

# How to Read a Research Article

## Introduction:

- Based on the central theme or main message, research papers can be categorized into 4 major groups. They are,
  - 1) A novel invention or discovery (e.g; Discovery of protein X involved in T cell signaling)
  - 2) Study of an existing knowledge in different system and its relevance/application in that system. (e.g; protein X involved in T cell signaling also inhibits actin remodeling in CHO cells)
  - 3) Discovery of a novel method (e.g; use of GFP fusion proteins as tracer molecules in cells)
  - 4) Application/modification of an existing method/information for a different use/purpose (e.g; modification of GFP and development of pH sensitive & redox sensitive GFP molecules).
- Again, based on the type of research, the research paper can be broadly categorized into 2;
  - 1) **Basic research papers** (discoveries/inventions and extensions of such known discoveries) &
  - 2) **Application oriented papers** (development of novel or economic methods/systems/tools)

**Remember:** Most papers are BORING SCIENTIFIC LITERATURE, WORST WRITTEN WITH GREAT COMPLEXITY AND CONFUSING WORD CONSTRUCTION. So, it's a challenge to read them and understand them in complete. **So, before reading paper, find peace and avoid all possible distractions.** In the beginning, it would be tough to read paper while eating or watching TV.

## Reading a research article:

**Order of reading a paper:** According to many experts in the field, the best and fastest way to read and understand the contents in a paper is by reading them in the following order.

**Title → Abstract → Introduction → Discussion → Results → Figures → Materials and methods**

This is not a general rule, but it's an observed fact that people **grasp more in less time** when they read in the above mentioned order. Reading results immediately followed by its corresponding figure is also advised. Initially, there will be difficulties to understand them in first reading (especially when you are new to the specified topic), however stick to this order. This will improve your efficiency in understanding contents.

## How do I read a paper?

- Focus is the key; **avoid distractions.**
- Read the paper in one shot; **never break and read.** Don't lose the flow of reading.
- Be relaxed and read the paper from beginning to end, like **how you read a newspaper.** By doing so, at the end of your first reading you will learn only 50% or 30% or sometimes even 10% of the entire content. Never mind!...
- Many things will be very obscure and unfamiliar in first reading, but **never stop at each and every point and try to clarify it** before going ahead. **This will kill your time;** so try to complete the paper in one sitting itself.

- **Mark the words/techniques unfamiliar to you** in pencil in the first reading itself, which you would need to refer later.
- After first reading, **try to get a brief idea of story** from whatever you understood. What is the message? Categorize the paper in the above listed types.
- Now **refer in detail every marked field** and try to understand the concept. Spend enough time on this. Google is the best. Also look the required references mentioned in paper (in brief only) for details, if needed. While referring for something unknown, do not get deviated unnecessarily by something else 'less' related to it. Do references, until you get an **almost precise answer** for your doubts and go to next one.
- The main idea of this first reading is to pick down unknown stuff and to have a vague idea of the story. Once you have referred and understood the marked fields, **read the paper again** completely, but this time **with good concentration**. **The second reading is very critical** and you will grasp much more details in this <sup>2nd</sup> reading. Again mark unfamiliar ones and refer later.
- **Read 3 or 4 times** if you don't understand some points which are still unclear, but this time read only those parts which are unfamiliar to you.
- Finally, **summarize the paper in your own words**: What is the main message? What were their aims? How did they approach it? What are the experiments they did? What was their conclusion? What is the future scope they mentioned?
- **Find the key points of the study (+ points)**, which made the study unique (new discovery or finding/ techniques used/ approach/ methodology/ model system used/ modifications from previous studies etc) and highlight it in last slide of your presentation, after summary.
- **Try to be critical**: Not all papers are perfect and face some kind of critics. Try to see the quality of data. How many times did they do the exp (n value)? Did they use all the necessary controls? What was the statistics used? Are the error bars significant? Did they do *invitro* or *invivo* experiments? Did they use the right model system to study the effects? What data is lacking? How relevant/ useful is their study? What did they comment on future perspectives of study? Is the paper well written? Also remember, **don't be over critical...**

### **I don't understand the paper at all; most of it is new to me:**

This is a common problem when you are beginner or new to the field. In such case, you would have to identify yourself why you don't understand it; often, this is because you are very unfamiliar with the stuff presented in paper. The only solution is to spend more time on referring and understanding the unknown marked fields after first reading.

### **Do I need to know everything about the paper?:**

The answer is, **NO**. It's not your paper; you don't have to know all about it. Get the main message, approach, significance of study and future aspects. You can skip many minor details. Never try to break your head for something which no one understands completely, often some statistics used are very complex and have tough formulas, in such cases you don't have to dig into details. Also, no need to go in details of materials & methodology unless important and has to be mentioned in talk.