

Biomedical and Biological Sciences A-exam FAQ

What is the purpose of the A-exam?

To assess the critical thinking skills of the student.

BBS views the A-exam as a test of the student's critical thinking abilities. Although sufficient data must be generated by the student prior to the exam to provide robust discussion and demonstrate adequate progress, the focus should not be on the results themselves. Instead, the student should be assessed for their ability to answer questions on topics that include, but are not limited to: how the proposed experiments fit into the larger context of the research topic; how the student justifies their hypotheses, whether appropriate controls are described; what are potential alternative interpretations and pitfalls, the choice of statistical methods, and how the student will ensure rigor and reproducibility. Importantly, **one Aim must be developed independently by the student (see below).**

The role of the faculty is to assess whether or not the student possesses fundamental knowledge of their proposed discipline, and has the creativity, discipline, and critical thinking skills needed to complete a PhD project. As mentioned previously, sufficient data should be generated to ensure both adequate discussion as well as to demonstrate progress. However, the goal of the BBS PhD is to develop budding scientists capable of evaluating their own project, as opposed to simply developing students' technical skills. The following are guidelines for the A-exam to help students and faculty understand their roles and responsibilities.

When should students take the exam?

BBS strongly recommends students take the exam by the end of the fall semester of the third year.

Students can, of course, take the exam sooner or later, based on their chair's recommendations. Keep in mind, however, the graduate school requires this exam must be taken prior to the start of the fourth year. It is the student's responsibility to ensure faculty availability and an appropriate date. The student must file paperwork for the proposed exam date at least seven calendar days prior to the exam. Failure to file on time can render the exam invalid.

What does the exam entail?

A written research proposal (minimum 7 pages, single spaced; maximum 10 pages) and an oral exam (chalk talk based).

The proposal is meant to indicate **the student's view** as to where the project should go over the next ~3-4 years following the A-exam. Because the exam emphasizes the student's critical thinking abilities, the proposal must be written entirely by the student. **Further, the student should come up with at least one Aim completely on their own.** This Aim should be clearly indicated in the oral and written part of the exam. Whether or not the student actually pursues the research proposed is secondary to exploring why the student proposed that particular research focus. Thus, while Aim 1 and 2 might follow directly from their current research, Aim 3 should encompass future directions the student thinks the project should take. This Aim builds upon a common A-exam question, which asks students what other approaches a student thinks could be taken to address their project goals. It allows the committee to assess how well the student can come up with a hypothesis and expected outcomes using a different approach. For example, if the primary project is a biochemistry-based project, the student could suggest a cell biology or

genetics oriented approach. Such an Aim allows the committee to assess the student's thought processes independent of any input from the PI, or the PIs approach to the project.

Because often times students have already written fellowships prior to the exam, the chair should ensure that the student does **not base their proposal entirely** on Aims developed in consultation with the chair, or is **limited in scope to the immediate work** planned for the next year.

Typically, the proposal will use the NIH F31/F30/R21 format. This includes a Specific Aims page and six pages of Research Strategy (which includes data as figures in the body of the text). The text itself should be single spaced, with one-inch margins. Students can include more pages, if desired, up to the 10-page total limit. References are in addition to these page limits.

What input does the chair provide on the proposal?

As noted previously, the proposal must be developed by the student. If the chair has significant concerns over the proposal or the readiness of the student, it is the **chair's prerogative and responsibility to delay the exam**. **At least** two weeks prior to the A-exam, the student should give the proposal to their chair. The chair should return comments as soon as possible. These comments should be relatively broad (e.g. where are the controls for your new Aim 3?) and not detailed corrections. If the chair agrees to move forward, the student should then revise the proposal for the committee with no further input from the chair. The proposal should be sent to the entire committee seven calendar days before the exam.

What is the format of the chalk talk?

Students are expected to prepare a chalk talk for their defense. Three to five slides can be used to represent data that are hard to draw (e.g. movies, immunohistochemistry slides, pathways), but there should be no text on the slides (e.g. hypotheses, background, etc.). Further, each slide should not have multiple overlapping images in an effort to present additional data. Instead, students should refer faculty to the data represented in the written proposal. Students should consider carefully how to visually represent their proposed project, and map out ahead of time what they anticipate drawing on the board. This might include how controls would be represented, as well as anticipated results (**see below for an example A-exam chalk talk**).

How should students prepare for the exam?

It is recommended that students have at least two practice presentations prior to the exam. The first presentation should be to members of the student's own lab group (without the chair present). Students should have a colleague write down all questions asked (as well as the answers given by the student), to provide a guide as to questions that might be asked by experts in the field (e.g. the chair). A second presentation should be given to colleagues outside of the lab. This presentation allows the student to determine what questions other committee members, who are not experts in the field, might ask.

What is the order of events for the exam?

Because the A-exam can substitute for a formal third year committee meeting, the student should give a summary of courses completed (with grades), remaining courses to take (if any), and what/when remaining BBS requirements need to be fulfilled. The student will be asked to leave,

and the chair should give a brief overview of their opinion of the student's progress to date (concerns and strengths). Faculty can also provide their opinions of the student's written proposal, and any concerns they may have, if any.

Upon their return into the room, the student can begin the proposal. It is anticipated that they will be interrupted frequently, often within the first few minutes. All members should ask questions (including the chair). Further, the chair should NOT try to answer questions for the student. Even if the student is having difficulty answering a question, they should be prompted to try and propose potential approaches to answer that particular question. **Thus, questions are not limited to the proposal, but can be broad and open-ended, with no known answer.** Further, the members representing the student's concentrations are also expected to ask questions regarding that subject area (e.g. Biochemistry, cancer, repro) to determine the student's breadth of knowledge and ability to apply that to their project. Most exams last approximately 2.5 hours.

How is the exam graded?

At the conclusion of the exam, students will leave the room to allow faculty to discuss the performance. Faculty have three options: **Pass, Conditional Pass, or Fail**. A passing grade indicates the committee believes the student has demonstrated the ability needed to complete a PhD. Note this is a **key milestone that demonstrates satisfaction with progress** to date by the chair and committee.

A **conditional pass** is given if faculty find some key aspect of the A-exam less than satisfactory. This might encompass the writing of the proposal, the student's knowledge of an area, their ability to answer questions, or some other critical concern. Conditional passes should not be given for comparatively minor concerns, but involve some aspect the student must significantly improve in order to meet the standards for the PhD. If the committee votes for a conditional pass, they must provide specific steps the student can take to address these concerns (e.g. re-write Aim 3, provide a two-page review article on a subject, take a course in statistics, etc.).

A **failing grade** is given if there are significant concerns over multiple aspects of the student's performance. Students who fail are placed on academic probation. The committee can decide if a second A-exam should be allowed. If so, the exam must be taken no sooner than three months after the first exam, but no later than the end of the following semester. If no second exam is allowed, or the student fails the re-take, then the student will be asked to leave the program.

For all outcomes, the chair of the committee should relay to the student a summary of the discussion in front of the committee. Note that rate of progress of the student should also be discussed. While the data produced by the student is not the primary focus of the exam, if there are significant concerns regarding the amount of work produced, or whether the proposed future directions are likely to be fruitful, these issues should be brought to the attention of the student.

What are the responsibilities of the student following the exam?

Students should obtain all signatures and file the A-exam results with the graduate field assistant (GFA) within **two business days**, or the results of the exam may be invalid. Because the A-exam can substitute for the student's annual committee meeting, any concerns raised by the faculty regarding student progress should be detailed in a written summary by the student, and sent to the GFA within one week for placement in the student's file. This summary will be discussed at

the next committee meeting. If the student receives a conditional pass, this summary must include what the committee required the student accomplish within a given timeframe to fulfill the conditional pass.

Sample Checklist

- Three to four months prior: poll faculty for available date and reserve room.
- Two to four weeks prior: provide exam to chair for feedback
- Two weeks prior: file paperwork with GFA
- One to two weeks prior: complete two practice chalk talk presentations
- Seven days prior: provide exam to all committee members
- Day of exam: bring summary sheet documenting grades, BBS requirements completed/to be fulfilled, paperwork
- Within two business days: file completed paperwork
- Within one week: file summary of any work to be done (e.g. conditional pass, goals suggested by committee) with GFA
- Within one semester: complete re-take of exam, if necessary.

Example images from chalk talk (no slides at all; Marlana Holter in Cummings lab):

B-cells → **INSULIN** → ↓ blood glucose
α-cells → **GLUCAGON** → ↑ blood glucose

T2DM → ↑ glucagon

↑ insulin resistance → ↓ insulin production → Impaired β-cell function → ↓ β-cell mass, endocrine dysreg.

INCRETIN EFFECT

CLASSICAL

PROBLEMS:

1. DPP-4
2. $t_{1/2} \sim 2m$
3. low

GLP-1 Mechanism:

GLP-1 → GLP-1R → Secretome (INSULIN, GLUCAGON) → α/β (PPI/β) → GLP-1

Proglucagon Pathway:

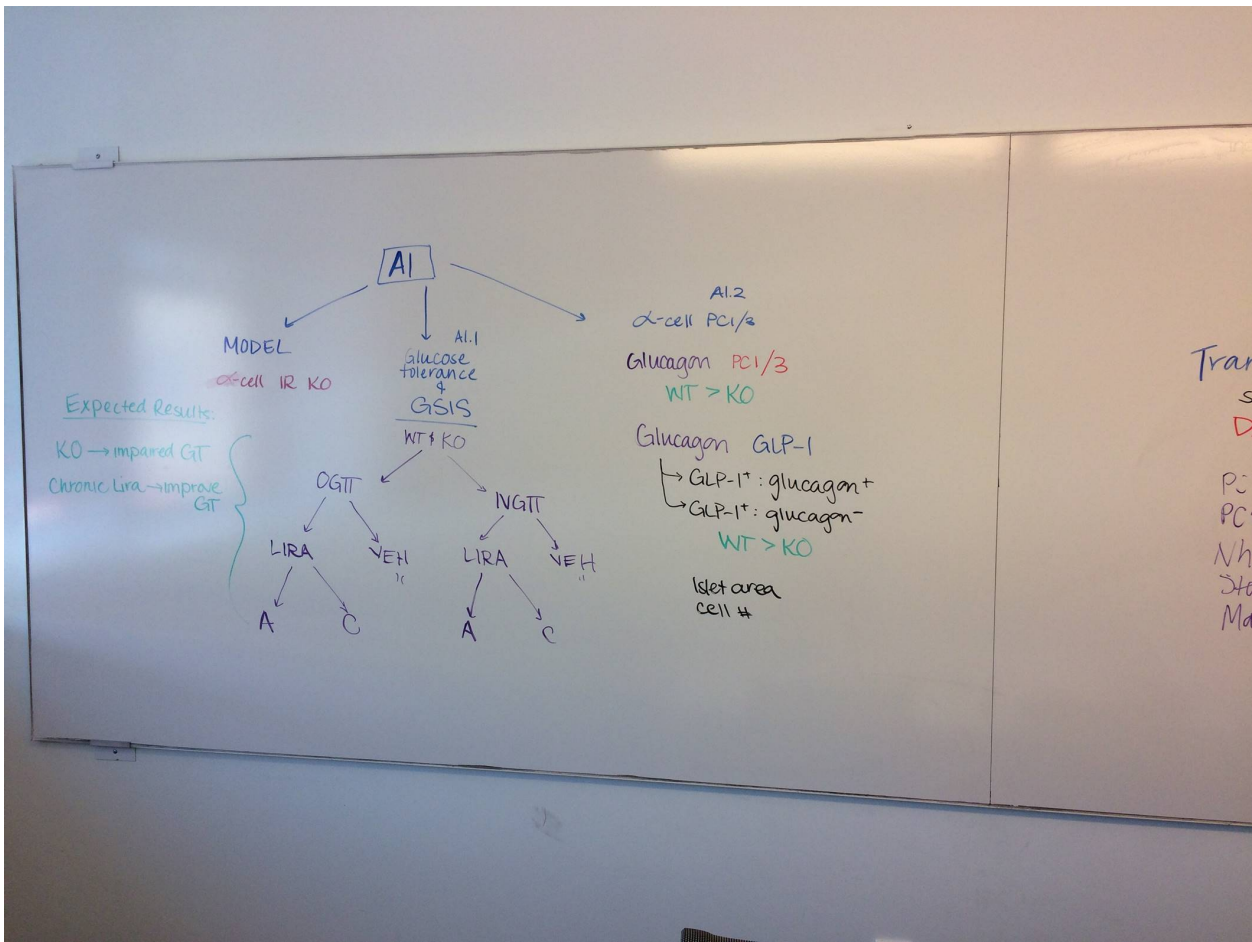
Proglucagon → PPI/β → GLP-1, PPI/β → PPI/β → GLUCAGON

Experimental Design:

WT & KO → VEH → media → α

Ext → WT & KO → VEH → media → α

1. β cell
2. PPI/β
3. Glucagon



Trans
s
▷
PC
PC
Nh
St
Ma

