

The Art of the Aim
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July 17, 2026
U-RIG Summer Workshop

•A scientific aim is:

- A question that will be answered by a defined set of experiments.
- One aim = one biological question

•A scientific aim is not

- a task
- a method
- a to-do list
- a milestone

Parts of a Scientific Project

Project Goal: Long term vision

Specific Aim: What question will you answer?

Hypothesis: WHY do you think this is true?

Experiment (Approach): How you answer the question?

Expected Outcome: What will I know if the Aim succeeds?

Impact: Why should the NIH care? (How those findings will advance the field, improve future studies, or ultimately benefit health.)

Guidelines for NIH Aims

- Is the aim important?
- Is the aim testable?
- Can the proposed experiments actually answer the question?

When reviewing aims

- Evaluate the logic
- Be respectful, specific (NOT: “Bad aim”)
- What could improve this aim?
- In your breakout groups, identify
 - Strengths
 - Weaknesses
 - One recommendation

Breakout Groups

- Group 1 (and 4): Aim 3, 6, 9, 12
- Group 2 (and 5): Aims 4, 7, 10, 13
- Group 3 (and 6): Aims 5, 8, 11, 14

Example 3

- Aim 1: Study urinary tract infections.

Example 4

- Perform RNA-seq on bladder tissue after UTI.

Example 5

- Aim 1: Investigate all host-pathogen interactions during urinary tract infection.

Example 6

- Hypothesis: Inflammation influences recurrent UTI.
- Aim: Determine the role of inflammation in recurrent urinary tract infections.

Example 7

- Hypothesis: Antibiotics alter the microbiome.

Aim: Determine whether antibiotics alter the gut microbiome, urinary microbiome, immune response, epithelial repair, bacterial persistence, and recurrence

Example 8

- Hypothesis: Uropathogenic *E. coli* survives antibiotics inside bladder cells.
 - Aim: Determine whether intracellular bacterial communities promote recurrent infection.
- Approach: 16S sequencing

Example 9

- Hypothesis: Urinary dysbiosis causes recurrent UTI.
 - Aim: Determine whether urinary dysbiosis causes recurrent UTI.
- Approach: Compare microbiomes of healthy women and women with recurrent UTI.

Example 10

- Hypothesis: Neutrophils promote recurrent UTI by damaging the bladder epithelium.
- Aim: Determine whether neutrophil infiltration promotes recurrent UTI.
- Approach: Measure neutrophil numbers.

Example 11

- Hypothesis: Biofilms protect bacteria from antibiotics.
- Aim: Determine whether catheter biofilms increase treatment failure.

- Approach: Confocal microscopy.

Example 12

- Hypothesis: The urinary microbiome influences susceptibility to recurrent infection.
- Aim: Determine whether the urinary microbiome regulates susceptibility to recurrent UTI.
- Approach: Treat mice with antibiotics.

Example 13

- Hypothesis: Commensal bladder bacteria suppress uropathogenic *E. coli* colonization by competing for iron.
- Aim: Determine whether commensal bladder bacteria limit UPEC colonization through iron competition.
- Approach
 - Competition assays
 - Iron supplementation
 - Mouse infections

Example 14

- Aim 1: Determine whether intracellular bacterial communities promote recurrent urinary tract infection by protecting uropathogenic *E. coli* from antibiotic treatment.
- Hypothesis: Intracellular bacterial communities act as protected reservoirs that survive antibiotic exposure and seed recurrent infection.
- Approach: Using a mouse model of recurrent UTI, we will quantify intracellular bacterial communities before and after antibiotic treatment using confocal microscopy and bacterial culture. Pharmacologic disruption of intracellular invasion will determine whether eliminating these reservoirs reduces recurrence.