Tips on Writing and Presentation

Huan-Xiang Zhou June 2013 Writing papers (and getting them published) and presentation are the two most important means of communicating your research to others. No efforts should be spared in making them effective.

Each Paper Should Present One Message

This message should be repeated multiple times throughout the paper:

- Title
- Abstract
- Introduction: last sentence of first paragraph; last paragraph
- Results and Discussion
- Conclusion

Title - Rapid search for specific sites on DNA through conformational switch of nonspecifically bound proteins

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We develop a theory for the rapid search of specific sites on DNA, via a mechanism in which a nonspecifically-bound protein can switch between two conformations. In the "inactive" conformation, the bound protein has favorable, nonspecific interactions with the DNA, but cannot be recognized by the target site. In the "active" conformation, the protein is recognized by the target site but has a very rugged energy surface elsewhere on the DNA. The rate constant for protein binding to the specific site is calculated by an approach in which the protein, after reaching the DNA surface via 3D diffusion, searches for the target site via 1D diffusion while being allowed to escape to the bulk solution. Mindful of the pitfalls of many previous approximate treatments, we validate our approach against a rigorous solution of the problem when the protein has a fixed conformation. In the 1D diffusion toward the specific site, a conformationally switchable protein predominantly adopts the inactive conformation due to the favorable nonspecific interactions with the DNA, thus maximizing the 1D diffusion constant and minimizing the chance of escape to the bulk solution. Once at the target site, a transition to the active conformation allows the protein to be captured. This induced-switch mechanism provides robust speedup of protein-DNA binding rates, and appears to be adopted by many transcription factors and DNA-modifying enzymes.

Ever since the first demonstration that proteins can bind to specific DNA sequences (1, 2), numerous studies have been carried out to address the question of how a protein can readily find a short specific site on a long DNA (3–20). It is widely ac-

Introduction-1st par.

Abstract-

has been questioned (15). Here we present an approach for calculating the protein-DNA binding rate constant k_a that allows for proper coupling between 3D and 1D diffusion. We use this approach to treat the conformational switch of a nonspecifically bound protein, and demonstrate that it provides a robust mechanism for speeding up the search of specific sites.

two-state model, but with an unjustified specification of \bar{n} . Using our approach based on the position-dependent capture probability, we show that a DNA-binding protein can stay mostly in a fast diffusing "inactive" conformation until it encounters the specific site, whereupon interactions with the specific site induce it to quickly switch to the active conformation for recognition. This induced-switch mechanism appears to be adopted by many transcription factors and DNA-modifying enzymes.

 Introduction last par.

Results and Discussion

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the accuracy of the $k_{\rm a}$ calculation. We finally use this approach to treat the conformational switch of a nonspecifically-bound protein, and find that adopting the fast diffusing inactive conformation during the approach to the specific site and then quickly switching to the active conformation via interactions with the specific site allow the protein to achieve significant speedup in $k_{\rm a}$. Our results suggest that this "induced-switch" mechanism is adopted by many transcription factors and DNA-modifying enzymes.

Opening paragraph

A Paper Should Answer

- WHAT is that you studied?
- WHY did want to do it? <
- HOW did you do it?
- WHAT is that you found?
- WHY is the finding important?

Five-sentence summary:

This paper is a study of <u>aaa</u>. We did the study because <u>bbb</u>. The study was done by <u>ccc</u>. We found <u>ddd</u>. This finding is important as it <u>eee</u>.



Introduction Section

- In many ways the most important section
- State
 - the subject of your study ("study of <u>aaa</u>")
 - the motivation ("did the study because <u>bbb</u>")
- Highlight the most important finding and explain why the importance
- Summarize prior studies to provide the background for evaluating your study/finding: gap in knowledge; conflicting theories; experimental observations waiting for explanations

Discussion Section

- Explain how the finding of your study has changed/advanced the field
- Note caveats and alternative interpretations of results
- How your study will impact future studies
 - With the structure modeled or mechanism developed here, we can now design drugs

Paragraphs

- Each paragraph talks about one point; the same point is covered in the same paragraph
- Each paragraph can be condensed into a single sentence
- In writing a section
 - first <u>list</u> the points to be covered
 - then <u>order</u> the points logically
 - finally <u>expand</u> each point into a paragraph
 - pay attention to <u>transition</u> between paragraphs; logical ordering helps

Sentences and Phrases

- Make sure that subject and verb agree
- "Evidence" is not countable and should be treated as singular
 - The evidence presented shows xxx; three lines of evidence suggest yyy
- When in doubt, use Google!
 - "to a lesser extent" 147 million hits vs. "to a less extent" 5.6 million hits

Words

- Strive to use precise words
 - **Initial:** "... the flexibility allows the protein to wrap around protrusions and indents of the target, giving rise to an intricate interaction surface ..."
 - Final: the bound state, flexibility allows the protein to wrap around protrusions and indents of the target, which gives rise to a <u>convoluted</u> interaction surface and high
- Words having several meanings can result in misinterpretation
- Use spellchecker!

Presentation

- Purpose is to make your audience understand, not to impress the audience with your study
- Know your audience and present appropriate introductory materials to prepare your audience
- Simplify the presentation of your study so the audience has a chance to get it; leave out the gory details that you think may wow your audience
- Do not introduce a topic unless you're going to fully explain it; don't leave your audience wondering why that was brought up