 5200 **Sweden** 46 08 555 12700 **Switzerland** 41 026674 55 05  
**Taiwan** 886 2 2578 7189 **Thailand** 66 2 651 8311 **United Arab Emirates** 971 4 8187300 **United Kingdom** 44 020 8328 2000

