

Crafting Strong Specific Aims

Sunita Patterson
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Specific Aims section of an NIH proposal

SPECIFIC AIMS

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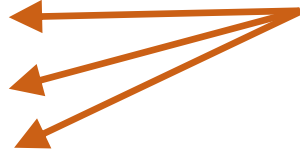
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Aim 2: Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Fusce posuere, magna sed pulvinar ultricies, purus lectus malesuada libero, sit amet commodo magna eros quis urna. Fusce est. Vivamus a tellus. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Nunc viverra imperdiet enim. Fusce est. Vivamus a tellus.

Aim 3: Fusce posuere, magna sed pulvinar ultricies, purus lectus malesuada libero, sit amet commodo magna eros quis urna. Fusce posuere, magna sed pulvinar ultricies, purus lectus malesuada libero, sit amet commodo magna eros quis urna. Nunc viverra imperdiet enim. Fusce est. Vivamus a tellus. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas.

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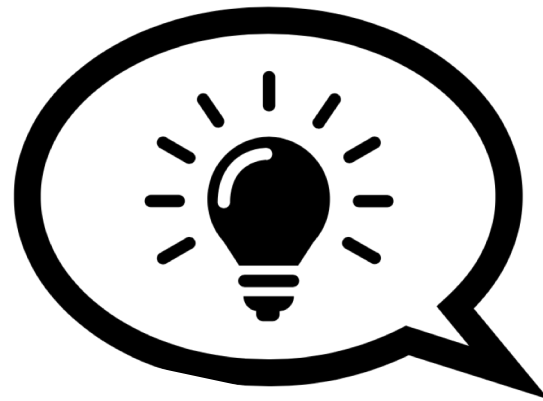
The specific aims you propose to do



“Make your aims sing and harmonize ... Craft your aims carefully so reviewers will see both their individual and synergistic worth.”

NIH Center for Scientific Review

Designing the Aims



Central hypothesis
or
central objective

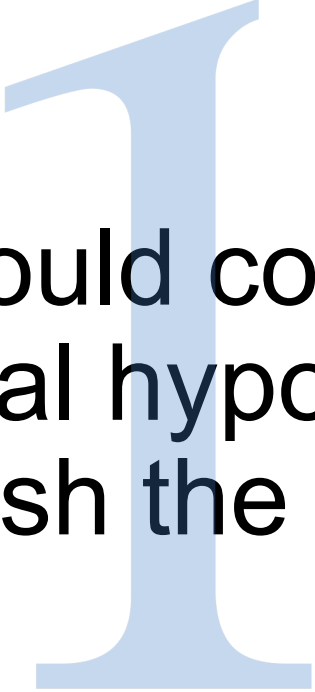
Central hypothesis
or
central objective

```
graph TD; A[Central hypothesis or central objective] --- B[Aim 1]; A --- C[Aim 2]; A --- D[Aim 3];
```

Aim 1

Aim 2

Aim 3



The aims should collectively test
the central hypothesis or
accomplish the objective

Example

Hypothesis: Host protein and antibody profiles can constitute a biomarker for increasing *M. tuberculosis* infection activity and predict the risk for development of TB in asymptomatic people living with HIV.

Example

Hypothesis: Host protein and antibody profiles can constitute a biomarker for increasing *M. tuberculosis* infection activity and predict the risk for development of TB in asymptomatic people living with HIV.

Aim 1. Determine host protein biomarkers for increasing *M. tuberculosis* infection activity in asymptomatic people living with HIV.

Example

Hypothesis: Host protein and **antibody profiles** can constitute a biomarker for increasing *M. tuberculosis* infection activity and predict the risk for **development of TB** in **asymptomatic people living with HIV**.

Aim 1. Determine host protein biomarkers for increasing *M. tuberculosis* infection activity in asymptomatic people living with HIV.

Aim 2. Define **antibody profiles** associated with **development of TB** in **asymptomatic people living with HIV**.

Example

Hypothesis: Host protein and antibody profiles can constitute a biomarker for increasing *M. tuberculosis* infection activity and **predict the risk** for development **of TB** in **asymptomatic people living with HIV**.

Aim 1. Determine host protein biomarkers for increasing *M. tuberculosis* infection activity in asymptomatic people living with HIV.

Aim 2. Define antibody profiles associated with development of TB in asymptomatic people living with HIV.

Aim 3. Develop **prediction** models for **risk of TB** in **asymptomatic people living with HIV**.

Example

Need: Development of an ocular drug delivery nanowafer with controlled drug release attributes

Example

Need: Development of an ocular drug delivery nanowafer with controlled drug release attributes

Aim 1. Nanowafer fabrication and optimization of total drug content and drug stability

Aim 2. Optimization of in vivo pharmacokinetics and maximum tolerated drug dose

Aim 3. Evaluation of nanowafer efficacy on inhibition of corneal neovascularization

Example

Hypothesis: Protein Z regulates oxidative stress via its coordinated functions in nuclei and mitochondria.

Example

Hypothesis: **Protein Z** regulates **oxidative stress** via its coordinated **functions in nuclei** and mitochondria.

Aim 1. Investigate how **protein Z functions in the nucleus** for protection from **oxidative stress**.

Example

Hypothesis: **Protein Z** regulates oxidative stress via its coordinated **functions in** nuclei and **mitochondria**.

Aim 1. Investigate how protein Z functions in the nucleus for protection from oxidative stress.

Aim 2. Determine novel **functions** of **protein Z in mitochondria**.

Example

Hypothesis: Protein Z regulates oxidative stress via its coordinated functions in nuclei and mitochondria.

Aim 1. Investigate how protein Z functions in the nucleus for protection from oxidative stress.

Aim 2. Determine novel functions of protein Z in mitochondria.

Aim 3. Determine the relevance of **regulation of oxidative stress** by **protein Z** for suppression of prostate cancer.

Example

Hypothesis: Protein Z regulates oxidative stress via its coordinated functions in nuclei and mitochondria, and these functions are necessary to **suppress prostate cancer** initiation.

Aim 1. Investigate how protein Z functions in the nucleus for protection from oxidative stress.

Aim 2. Determine novel functions of protein Z in mitochondria.

Aim 3. Determine the relevance of **regulation of oxidative stress** by **protein Z** for **suppression of prostate cancer**.



Each aim should have a
clear endpoint

Example

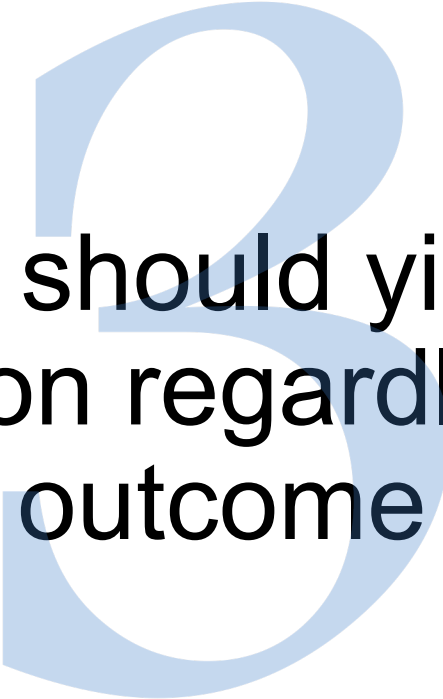
Hypothesis: MYC and AP-1 are key instigators of fibroproliferative remodeling in bladder smooth muscle and represent novel therapeutic targets in the setting of bladder fibrosis.

Example

Hypothesis: MYC and AP-1 are key instigators of fibroproliferative remodeling in bladder smooth muscle and represent novel therapeutic targets in the setting of bladder fibrosis.

Aim 1. Determine the functional significance of the MYC-centric network in bladder smooth muscle remodeling.

Aim 2. Determine the effect of pharmacologic inhibition of AP-1 on remodeling and fibrosis in the context of bladder outlet obstruction.



Each aim should yield useful
information regardless of its
outcome

Example

Weak:

Aim 1. Determine whether molecule X initiates pathway G.

Example

Weak:

Aim 1. Determine whether molecule X initiates pathway G.

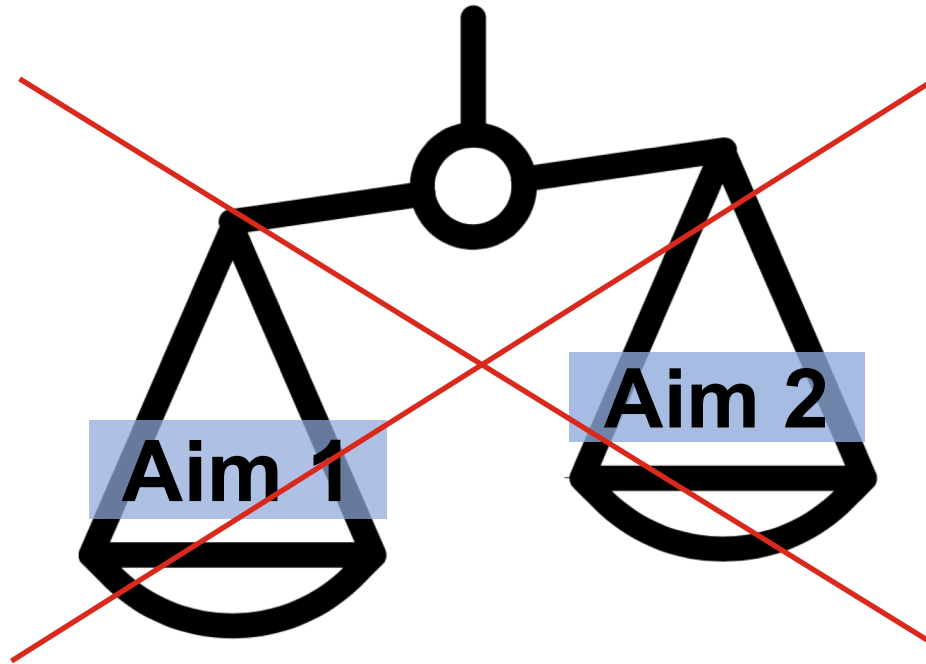
Better:

Aim 1. Identify the mechanism responsible for pathway G initiation.



The aims should be similar in
scope

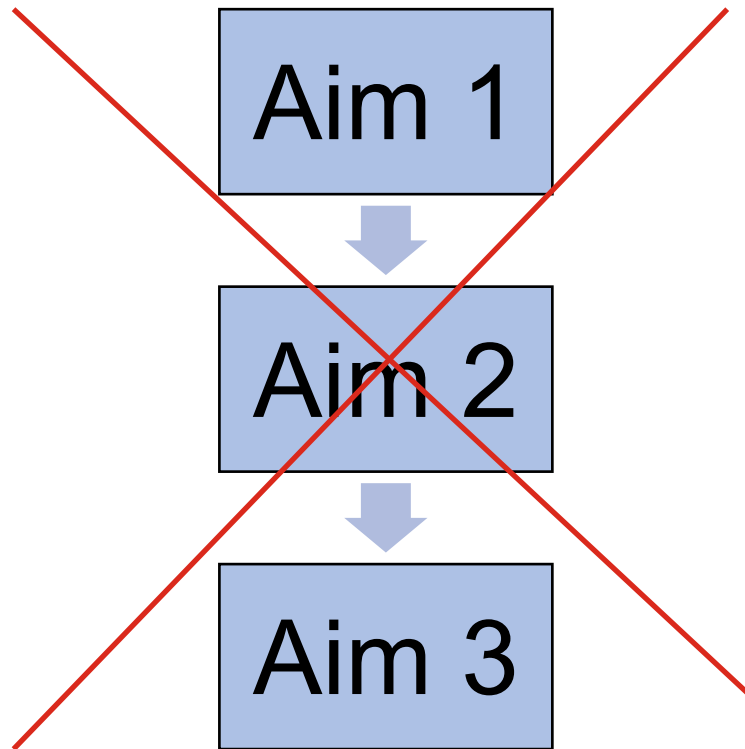
Avoid unbalanced aims





The aims should be
independent

Avoid dependent aims





The aims must be feasible

Aims must be feasible in terms of:

- Time
- Resources
- Expertise

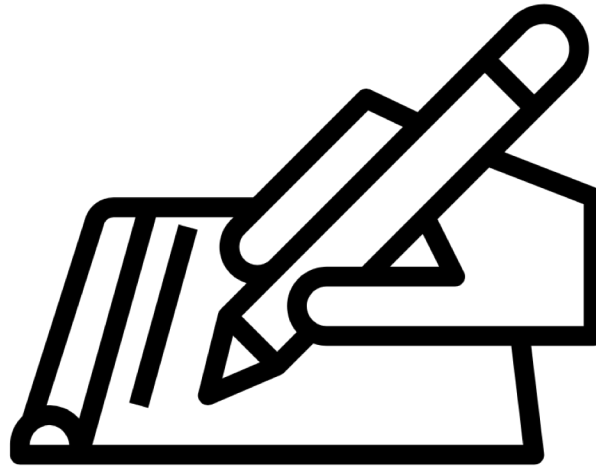


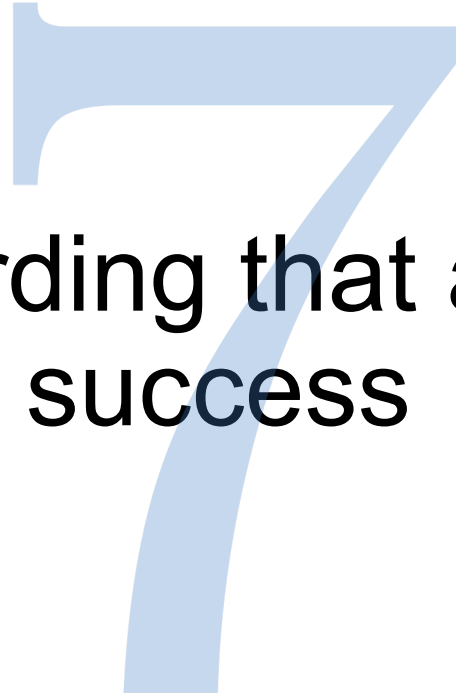
Designing the aims

Each aim should:

- ✓ help test the central hypothesis
- ✓ have a clear endpoint
- ✓ yield useful information
- ✓ be similar in scope to the other aims
- ✓ be independent
- ✓ be feasible

Writing the Aim Statements





**Use wording that assures
success**

Example

Weak:

Aim 1. Determine whether molecule X initiates pathway G.

Better:

Aim 1. Identify the mechanism responsible for pathway G initiation.

Example

Weak:

Aim 1. Determine whether molecule X initiates pathway G.

Better:

Aim 1. Identify the mechanism responsible for pathway G initiation.

Our working hypothesis is that kinase H-mediated phosphorylation of molecule X leads to pathway G initiation.

Example

Weak:

Aim 2. Investigate whether tumorigenic properties of potential cell types of origin of bladder cancer are defined by specific oncogene/tumor suppressor alterations.

Example

Weak:

Aim 2. Investigate whether tumorigenic properties of potential cell types of origin of bladder cancer are defined by specific oncogene/tumor suppressor alterations.

Better:

Aim 2. Identify specific oncogene/tumor suppressor alterations that define tumorigenic properties of potential cell types of origin of bladder cancer.



Use verbs that convey a clear
endpoint

Use strong verbs

isolate

determine

identify

discover

define

elucidate

ascertain

Avoid weak verbs

~~examine~~

~~explore~~

~~evaluate~~

~~study~~

~~investigate~~

Example

Weak:

Aim 2. Investigate novel functions of protein Z in mitochondria.

Example

Weak:

Aim 2. Investigate novel functions of protein Z in mitochondria.

Better:

Aim 2. Determine novel functions of protein Z in mitochondria.

Example

Weak:

Aim 2. To **evaluate** differences in the psychometric properties of language sampling techniques as a function of variations in subject age and sex.

Better:

Aim 2. To **identify** differences in the psychometric properties of language sampling techniques as a function of variations in subject age and sex.



Focus on the outcome rather
than the method

Avoid process-oriented verbs

perform

measure

characterize

compare

describe

correlate

catalog

Example

Weak:

Aim 3. Utilize newly CRISPR-Cas9-generated mice bearing germline mutations in the X and Y binding sites to determine the importance and X isoform dependence of the anticonvulsant actions of agent Z.

Example

Weak:

Aim 3. ~~Utilize newly CRISPR-Cas9-generated mice bearing germline mutations in the X and Y binding sites to~~ determine the importance and X isoform dependence of the anticonvulsant actions of agent Z.

Better:

Aim 3. Determine the importance and X isoform dependence of the anticonvulsant actions of agent Z.

Example

Weak:

Aim 1. Use behavioral pharmacology and in vivo voltammetry to identify the specific midbrain receptor X subtype(s) that mediate behavioral and dopaminergic responses to stress.

Example

Weak:

Aim 1. **Use** behavioral pharmacology and in vivo voltammetry to **identify** the specific midbrain receptor X subtype(s) that mediate behavioral and dopaminergic responses to stress.

Better:

Aim 1. **Identify** the specific midbrain receptor X subtype(s) that mediate behavioral and dopaminergic responses to stress, **using** behavioral pharmacology and in vivo voltammetry.

Example

Better:

Aim 1. Identify the specific midbrain receptor X subtype(s) that mediate behavioral and dopaminergic responses to stress, ~~using behavioral pharmacology and in vivo voltammetry.~~

Best:

Aim 1. Identify the specific midbrain receptor X subtype(s) that mediate behavioral and dopaminergic responses to stress.

10

Use parallel grammatical structure

Example

Weak:

Aim 1. To investigate how protein Z functions in the nucleus for protection from oxidative stress.

Aim 2. Determine novel functions of protein Z in mitochondria.

Aim 3. Determine the relevance of regulation of oxidative stress by protein Z for suppression of prostate cancer.

Example

Better:

Aim 1. Investigate how protein Z functions in the nucleus for protection from oxidative stress.

Aim 2. Determine novel functions of protein Z in mitochondria.

Aim 3. Determine the relevance of regulation of oxidative stress by protein Z for suppression of prostate cancer.

Example

Better:

Aim 1. To investigate how protein Z functions in the nucleus for protection from oxidative stress.

Aim 2. To determine novel functions of protein Z in mitochondria.

Aim 3. To determine the relevance of regulation of oxidative stress by protein Z for suppression of prostate cancer.

**Make the aim statements clear
and concise**

Examples

Aim 1. Discover the relevant molecular players linking BTN3A1 to Vd9Vg2 T-cell activation.

Aim 1. Identify the signals driving the thymic development of C4-specific Treg cells.

Aim 1. Determine the mechanism by which TAK1 regulates NUMBL expression.

Adapted from NIH projects 5R01AI115471-05, 5R01AI126756-04, 5R01AR054326-10

Example

Aim 3. Define the impact of sleep deprivation across subregions within the hippocampus and within individual cell types, providing a detailed spatial map and cellular signature of the effects of sleep deprivation.

Example

Aim 2. Determine the functional consequences of targeting the Sema3F-Nrp2 axis in a model of partial bladder outlet obstruction.

Writing the aim statements

Each aim should:

- ✓ use wording that assures success
- ✓ use verbs that convey a clear endpoint
- ✓ focus on the outcome rather than the method
- ✓ use parallel grammatical structure
- ✓ be clear and concise

Sources

National Institute of Allergy and Infectious Diseases, Draft Specific Aims. 2017. <https://www.niaid.nih.gov/grants-contracts/draft-specific-aims>

National Institutes of Health. Research Portfolio Online Reporting Tools Expenditures and Results (RePORTER) database. <https://projectreporter.nih.gov>

Peyman JA, Robinson WH, Allen KD. Specific Aims--Do's and Don't's [slides]. <https://www.rheumatology.org/Portals/0/Files/Specific%20Aims%20-%20Do%27s%20and%20Don%27ts.pdf>

Robertson JD, Russell SW, Morrison DC (Grant Writers Seminars & Workshops). *The Grant Application Writer's Workbook* [chapters 7 and 8]. 2019. <http://www.grantcentral.com/>

The RML is here to help!

Writing, editing, responding to reviewers:

Scientific Publications

scientificpublications@mdanderson.org

713-792-3305

Literature searches, EndNote, data
management:

Research Services

RML-Help@mdanderson.org

713-792-2282

Additional resources

Webinars:

- Preparing an Efficient, Effective Grant Proposal
- NIH Resources for Applicants

Presentations:

- What Are Grant Reviewers Really Thinking?
- Writing the Specific Aims Section
- Avoiding the Seven Deadly Sins of Grant Proposal Writing

<https://inside.mdanderson.org/departments/sqipub/educational-programs.html>

INTEREST program

- Important upcoming dates:
 - **April 17:** INTEREST Intent Form and grant abstract due
 - **May 1:** Full application due
 - **May 15:** INTEREST Review Meeting
- Contact INTEREST@mdanderson.org

<https://myteams.mdanderson.org/cop/fc/SitePages/INTEREST.aspx>