

ASSIGNMENT #2: Designing a set of experiments for a given abstract
Due: October 14, 2004

NOTE: This is a permuted version of an actual scientific abstract. I have changed names, some facts, and an occasional experiment to discourage you all from locating the paper on PubMed. That being said, the abstract does NOT contain real data and should not be treated as such!

ABSTRACT:

The crystallin proteins are known to be involved in cataract formation. Cataract is caused by self-association and precipitation of crystallins in eye lens cells. A large-scale mutagenesis screen identified a mouse mutant with a dominant cataract and was named Mut. The aim of this study was to describe the morphology of the mutant, map the mutation, and to characterize the underlying characteristics of the mutant protein. The microscopic examination revealed a strong nuclear cataract surrounded by aggregated material in the center of the lens. The histological analysis demonstrated remnants of aggregate-expressing cells throughout the entire lens. The mutation was mapped to a crystallin protein found on chromosome 1 by a genome-wide linkage mapping six DNA polymerase encoding genes and the closely linked RNA polymerase encoding gene. Finally, a T-->A exchange in exon 7 of the crystallinA encoding gene (symbol: CrysA) was demonstrated to be causative for the cataract phenotype. This particular mutation is, therefore, referred to CrysA(Mut). The alteration in codon 76 leads to an amino acid exchange of glutamic acid to phenylalanine. Glutamic acid at this position is highly conserved; it is found in all mouse and rat crystallinAs as well as in the human crystallins. It may be replaced solely by aspartic acid, which is present in all sheep crystallinAs and in the dog crystallinABs. Studies of the purified protein showed that the exchange of a polar and acidic side chain by a hydrophobic one influences the overall surface-exposed hydrophobicity of the molecule. Further studies show that this mutation caused a increase in the ability of the crysA(Mut) protein to self associate and form high order polymerized species. The large molecular weight oligomers of crysA(mut) are resistant to protease degradation. The Mut mouse demonstrates the importance of the integrity of the CrysA gene for lens transparency.

Guidelines for your experimental design from a provided abstract:

An abstract is a brief description of the data presented in a paper. But often an abstract provides much more information than that. You should begin by dissecting the abstract for content and determining what exactly is being described.

WHAT DOES AN ABSTRACT CONTAIN?

1. What is the global purpose of the described experiments?

The abstract must always state the purpose of a given set of experiments including the global problem into which the research fits. Often in the biological sciences we are working on a small facet of a much more global disease or disorder. The global impact of the work should be mentioned as well as the hypothesis directly addressed by the subsequent experiments.

For example, if I was working on identifying specific interaction partners of the BRAC1 protein, my global purpose would be to elucidate the mechanism of breast cancer formation in humans.

2. What is the specific purpose addressed?

The hypothesis is the question directly addressed in the experimental work. This is sometimes includes a purpose to the experiments and often is very specific to the work.

Following our aforementioned example, my purpose would be to determine the interaction partners of BRAC1.

3. What methods did the authors use to study their problem?

Often in an abstract, the experimental techniques are described briefly or not all. Make a list for yourself of what techniques they do describe.

In my BRAC1 paper, I might say: A yeast two-hybrid screen was used to identify potential binding partners of BRAC1.

4. What was their result?

This usually encompasses the majority of the abstract. This is new and authors want anyone who reads his/her abstract to come away believing the result and not getting bogged down in experimental detail.

For example: Analysis of many different kinases revealed that only FAKE1 and FAKE2 were able to interact with BRAC1.

5. How does this relate to the original problem? What are the implications of this result?

For example: This suggests that BRAC1 has only limited involvement in the Ras signaling pathway in the cell and is, therefore, unrelated to colon cancer.

ASSIGNMENT

You must now begin to think to yourself what else would have to be done to get the stated result. For example: How was the protein purified? How did they visualize

cytological changes? What dye did they use? What kind of animal did they use? Why? Was it recombinant? If so, how did they make it? What was the phenotype/genotype of the animal? How was it determined? What controls did they use/need? Answers to these types of questions will be the majority of your write-up. You must describe all experiments that led to the result(s) of the abstract. I do not expect you to describe insignificant details such as your buffer concentration, but I do expect a level of detail from which one could actually design a preliminary set of experiments. For example, if you feel you should maintain physiological pH throughout your experiments, state that and explain why.

WRITTEN SUBMISSION

1. Avoid stylistic writing that expresses thoughts and feelings. Unfortunately, as scientists, we are encouraged to be stoic and not to express our opinions unless in reference to future directions of experimental work.
2. Do not use “I” or “we”. Although pronouns are beginning to resurface as an acceptable form of scientific communication, they encourage the inclusion of feelings or thoughts which are not appropriate to describe solid experiments.
3. Your experimental design write-up should consist of 2 pages (double spaced). You can include diagrams, but it is not a requirement and they should be included in addition to your page requirement.
4. Your written submission must include references. You did not invent the techniques you are describing yourself! You must reference a paper in which the technique is used similarly or at least a textbook chapter describing it. You may use any acceptable scientific format that includes article titles, author names, journal title, volume, year, and page numbers.

As always, you should feel free to contact me with any question or concerns you may have.