The Writing Process

- Work on global (big picture) issues first
  - conceptual or developmental level
  - content, organization
  - structure, logic
  - assumptions, evidence, arguments, relationships

- Work on local issues second
  - paragraph, sentence, word level
  - reconsider style, terminology
  - pay attention to mechanics: grammar, spelling

Observations (methods)

- Describe fully the parameters of the observations, simulations, or codes
  - Why did you choose the setup or sample?
  - Details matter here (seeing, calibrations, accuracy)
  - How were data reduced? Sky subtraction, nods, etc.
- Usually past tense
  - other parts of the paper usually present tense
- Be sure to provide appropriate citations and credit
  - Download data? Who took it? Has it been previously published?
  - Survey data? Describe the survey!
  - 2MASS, WISE, Gaia: all have citations!
  - Codes were written by someone
  - Instruments were built by some group of people
- Use subsections to split different data types
- **Enough detail for paper to be repeatable**

Results

- Function: objectively present key results in an orderly and logical sequence
  - Data-driven: usually without interpretation
  - Logic often organized around Tables and Figures
    - Make Tables and Figures first, build around them
- Style: concise and objective
  - Interpretation left for “analysis” section
- Usually few citations
- What are the key results? Highlight those
  - Be sure to describe negative results and assumptions

Results

- Key results: put up front
- Subsections: different results
  - Each subsection should focus on one topic
  - Roughly 3-6 paragraphs/subsection
- Be quantitative
  - “Galaxy A is more massive than Galaxy B” is not very informative
    - Galaxy A and Galaxy B have different masses is worse
  - General rule, but especially applicable for results
- Text describes figures and tables
  - Leave details of Figures (the red line shows…) for caption; scientific description for text
  - Remember that for key results, if they are controversial, then people will only believe them if they can see the results for themselves
    - People will believe boring results that conform to expectations
- Sometimes Results split into multiple sections

Analysis

- Results: data-heavy
- Discussion: broad interpretation and importance
- Analysis: connects results and discussion

- Broaden out from results
  - Physical interpretations?
  - Equations for interpretation?
  - Modeling observations (or observational predictions from models)

- Logical flow to arguments (as everywhere):
  - Conclusions at front
  - Each subsequent paragraph develops and demonstrates those conclusions

- Sections/subsection titles can tell a story

Discussion

- Place your results in context of other work
  - Do your findings agree with what others have shown?
  - If not, do they suggest an alternative explanation or perhaps a unforeseen design flaw in your experiment (or theirs?)

- Do your results provide answers to your testable hypotheses?
  - If so, how do you interpret your findings?

- Given your results+analysis, what is our new understanding of the problem you investigated and outlined in the Introduction?
  - If warranted, what would be the next step in your study, e.g., what experiments would you do next?
  - Connect back to Introduction (perhaps including rewrite of intro)
  - Why is this important?

- Some speculation is ok (sensationalism is not ok)
  - Always identify “speculation” as such: preferred interpretations that are consistent with data
  - Always identify assumptions and caveats clearly

Conclusions

- Summarize main points
  - Include most important caveats
  - Never add new results or ideas
- Some reminder of comparisons to previous works
- Some readers will skip to the conclusions, so make sure that:
  - detailed enough to communicate information (more than abstract)
  - Interesting enough to draw the reader to important points
  - Highlight new ideas in paper and anything controversial
  - Ensures that the most important caveats also described

Appendix: for random topics that would otherwise break your focus

- Details of a source or a code
- Investigations that are tangential to main results
- Extras
  - Data
  - Plots
  - Tables
  - Formula and derivations

Section titles and sub-titles

- “Results”, “Analysis”, “Discussion”
  - no information
- Descriptive title sections
  - Invites readers in
  - Tells readers where information is located
  - Provides readers an obvious outline
- Parallel titles when possible

Document Design

- The layout of words and graphics determines the look of a document.
  - grid pattern, white space, etc.
  - margins, justification, indentation, spacing, font
  - headings, paragraph length, bullets, etc.

- Goal is to invite a diversity of readers in, guide them through the material, and help them understand and later remember the information.