Proposal writing:
A key to success

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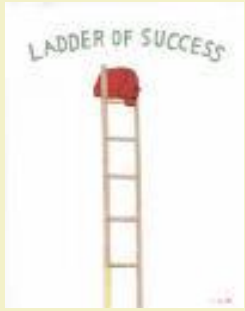
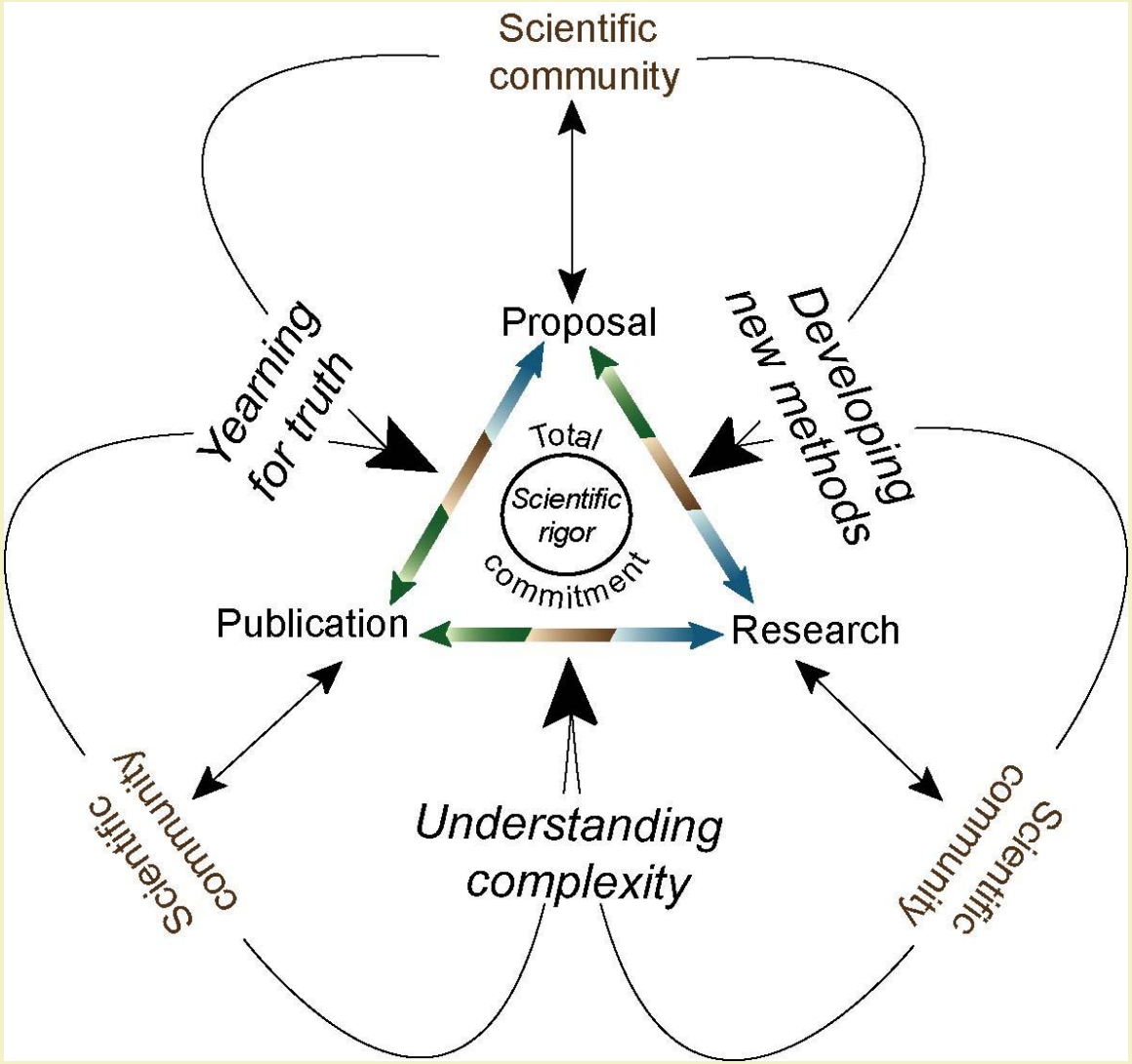
Proposal writing is a key skill in science (and life)

- Asking the right question is as important as answering a particular question
- Proposals are necessary for obtaining needed resources
- Proposals organize ideas, time and effort
- Proposal writing is a creative process
- Success in many fields is often measured as one's ability to obtain resources

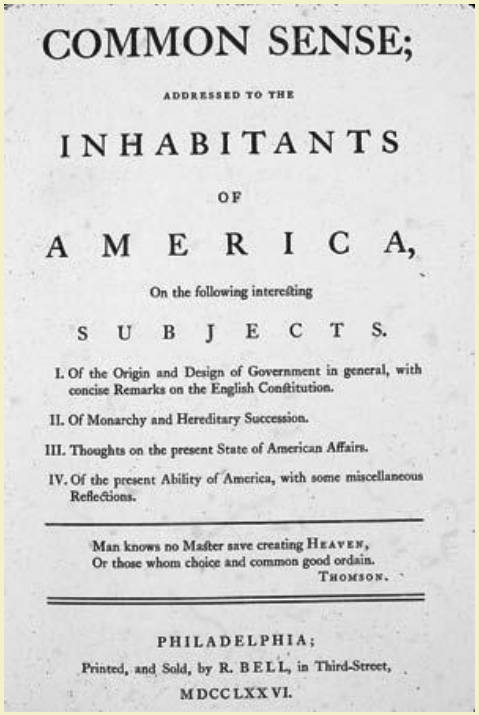


Proposal writing is part of the overall process of doing science



Several elements are common to all proposals

- Proposal must convince reviewers
  - 1) that you are addressing an important question
  - 2) that you or your team are the right person/group to address the question
- Proposal has to fit within the aims of the program
- Proposal needs to establish that the resources provided by the agency or institution will be well spent



COMMON SENSE;

ADDRESSED TO THE

INHABITANTS

OF

AMERICA,

On the following interesting

SUBJECTS.

I. Of the Origin and Design of Government in general, with concise Remarks on the English Constitution.

II. Of Monarchy and Hereditary Succession.

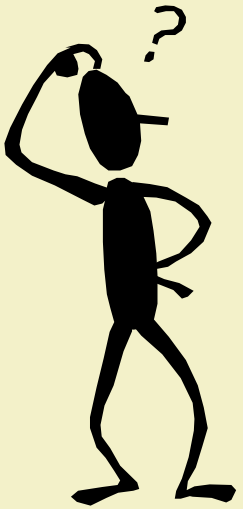
III. Thoughts on the present State of American Affairs.

IV. Of the present Ability of America, with some miscellaneous Reflections.

Man knows no Master save creating HEAVEN,
Or those whom choice and common good ordain.
THOMSON.

PHILADELPHIA:
Printed, and Sold, by R. BELL, in Third-Street,
MDCCLXXVI.

Developing an idea is an iterative process

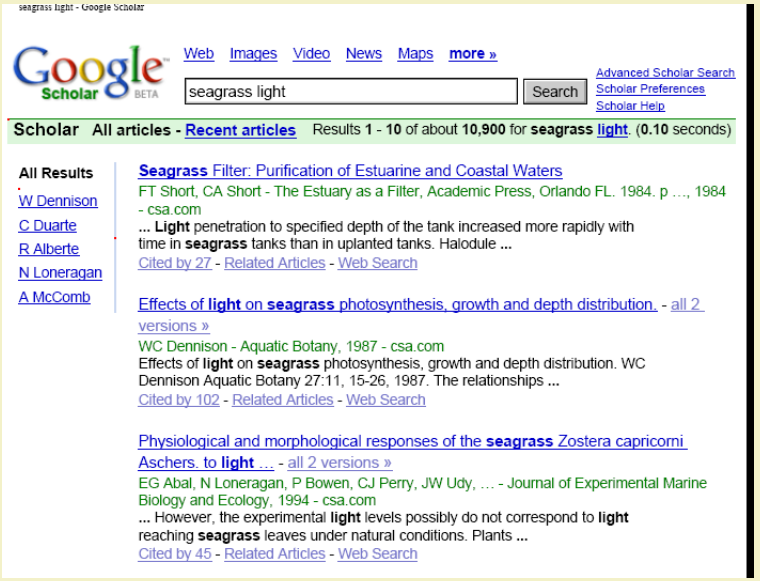


- Ask a question/develop a hypothesis
- Then ask yourself:
  - Can I design an experiment to answer the question/test the hypothesis?
  - If I can answer the question/test the hypothesis, then “So what?”
- Reformulate the question/hypothesis
- Than ask your advisors, colleagues, students the same questions

Develop an understanding of the relevant scientific literature

- Read relevant scientific papers
- Search web for relevant information
- Talk to advisors, colleagues, students
- Attend seminars
- Visit other laboratories
- Don't follow this adage:

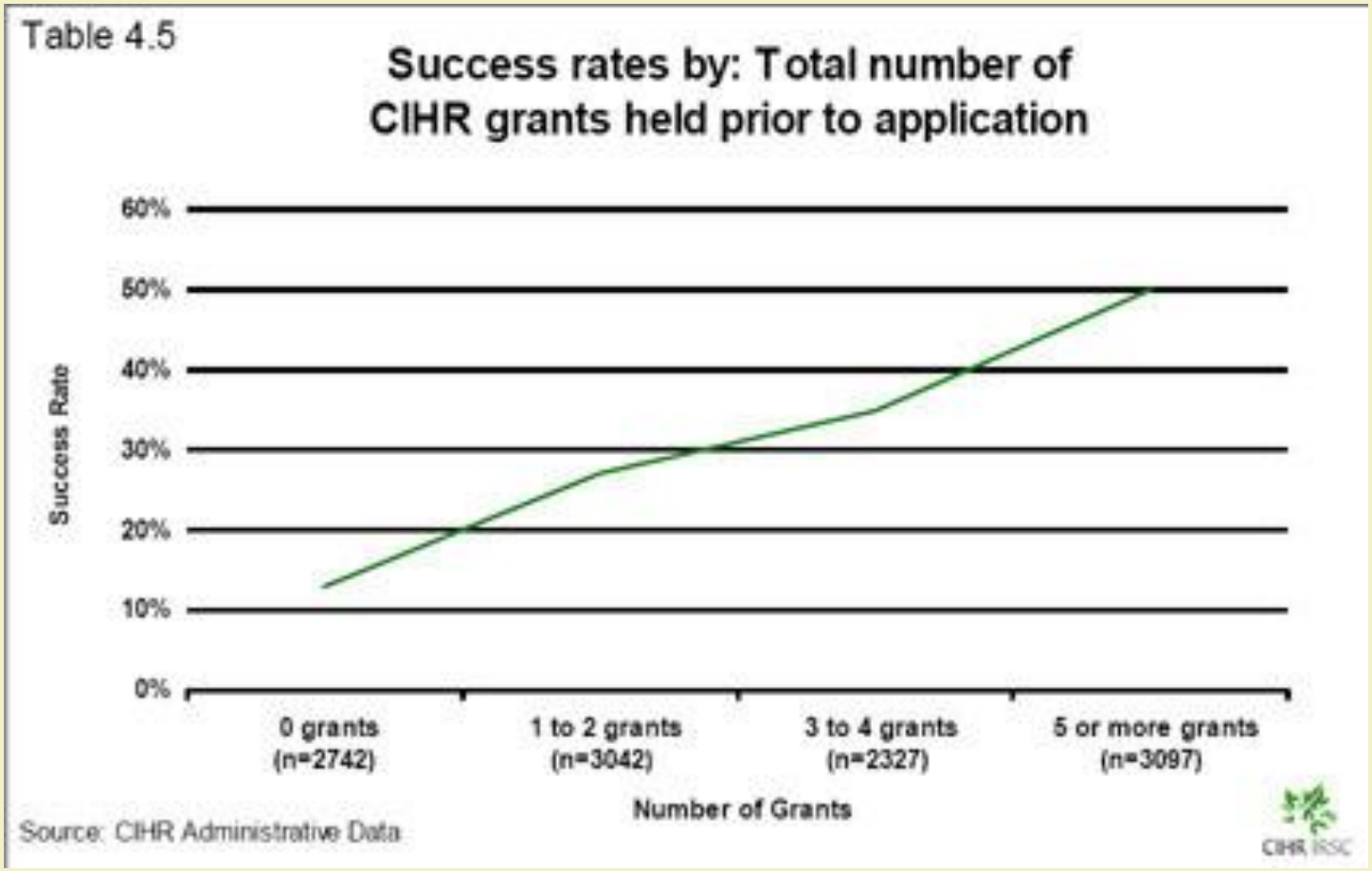
"Weeks and months of lab and field work can save an afternoon in the library"



Develop the zen of proposal writing

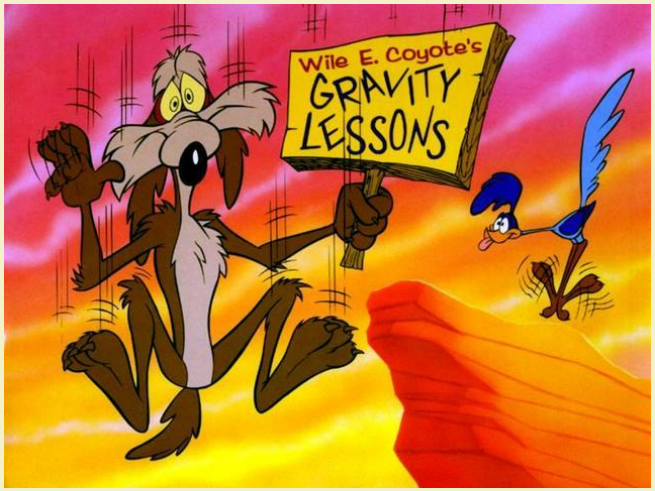
- ***Enthusiasm*** counts; get excited
- Give yourself adequate ***quality time***
- ***Feedback & revision*** essential; seek it out

Proposal success is cumulative (first proposal is the hardest)



Low success rates → Try, try, try again

Fiscal year	Number submitted	Number awarded	Total $ awarded (millions)	Success rate (%)
Fate of unamended (unsolicited) R01 research grant applications				
Type-1 grants: new submissions				
1999	8957	1761	456	19.7
2000	8626	1736	503	20.1
2001	8284	1590	501	19.2
2002	8560	1556	510	18.2
2003	9605	1477	493	15.4
2004	10624	1288	438	12.1
2005	10605	970	351	9.1
Type-2 grants: continuation (renewal) submissions				
1999	3214	1772	554	55.1
2000	3233	1708	563	52.8
2001	3100	1637	583	52.8
2002	3153	1555	559	49.3
2003	3767	1697	627	45.0
2004	3773	1530	580	40.6
2005	3896	1262	496	32.4

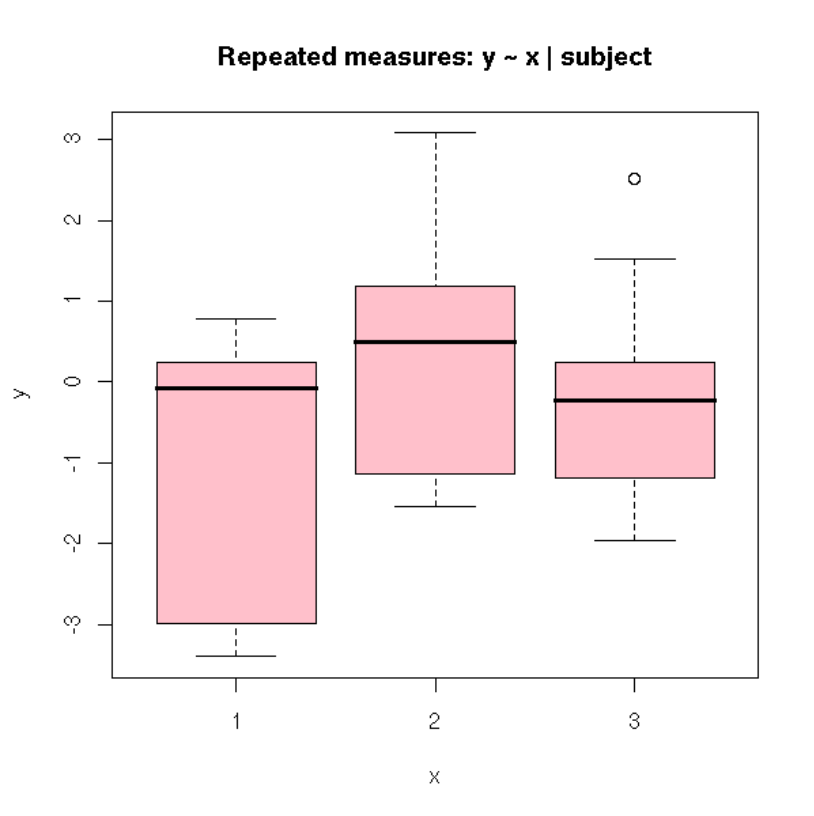


Key aspects of proposal sections

- Title: most important words in the proposal
- Abstract: 2nd most important words; written for general audience
- Budget/budget justification: follow guidelines; realistic needs, not wish list
- Biographical sketch: tailor to proposal
- Research plan: clear objectives, hypothesis-driven
- References: inclusive, complete, consistent

Develop estimates of replication

- Statistical analysis helpful in defining the numbers of replicates required
- Level of replication important in being able to budget (time and money)
- Previous work or preliminary data can provide estimate of variability
- Include the concept of replication in the experimental design



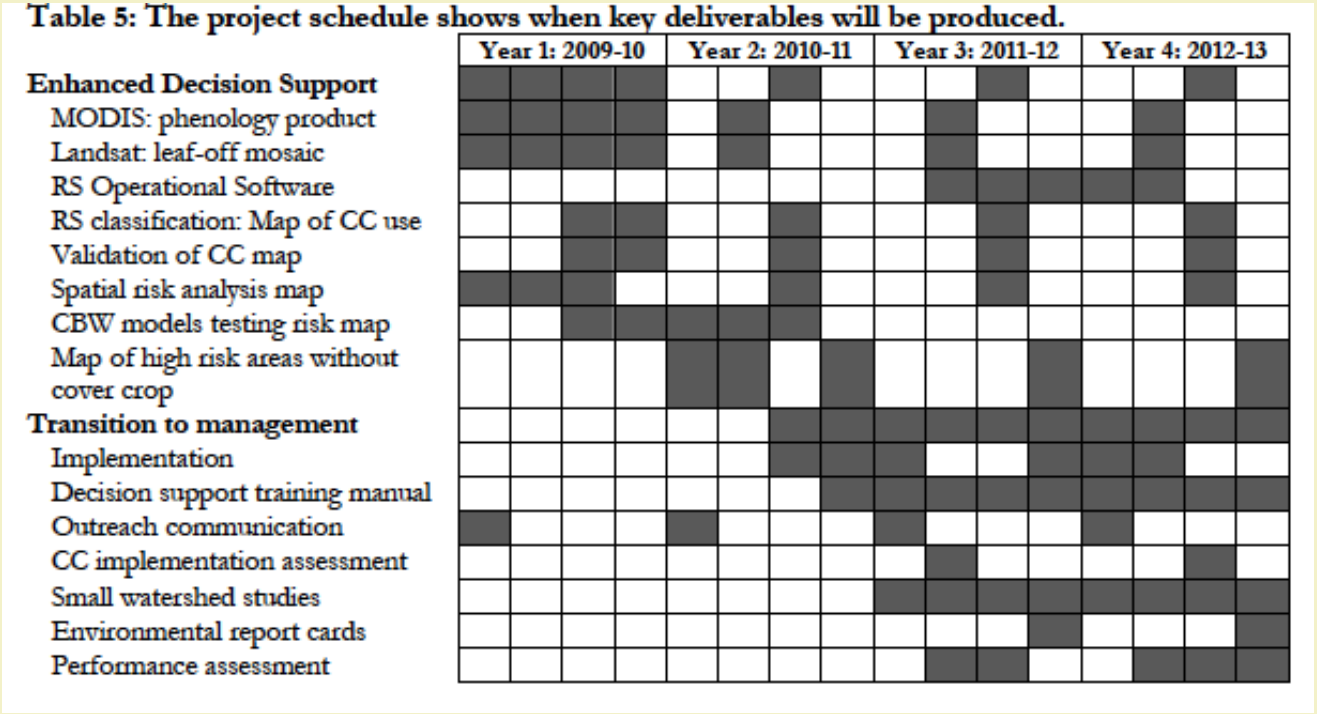
Include a time line/research plan

Important calculation:

Estimated time/2 ≈ Real time

Example time line:

Table 5: The project schedule shows when key deliverables will be produced.



Get the references right

- References need to be inclusive; include potential reviewers & key papers
- Referencing must be consistent; standard style throughout
- References in text need to match references in bibliography

Costanzo, SD., O´Donahue, MJ., Dennison, WC., Loneragan and Thomas, M. 2001. A new approach for detecting and mapping sewage impacts. *Marine Pollution Bulletin* 42: 149-156

Erftemeijer, PA. And Middelburg, JJ. 1993. Sediment-nutrient interactions in tropical seagrass beds: a comparison between a terrigenous and a carbonate sedimentary environment in south Sulawesi (Indonesia). *Marine Ecology Progress Series* 102: 187-198

Grice, AM., Loneragan, NR. And Dennison, WC. 1996. Light intensity and the interactions between physiology, morphology and stable isotope ratios in five species of seagrass. *Journal of Experimental Marine Biology and Ecology* 195: 91-110

McCook, LJ. 1999. Macroalgae, nutrients and phase shifts on coral reefs: scientific issues and management consequences for the Great Barrier Reef. *Coral Reefs* 18: 357-367

Udy, JW and Dennison, WC. 1997. Physiological responses of seagrasses used to identify anthropogenic nutrient inputs. *Marine and Freshwater Research* 48: 605-614

Van Tussenbroek, BI. 1994. Aspects of the reproductive ecology of *Thalassia testudinum* in Puerto Morelos Lagoon, Mexico. *Botanica Marina* 37: 413-419

Awareness of evaluation criteria helpful

Proposal Number: NSF02-132
Proposal Title: Molecular probes and monitoring
Principal Investigator: Ann Example

Scientific Merit: This is largely a methods development program of study. The attempt here is to compare molecular probe assay methods in a rigorous series of lab and field experiments.

Relevance to Program Objectives: This may be a better fit into a different funding scheme, but accurate analysis of one of the key species is a prerequisite for a monitoring program. There is no direct integration with the management community in this program.

Principal Investigator Qualifications: The PIs are clearly qualified.

Past Research Performance: A solid and consistent research publication record.

Facilities for Research: The PI has all the research infrastructure necessary for conducting the proposed research.

Costs: The budget is rather high, partially due to the field component, subcontracts, and technical support.

Overall Rating: VERY GOOD

Highlighting can be used to accentuate certain points

Seagrasses are not a monophyletic group of plants, indeed they are not even true grasses (Poaceae). Rather, "seagrass" is a functional grouping--marine flowering plants that live entirely submersed and share a large number of convergent morphological and physiological characteristics (Larkum & den Hartog, 1989). Recent evolutionary studies using DNA sequences of the chloroplast genome have revealed that the present seagrass diversity probably arose from 3 separate evolutionary events (Waycott & Les, 1996). Thus, convergence of various characteristics of seagrasses has occurred within and between these 3 groupings (Cymodoceaceae 'complex'; Zosteraceae, Hydrocharitaceae). The outcome of this convergence is a suite of common morphological and physiological characteristics (eg., internal gas spaces or lacunae, epidermal chloroplasts, lack of stomata, rapid leaf turnover, reduced respiratory tissue, salt excretion through the plasmalemma). In spite of this convergence, ***there exists a wide range of variability between seagrasses in the manner and way that they adapt to environmental conditions and this variability provides the focus of the proposed research.***

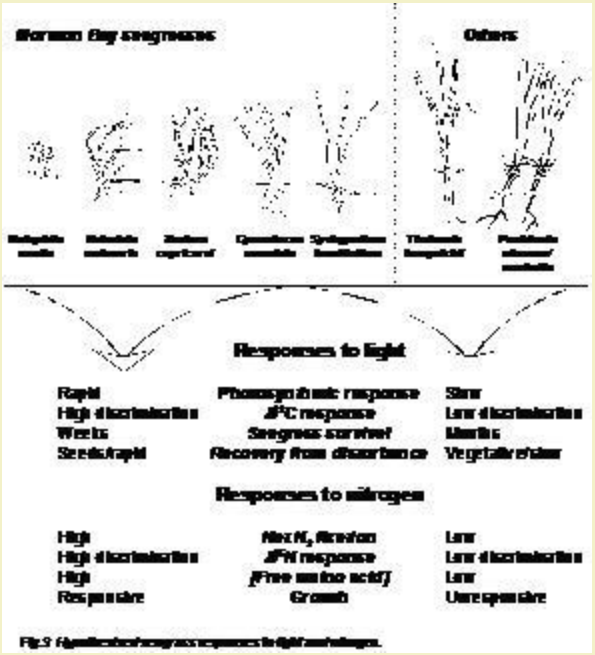
Proposal writing takes practice

- Effectiveness of collaborations in proposal writing process is generally a good predictor of the success of the research project

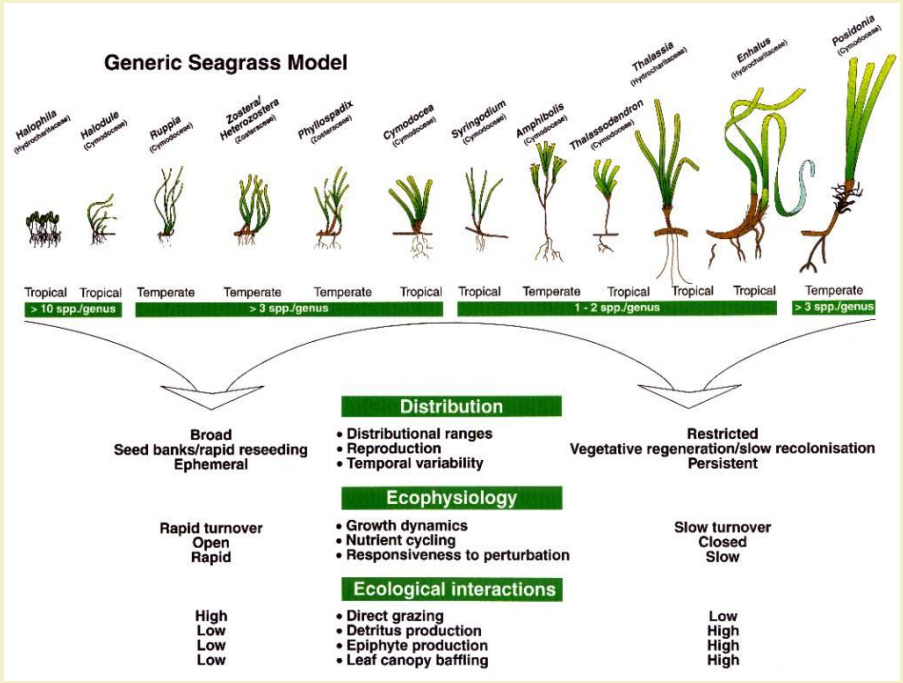
- Don’t take rejection personally; the best predictor of number of successful proposals is number of proposals submitted

- Proposal success can be surprising

Proposals can be converted into presentations & publications



Proposal figure



Publication figure

Research should be guided by, not ruled by, the proposal

- The proposal represents an initial plan and a justification for the research

- Obtaining good results more important than following proposal protocol (ideas change)

- Part of success is willingness to learn from mistakes and adapt

- A series of small experiments can be better than a probably doomed mega-experiment

Further resources

Lots of proposal writing guidance on www:

National Science Foundation

University of Pittsburgh

Science communication guidance

Integration and Application Network

Previous proposals