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Preparing for and taking your neuroscience candidacy exam

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Major steps for advancing to candidacy

- **Generate a F31-style research proposal, ideally based on your thesis project**
  Actively seek out and incorporate feedback (from your fellow students, postdocs, faculty, including your PI)

- **Present your proposal to your candidacy exam committee (20 min) and address any comments/questions (>2 hrs)**

- **Optional but strongly recommended: Submit your (revised) proposal to NIH or other funding agency**

Before you petition for candidacy….

- Form an advisory committee
- Ideally hold two (but at least one) advisory committee meetings
- Take required Neuroscience core courses (Molecular and Cellular Neuroscience, Systems Neuroscience), * Biostatistics, and *Neuroanatomy
- Complete online ethics module, Scientific Writing course by the end of summer term of 2nd year.
- Use the scientific writing course to develop a solid first draft of your proposal. Ideally, time it so your main scientific goals are clear before you take the course.
- Neuroscience electives do **not** need to be completed prior to your candidacy exam.

Getting the green light from your advisory committee (end of year 2)

- Get approval from your mentor(s) and your advisory committee to petition for candidacy. Ideally, use your 2nd committee meeting to announce your intention. **Important: to obtain approval, you don't need preliminary data for your proposal!**

- Write a specific aims page (NIH style), either based on or related to your thesis research (**on-topic**), or on a completely unrelated topic that neither you nor your lab have ever worked on (**off-topic**).

- Your advisory committee will (usually) not make comments on your specific aims. To get feedback, best to set up individual meetings.

Candidacy exam - Complete timeline

1. Get approval from your mentor/advisory committee for your petition.

2. Send me your specific aims page. The two of us will then generate your candidacy exam committee. Please do not contact potential committee members on your own.

3. Submit your aims page and the signed candidacy petition forms to Academic Standards Com. (ASC) by the **first Wednesday** of the month. Deadline to submit your petition is August 31 of your 2nd year (but you can ask for an extension).

4. Schedule your exam at a minimum of 6 weeks following ASC approval, but not later than the end of the same semester. **Be conservative and give yourself enough time to generate your proposal.**

5. Send your final proposal to your CE committee two weeks before your exam.

Selecting your candidacy exam committee

Current members of standing committee (year denotes end of term)

Michael Beierlein (Chair, 2024) - Cellular, Systems

Fabricio Do Monte (2026) - Systems, Behavioral

Kristin Eckel-Mahan (2026) - Molecular, Cellular

Gabriel Fries (2026) - Molecular, Behavioral

Jian Hu (2024) - Molecular, Cellular

Pierre McCrea (2024) - Molecular, Cellular

- Your committee (total of 5) consists of the current chair, some members of the standing committee, and other faculty of your choice. One "outside" member (not necessarily outside NGP) should have a non-overlapping research focus. Your PI can't be a member.
- Expertise is key! Consider including members from your advisory committee (2 max), and/or non-GSBS faculty
- MD/PhD students: Include a member of the MD/PhD committee
- Students with a secondary area of concentration: Include a faculty of the program of secondary focus.

Writing your proposal

- addresses an interesting scientific question/gap in knowledge
- contains a novel & testable hypothesis
- employs logical, related but independent steps (aims) to address that question
- makes use of rigorous experimental approaches to answer the question
- feasible, not too narrow but also not over-ambitious

Format: NIH F31 fellowship proposal ("1+6")

a. Specific Aims – 1 page limit. Concisely state goals and summarize expected impact of the research. **Clearly-defined** aims with **explicit hypotheses to be tested**.

b. Research Strategy – 6 page limit. Includes Significance, Innovation (optional), and Approach sections

c. Bibliography – not included in the page limits.

Specific aims

- Aims should be related, but NOT interdependent

- Ideally, each aim should have its own sub-hypothesis, leading to specific predictions for the outlined experiment(s)

- Try to avoid entirely descriptive aims
  - strong proposals seek to determine causal relationships and/or mechanisms. If necessary, add a (sub)-aim addressing a mechanistic question, even if you/your lab does not employ the relevant approaches

- Avoid redundant aims

  Aim 1: Determine activation of cortical microglia following TBI
  Aim 2: Determine activation of cortical microglia during AD

  You can modify your aims anytime, up until you submit your final proposal to your CE committee.

Your overall hypothesis should be

- specific/directional
  has to be testable/falsifiable
- well rooted in the literature (but not incremental)
- directly tested by your aims
- feasible to test within a reasonable timeframe
- devoid of any conditional (may, might, could)

Example: Projections from the orbitofrontal cortex to the basolateral amygdala increase the encoding of reward value.

Research strategy (6 pages)

1. Significance – broader context of your proposal, explain what gap in knowledge you will fill and how this will move the field forward (1 page max)

2. Innovation (optional) – concise summary of novel ideas, technical innovations, model systems, etc. that make your project unique (0.5 pages max).

3. Approach – detailed description of experimental strategies, including the overall rationale, your methods, any preliminary data and expected outcomes. Discuss potential problems and alternative approaches. With the exception of e.g. methods/statistics used in all aims, each aim should have all sections.

Approach & experimental design

- must be feasible (but - unlike F31 – you can propose experiments not employed in your lab).

  Ideally, use multiple methods to address the same question from different angles.
- make sure your experiments test your hypotheses
- Don't propose a correlational analysis for a hypothesis that requires a causal analysis.
- **describe preliminary data (can be from you, your lab, or simulated)**

  -> feasibility of your experiments, validity of your model system
- **outline excepted outcomes (and how you interpret them)**
- include controls and if necessary, validations of novel techniques
- State the statistical analyses you will employ
- State potential problems & alternative strategies

  -> should not be major problems

Generate schematics to illustrate background, hypotheses, experimental procedures, or expected experimental outcomes. **Please do not use published schematics!**

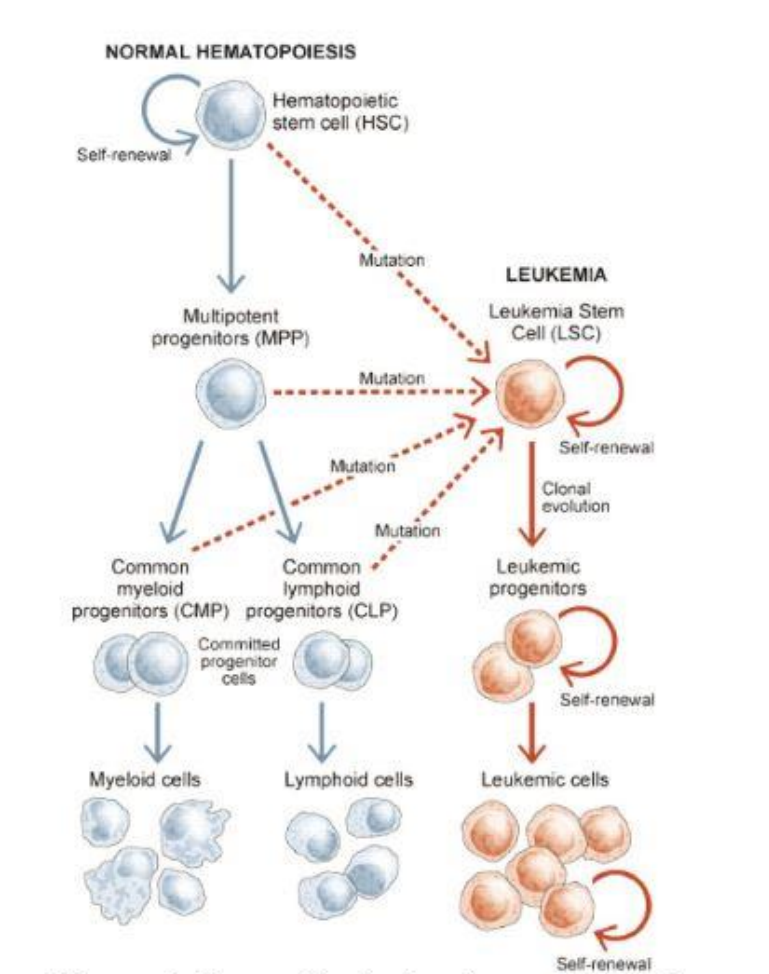

Figure 1. Hierarchical structure of normal hematopoiesis and leukemogenesis[1]

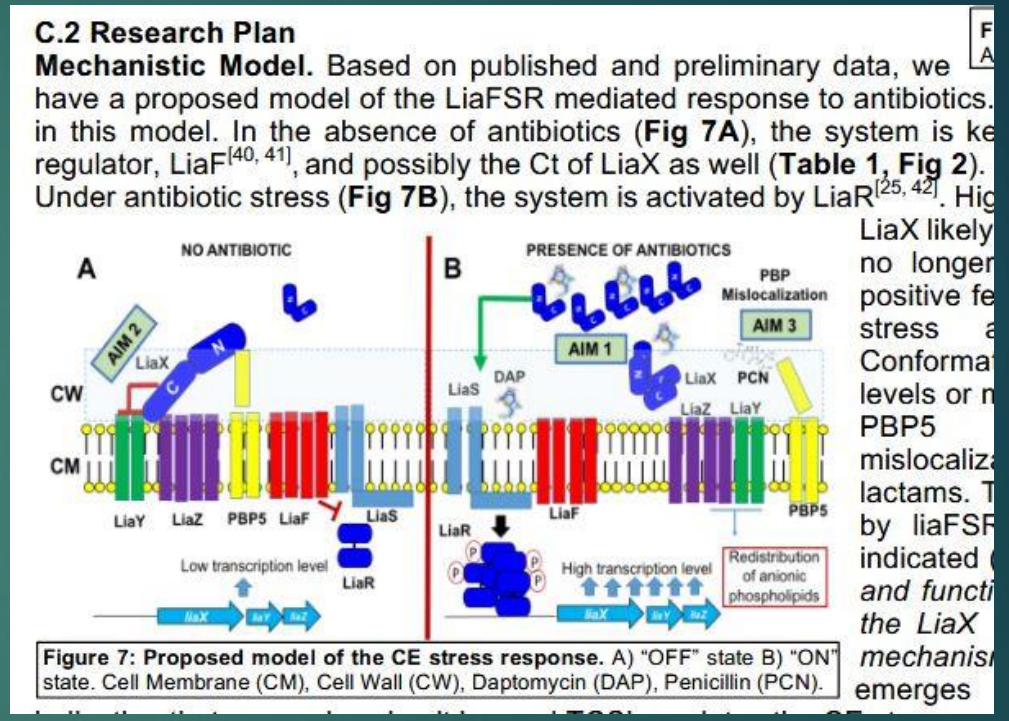

Figure 7: Proposed model of the CE stress response. A) "OFF" state B) "ON" state. Cell Membrane (CM), Cell Wall (CW), Daptomycin (DAP), Penicillin (PCN).

https://gsbs.uth.edu/academics/candidacy-exam

Oral presentation

Prepare a presentation about 20 minutes long (20-25 slides).

a. Significance/Background. Frame your project within the work in the field and identify gaps in knowledge that your project will fill.
b. Specific Aims (same as your written proposal). Clearly state your aims and your hypotheses. Briefly explain how you will approach them experimentally.
c. Research Strategy. Explain in detail the experimental approach(es) for each aim. Carefully describe expected results.

Oral presentation

Make extensive use of figures/schematics to illustrate

- Background
- Hypotheses
- Experimental strategy
- preliminary data/expected outcomes

Important schematics (to illustrate hypotheses, strategies, outcomes) should be generated by you. Showing figures/schematics from other sources should be the exception.

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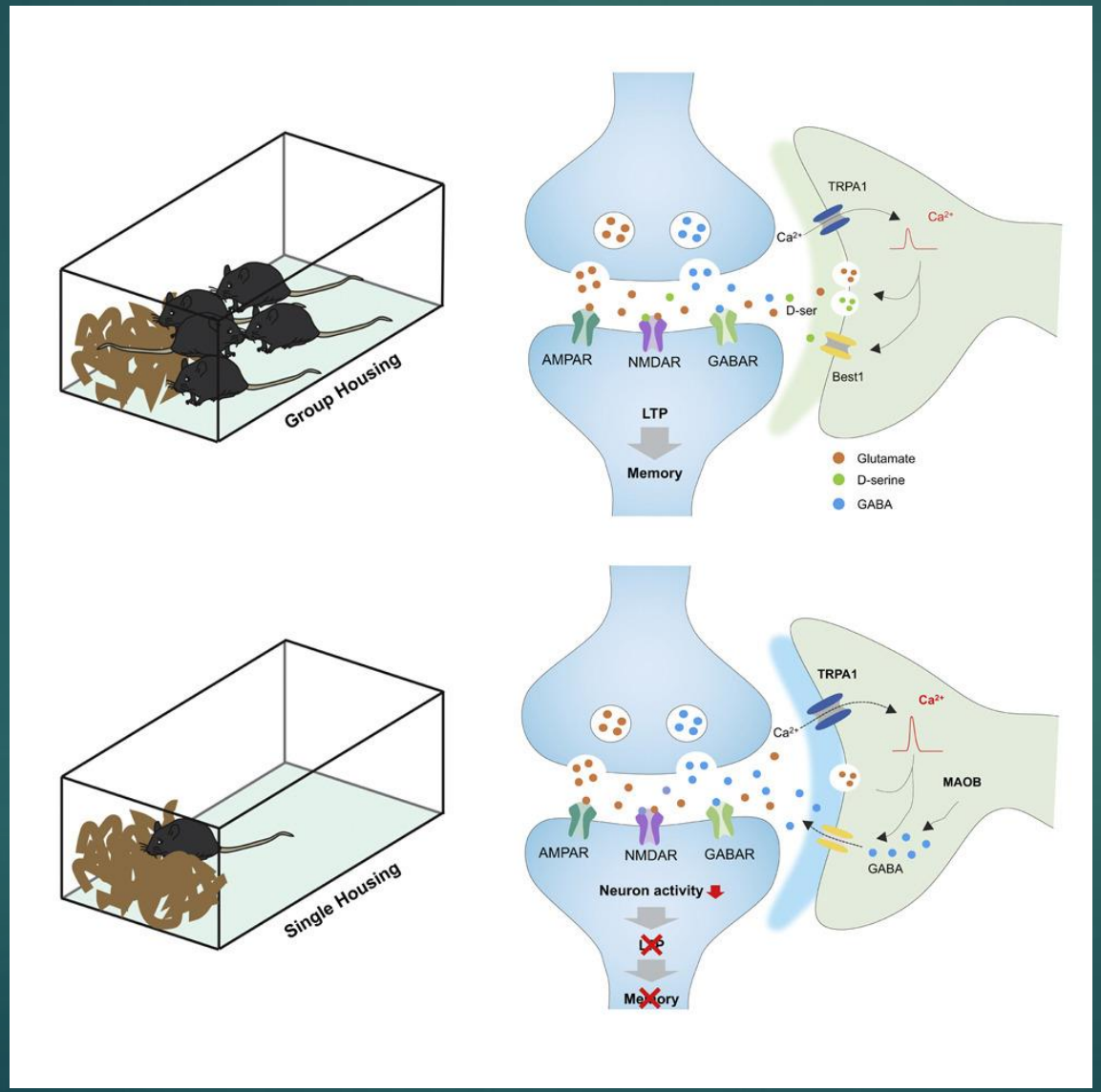

https://doi.org/10.1016/j.neuron.2023.01.015

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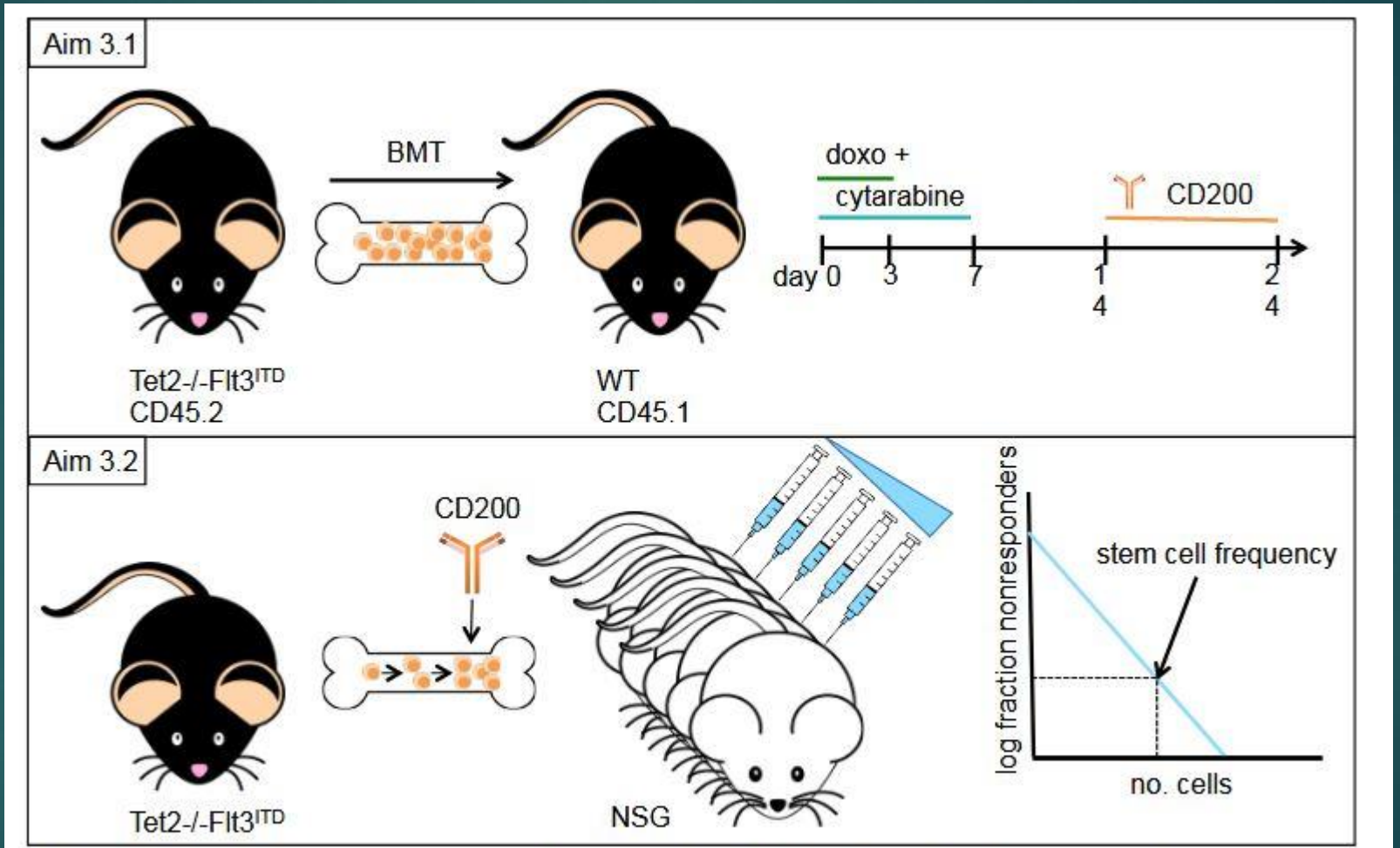

Figure 6. Aim 3.*1 In* vivo experiment strategy. Aim 3.2 Limiting dilution assay schema

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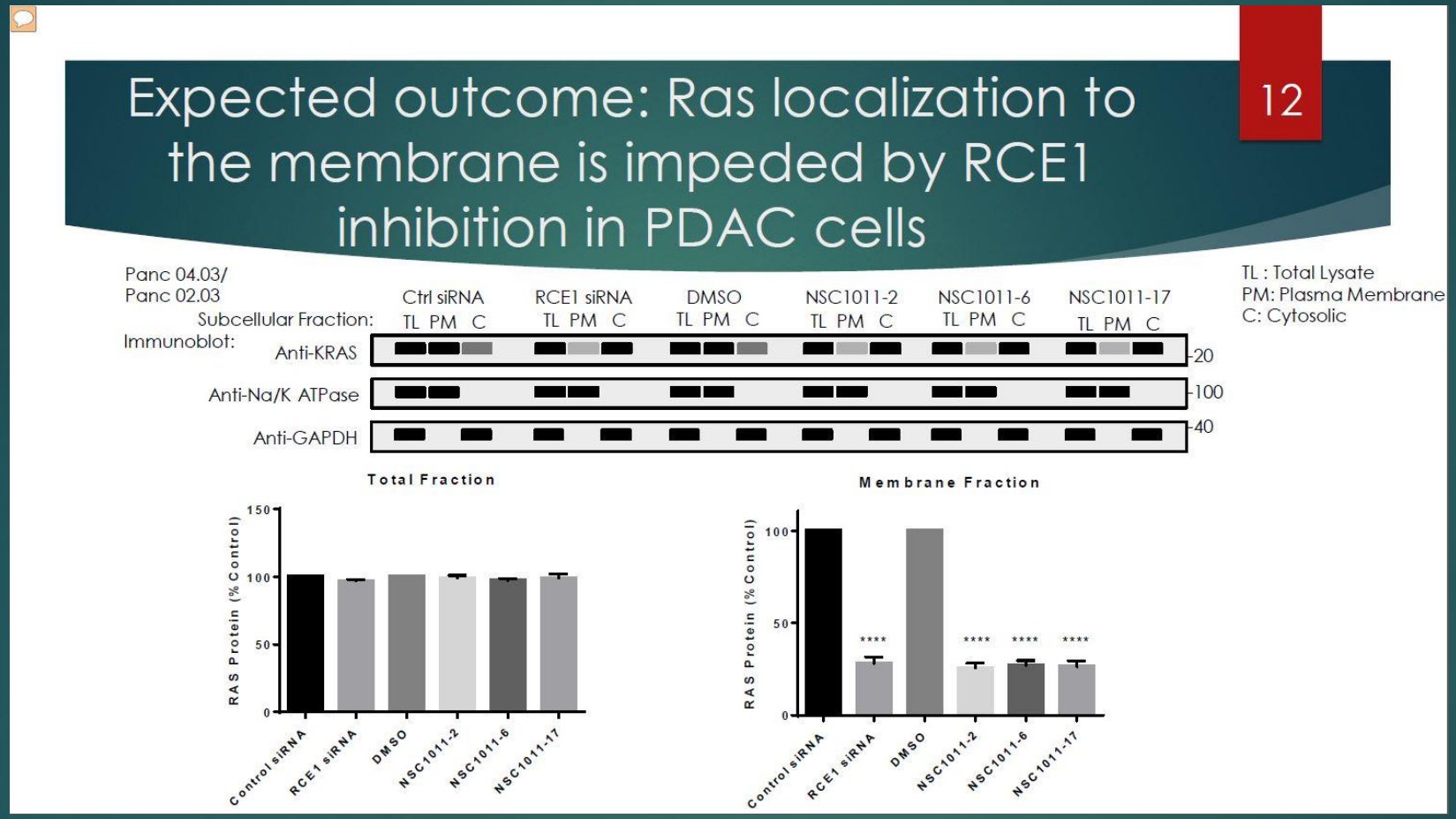

Important: data/outcomes can be simulated but make a note and don't use these "data" in your F31.

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Most questions from your committee will be on…

1. Biological and/or theoretical concepts/background related to your proposal
2. Scope and Significance ("Why is this an important problem?")
3. Rationale ("Why did you pick transcription factor x, and not y?")
4. Scientific methods/approaches, and why you chose them
5. Details of experimental outcomes (raw data, analyses, statistics)
6. Pitfalls, alternative strategies (including those that might be more appropriate but not used in your lab)

Most common weaknesses

Problems with Significance

- Neither significant nor exciting new research (i.e., will not advance science)
- Too incremental
- Lack of compelling rationale (**Why** is this important)

Problems with Experimental Approach

- Too much unnecessary experimental detail (e.g. buffer concentrations)
- Not enough description of experimental design, including appropriate controls
- Experiments are not directly testing hypothesis

- **Too much emphasis on your existing results**
- **No expected outcomes for each aim/sub-aim**

- No consideration of potential pitfalls or alternative models/hypotheses
- Inadequate consideration of statistics and/or power analysis

Possible outcomes

a. **Unconditional Pass:** Most likely outcome. You are done ☺.
b. **Conditional Pass:** The committee has identified some issues and will ask you to remedy them, e.g. with a revision of your proposal, a chalk talk, etc.
c. **Re-take exam:** Major issues with your proposal **and** your oral exam

Re-take exam (if necessary, after 3-6 months):

a. Unconditional Pass
b. Fail. **Has never happened in the NGP!!**

Your exam outcome is not a grade and has no impact on e.g. your chances to obtain an F31.

Seek constructive feedback

- **On:**
  1. Your specific aims (can be modified even after approval!)
  2. Your research proposal (has to be written by you, but feedback - even if detailed - is perfectly ok)
  3. Your presentation (ideally, schedule a mock exam)

- **From:**
  1. Your lab members
  2. Fellow students
  3. Faculty, including your advisor