Writing Specific Aims: A Hands-on Brain Engaged Guide to Making Your Reviewers Like You!

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What makes an excellent grant? (Define "excellent" as funded!)

3 features of good grants:

1. _____
2. _____
3. _____

What makes an excellent grant? (Define "excellent" as funded!)

3 features of an excellent grant:

1. __Excellent ideas__
2. __Excellent ideas__
3. __Excellent ideas__

Who decides if a grant is "excellent"?
(Translation: Who rates the scientific merit of a proposal?)

1. The Applicant
2. Study Section Review Administrator (SRA)
3. Reviewers
4. Program Officer
5. Council

The REAL Challenges of Writing an Excellent Grant

Two Challenges

1. To have truly excellent ideas
2. To communicate them clearly to a diverse group of reviewers
   - If the reviewers cannot see how truly excellent your ideas are, your grant will NOT get an excellent score.

The Importance of Presentation

- Excellent ideas can be invisible if presentation is not clear
  - Good Science + Bad Presentation → Probably not scored
- High quality presentation can enhance idea
  - Good Science + Good Presentation → Scored, but probably not competitive
- The best science requires a clear presentation to be understood
  - Excellent Science + Excellent Presentation → Great Score, probably funded (top 10%)

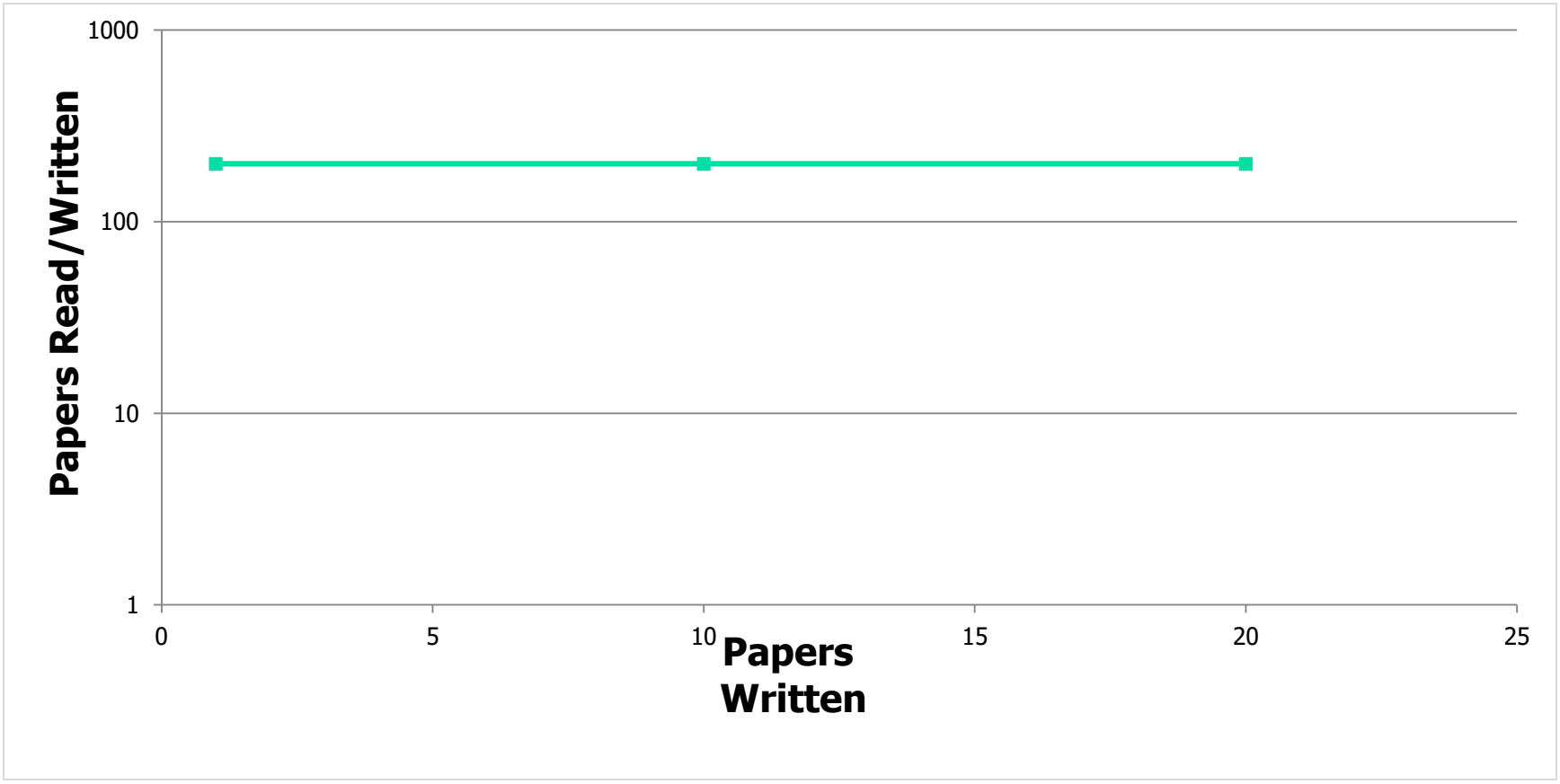
Elements of a research grant

- Hypothesis and Long-Term Objectives
- Specific Aims
- Background and Significance
- Progress / Preliminary Studies
- Research Design and Methods
- Literature Cited

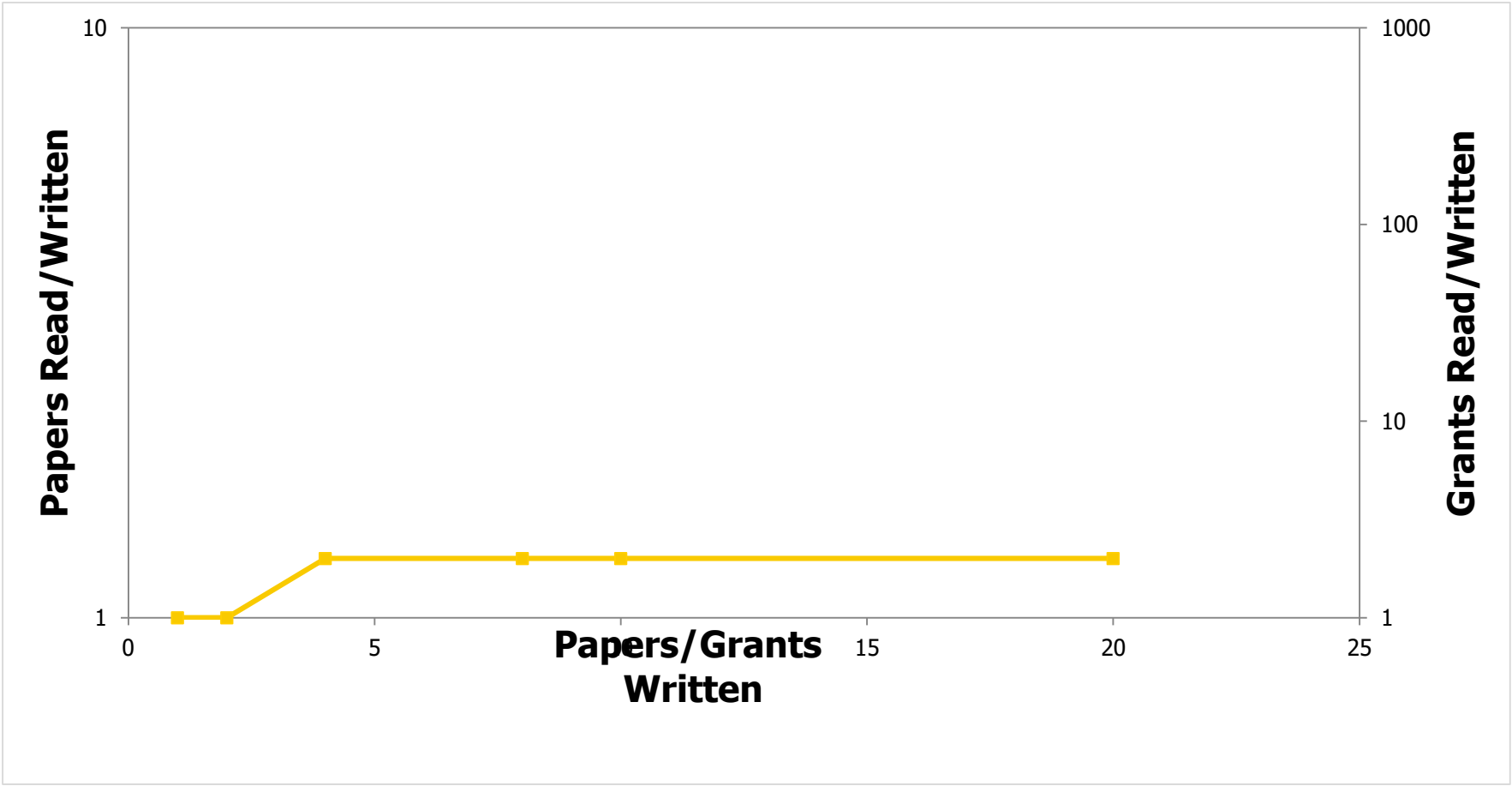
What to write when?

1. Specific Aims
   - These need to be done first
     - They provide a road map for the research
     - Common fatal flaw – A grant with Aim 1 as the key; if it fails then the whole grant collapses → low priority.
   - Get feedback and revise before proceeding
2. Experimental Design
   - This is an extension/explanation of the Specific Aims
     - This section should be written to be parallel in structure to the Specific Aims
3. Rest of proposal
4. More parts, etc.
5. Abstract/Budget
   - Abstract is for lay people (reviewers read it only if rest of grant is not clear!)

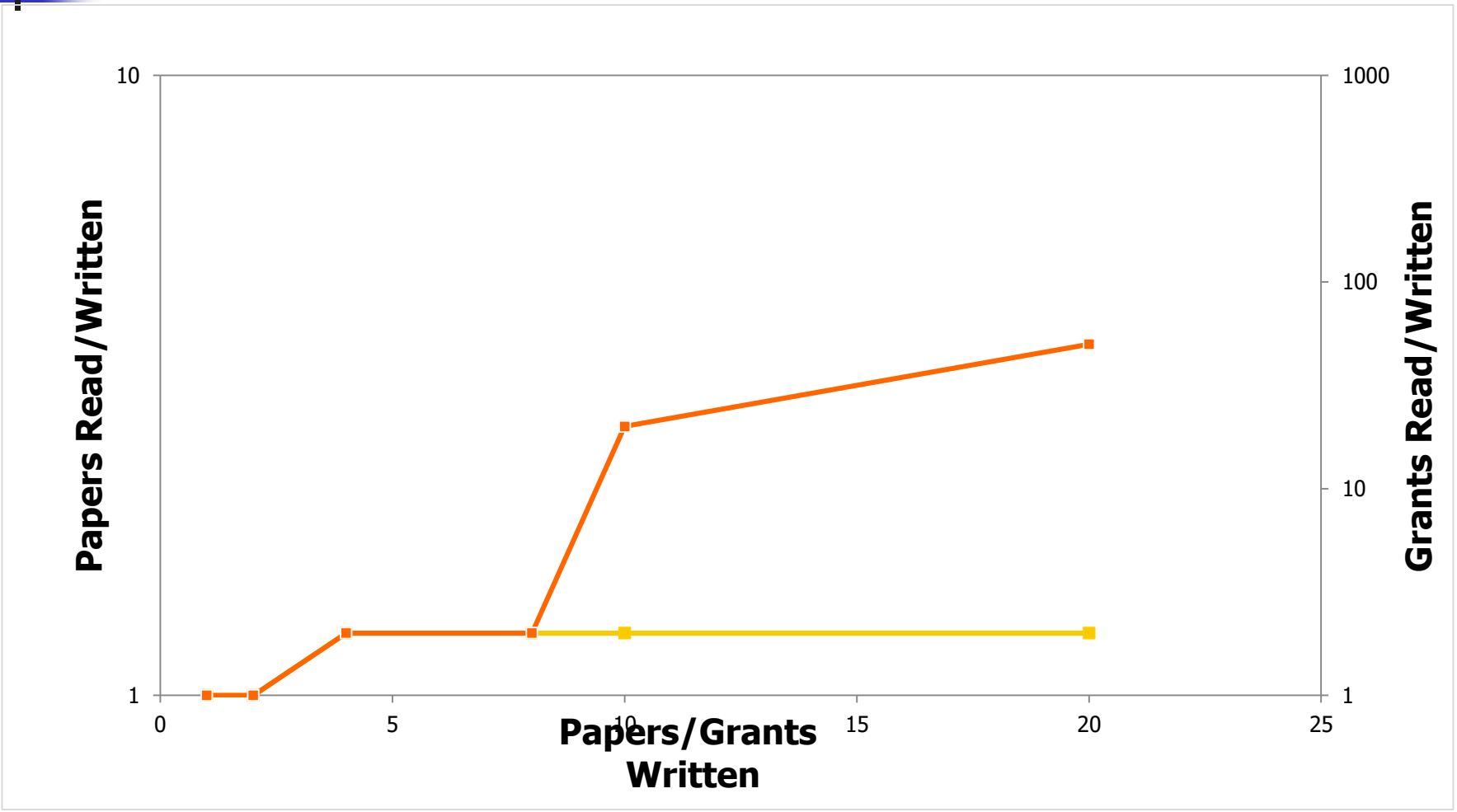
Papers: Experience



Papers vs Grants: Experience Differs



Papers vs Grants: Experience Differs (with Study Section)



The "Specific Aims" Section

- Should be ~1 page long and is THE MOST IMPORTANT PAGE IN THE APPLICATION
- This Section has two parts
  - A short, general statement about what your proposal will address, both long-term and short-term
  - A set of specific aims, each with a hypotheses that you will test and a brief explanation of how you will test them
  - Put the aims in a logical and sequential order.
- Repeat: This is the most important page in the application. If you do not stimulate the interest of the reviewer here, you are not likely to get a good score
  - Advice: Start with this section. Write it, get feedback, rewrite it – repeat. (10-15 times!)

The Specific Aims: Audience Participation

- Think about an experiment that you are doing or that you want to do
- Take a blank document and write a few sentences about that experiment as if you were writing Specific Aims for a grant
- 5 minutes ….

Brief Critique/Survey …

- Does your proposal make sense?
- Keywords
  - "The Goal …
  - "The hypothesis is …
  - "To test this hypothesis …" (some sort of method)
  - "The rationale for this experiment is …"
  - "The expected results/significance is …"

Before you write –

- Develop a solid hypothesis
  - What is the overall goal of your research?
  - What specific hypotheses will you address?
  - Why is it significant?
  - What is new, exciting, or creative?
    - Does it "advance the field"?
- Discuss the hypothesis with colleagues

The "Specific Aims" Section

The key word is SPECIFIC – explain what you are going to do and how it will change the world (in one page)

- Hypothesis for each aim.
- Experimental Approach of each aim, i.e., how the hypothesis will be tested
- Expected Results for each aim
- Significance of each aim.

Make Everything Obvious in your Grant Writing

- Tell them what you're going to tell them
- Tell them
- Tell them what you told them

Tell Them What You're Going to Tell Them

- One paragraph succinct introduction to the problem:
  - Water is a crucial need for agriculture. The goal of this project is to test the hypothesis that the rain in Spain falls mainly on the plain. This is the widely known Higgins/Doolittle hypothesis (Shaw, B. *Pygmalion.* 1916. Since the first statement of this hypothesis, it has become clear that rain alone is not an appropriate way to evaluate the total corpus of precipitation events, and that there is significant interaction between the type of precipitation and the local geography of peninsulas. Thus, to test this hypothesis we have 3 specific aims. The first two aims will evaluate a different aspect of precipitation in the various geographical subdivisions of the Hibernian Peninsula. In the third Specific Aim we will develop a mathematical model in order to generalize these findings to other peninsulae.

Tell them: Aim 1 – the key to the proposal

- Aim 1 is key – it sets the stage, usually both conceptually and methodologically
  - Specific Aim 1: The hypothesis of Specific Aim 1 is that in the Hibernian Peninsula there is significantly more rainfall in the Piedmont areas than in the Plains. To test this hypothesis we will exploit a new rain gauge technology developed in this laboratory (see PRELIMINARY RESULTS) that provides nanosecond resolution of rainfall events. We expect to find that more precipitation per unit time actually falls on the Piedmont areas than on the Plain and that each rainfall event lasts longer in the Piedmont but that the Plain has vastly more surface area. The overall effect heavily tips the balance of the total amount of precipitation with respect to geographical location. If we are correct, it would mean that the often cited Higgins/Doolittle hypothesis is only partially correct. However, the findings will be significant even if we are incorrect in the terms of developing a plan for allocating resources for agricultural development in the Piedmont vs the irrigation needs of the Plain."

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Tell Them: The additional aims must follow logically

- Build on the other aims –
  - Specific Aim 2: The hypothesis of Specific Aim 2 is that snow in Spain falls mainly in the Mountains. This hypothesis will be tested using the same methodology that will use for Specific Aim 1 except that the geographical placement of the collection sites will be altered and power will need to be supplied in order to convert the snow into water. This Aim is necessary in order to understand completely the precipitation pattern in Spain. This is because the Spring runoff snowmelt provides a potential irrigation source for the needs of Plains (as determined from Specific Aim 1). …
  - Specific Aim 3: For Specific Aim 3 the hypothesis is that other peninsula have similar precipitation patterns to Spain. This is necessary because the experiments of Specific Aims 1 and 2 will provide a conceptual framework for understanding the distribution of precipitation events only in a single peninsula. A global resource expenditure priority requires a general logic for peninsular precipitation. Thus, to test this hypothesis we will use the results of Specific Aims 1 and 2 to build a mathematical model of the effects of peninsular geography on precipitation. The mathematical model will then be modified and then tested in 3 peninsulae selected from the list maintained by the Higgins/Doolittle Society for the Study of Peninsular Precipitation (www.hdsociety.org/myfairlady). The selection will be based on the …"

Tell Them What You Told Them!

- Give the reviewers some words to use in the review
  - If successful, the 3 Aims of this proposal will provide, for the first time, a global perspective on peninusular precipitation. This perspective will provide for a method to distribute irrigation and other agricultural investments in a rational manner. We estimate that this would increase agricultural efficiency by ~25%. In the US alone this could save taxpayers over $1,000,000,000,000 per year.

Attempt 2: The Specific Aims: Audience with Brain-engaged

- Go back to your Specific Aims draft and revise using the template that was sent to you.
- 5 minutes ….

Brief Critique – Again!

- Does your proposal make sense?
- Keywords
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Use Text Formatting to make it easy to read

affects of insulin on cell surface expression of glucose transporter. Expression of a constitutively active version of Akt kinase mimics the effects of insulin by increasing cell surface expression of GLUT4 (Kohn *et al.*, 1996). These studies provide compelling evidence for roles of these two signaling molecules in the regulated trafficking of glucose transporters. *Our preliminary data suggest that the effects of PDGF on cell surface expression of EAAC1 are mediated by PI3-K. PDGF receptors activate both PI3-K and Akt kinase* (Franke *et al.*, 1995). *In the current proposal, we wish to explore the roles of both PI3-K and Akt kinase in the regulated trafficking of EAAC1.*

SNAREs and dynamins, 'accessory proteins', in regulated trafficking

A rapidly growing family of proteins that contributes to the regulation of protein trafficking and secretion in a number of different eukaryotic systems has been identified. This family consists of three groups: 1) proteins on the vesicle membrane called v-SNAREs, 2) soluble proteins (N-ethylmaleimide sensitive fusion protein, NSF, and soluble NSF attachment proteins, SNAPs), and 3) target membrane proteins called t-SNAREs (for reviews, see Linial, 1997; Sollner *et al.*, 1993; Sudhof, 1995; Sutton *et al.*, 1998). Docking of vesicles is mediated by

- Most reviewers believe scientists need to be able to pay attention to detail
- Most reviewers will assume that a person who submits a disorganized proposal with typographical errors will conduct sloppy science!

Be Persistent …

- *If at first you don't succeed, try, try again"*
  - *Teacher's Manual' (1840) by American educator Thomas H. Palmer*

How do I "Get Feedback and Revise"???

1. Get an experienced colleague to read and comment
   - Almost everyone is willing to read the one page Specific Aims sections is easy
2. Ask the Office of Research Development to organize a "mock" Study Section
   - Simulation of what happens at a real study section
   - You get to hear what a diverse group of reviewers really think about your ideas
   - If done right you'll get a good idea of where your project stands in the field.
3. Revise and Repeat – 15-25 drafts to get it right!!!!!