How to read a scientific paper

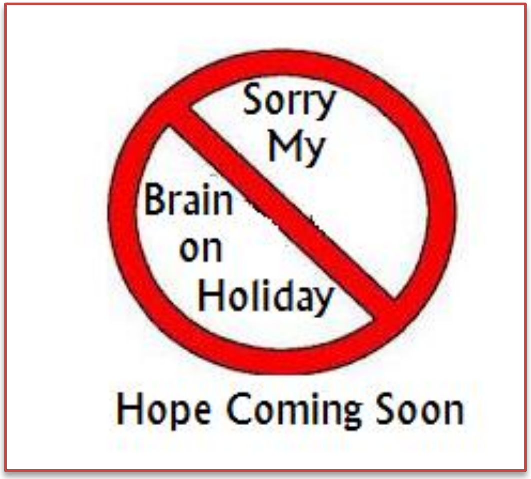
Sooad K. Al-Daihan

Biochemistry Department

- Scientific papers are the heart of the science community.

- It is essential to learn how to read a paper quickly but insightfully.

…… otherwise



Two Types of Scientific Papers Containing Two Types of Information

There are two types of scientific papers:

- ✓ Review articles: give an overview of the scientific field or topic by summarizing the data and conclusions from many studies.

- ✓ Primary research articles: contain the original data and conclusions of the researchers who were involved in the experiments and how the experiments were done.

few easy ways to distinguish between Review & Primary research

i. Many reviews will be labeled as "review“ on the first page of the article.

ii. Reviews don't have a "methods" section.

iii. In a review article, graphs, tables, or figures containing actual data will contain citations in the figure legend to the primary research papers that originally reported the findings.

It is also wise to read several reviews by different authors

Why bother ourselves?

- ✓ Journal papers are current
  - Textbooks are often years out of date.
- ✓ Journals are generally the most accessible means of obtaining the information that you need.
- ✓ You can get a good explanation for your data and enough details to replicate what you read about.
- ✓ To find out exactly what the latest developments are in a field.
- ✓ To find out how a certain piece of research was done.
- ✓ Because one day soon you could be writing papers too!

Why?

- Learn to do research.
- Learn to think critically about quality of research papers.
  - In any discipline, there are fads and there are lasting ideas… learn to tell the difference!
- Gain perspective.

The typical anatomy of a paper

- In most scientific journals, scientific papers follow a standard format.
- Most journals use a conventional IMRD structure.

A general rule of thumb, regarding what goes where, when both reading and writing a scientific article is

Title:
Short, succinct, eye-catching

Abstract:
Why & Why

Introduction:
When, Whom, Why, What & Why

How & Where

Results:
What

Discussion:
Why & How

Note: Some journals will allow the Results and Discussion sections to be combined. In this case, the **What** and the **why** are presented together.

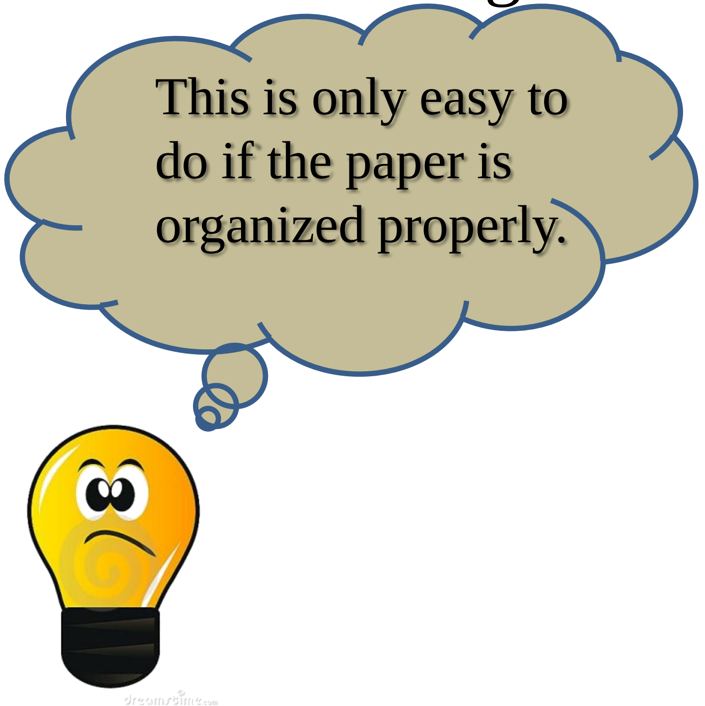
Generally…

you first read the Abstract in order to understand the major points of the work.

- It clarifies whether you in fact know enough background to appreciate the paper.
- It refreshes your memory about the topic.
- It helps you as the reader integrate the new information into your previous knowledge about the topic.

Continue...

- Introduction can be skimmed.
- The logical flow of papers goes straight from the Introduction to Results.
- Then to Discussion for interpretation of the findings.



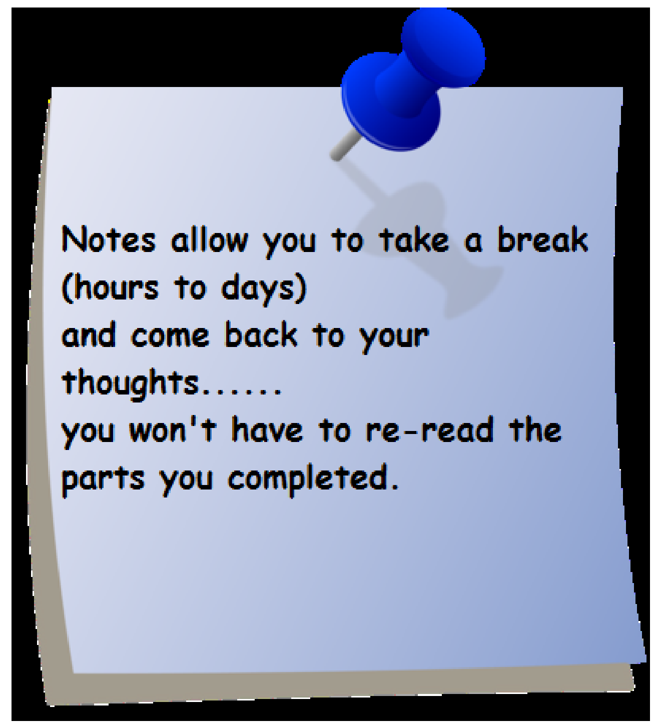
How to approach the introduction…

- ✓ Grab a blank piece of paper:
  - Take notes.
  - Draw figures.
  - Define vocabulary.

- ✓ Answer these questions:
  - What is the hypothesis being tested?
  - What are the basic conclusions?

How to read the results...

- ✓ Examine the figure.
- ✓ take notes.
- ✓ with each experiment/ figure you should be able to explain:
  - The basic procedure.
  - the question it sought to answer.
  - The results.
  - the conclusion.
  - Criticism.



How to read a discussion

Take notes and answer these questions:

✓ What conclusions do the authors draw?

Opinion/ interpretation?

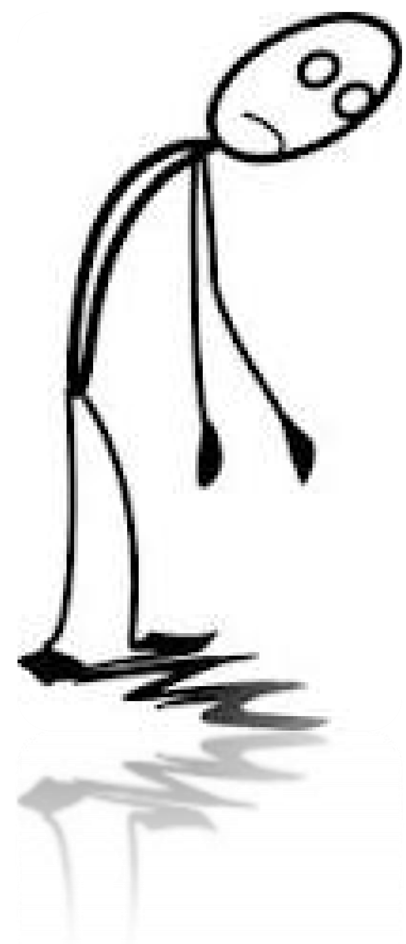
✓ Describe for yourself why these data significant.

Does it contribute to knowledge or correct errors?

- ✓ By now, you may be tired of this paper…

  But don't relax yet…

- ✓ save energy for the overall reflection and criticism.



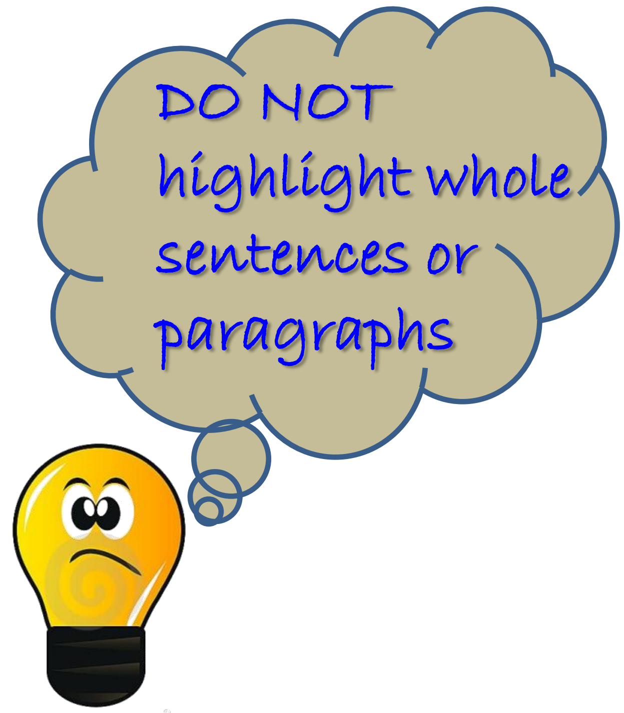
Reflection and Criticism

- ✓ Do you agree with the authors' rationale for setting up the experiments as they did?
- ✓ Did they perform the experiments appropriately?
- ✓ Were there enough experiments to support the major finding?
- ✓ Do you see trends/patterns in their data?
- ✓ Do you agree with the author's conclusions?
- ✓ What further questions do you have?
- ✓ What might you suggest they do next?

Reading a scientific paper

✓ **Struggle with the paper**

- Active not passive reading.
- Use highlighter, underline text, scribble comments or questions on it, make notes.
- If at first you don't understand, read and re-read, spiraling in on central points.



Continue…

✓Get into question-asking mode

- get used to doing peer review
- just because it's published, doesn't mean it's right
- nit-pick

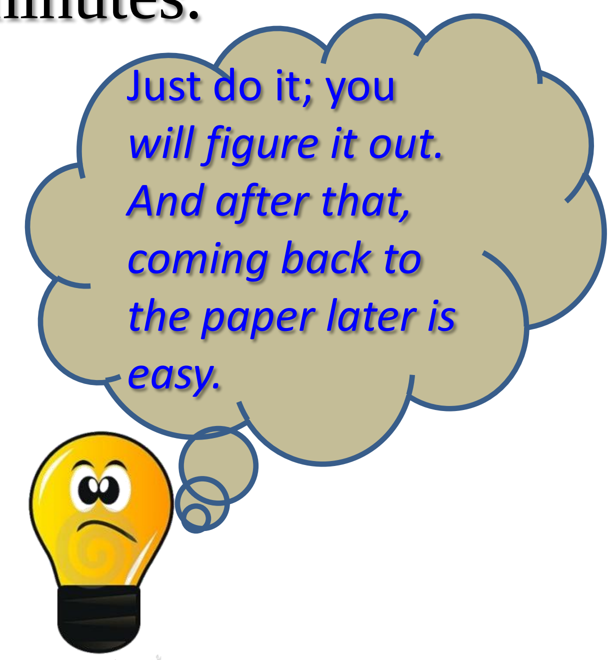
Continue…

- ✓ Move beyond the text of the paper
  - talk to other people about it.
  - read commentaries.
  - consult, dictionaries, textbooks, online links to references, figure legends to clarify things you don’t understand.

Continue…

✓ Don't give yourself very much time.

- This may seem counter-intuitive, but one of the best ways to break down barriers to reading a heavy paper is to sit down twenty minutes before some other appointment absolutely determined to "figure out what this paper's about" within the twenty minutes.



Ground Rules

- ✓ Try to understand.
- ✓ Don’t be afraid to ask.
- ✓ Be constructive.
- ✓ Be polite.
- ✓ Don’t be afraid to criticize (constructively!)

Template for Taking Notes on Research Articles:

Easy access for later use

Complete citation. Author(s), Year, Title , Journal, Volume #, Issue #, pages:

If web access: url; date accessed

Key Words:

General subject:

Specific subject:

Hypothesis:

Methodology:

Result(s):

Summary of key points:

Significance (to the field; in relation to your own work):

Important Figures and/or Tables (brief description; page number):

Other Comments:

Exercise

Open Access Journal of Clinical Trials

Open Access Full Text Article

ORIGINAL RESEARCH

Activities of key glycolytic enzymes in the plasma of Saudi autistic patients

A El-Ansary[1]
S Al-Daihan[1]
A Al-Dabas[1]
L Al-Ayadhi[2]

[1]Biochemistry Department, Science College, [2]Autism Research and Treatment Unit, Department of Physiology, Faculty of Medicine, King Saud University, Riyadh, Saudi Arabia

Objective: Measurement of plasma levels of lactate, lactate oxidase (LOX), pyruvate kinase (PK), and hexokinase (HK) as possible glycolytic parameters to assess brain damage in autistic patients.

Design and methods: Plasmatic levels of lactate, LOX, PK, and HK were determined in 20 autistic children aged 3-15 years and 20 age-matching healthy control subjects.

Results: Plasmatic levels of lactate and LOX were significantly higher in autistic patients compared to healthy subjects and that of PK and HK were significantly lower in these patients as compared to controls. This could reflect the impaired metabolism of astrocytes, the brain cells responsible for the production and provision of lactate, as the primary metabolic fuel for neurons.

Conclusion: Remarkably different levels of plasma glycolytic parameters were recorded in Saudi autistic patients. This could be correlated to the impairment of energy metabolism, glutathione depletion, and lead intoxication previously detected in the same investigated samples. The identification of biochemical markers related to autism would be advantageous for earlier clinical diagnosis and intervention.

Keywords: autism, glycolysis, lactate, lactate oxidase, pyruvate kinase, hexokinase

Introduction

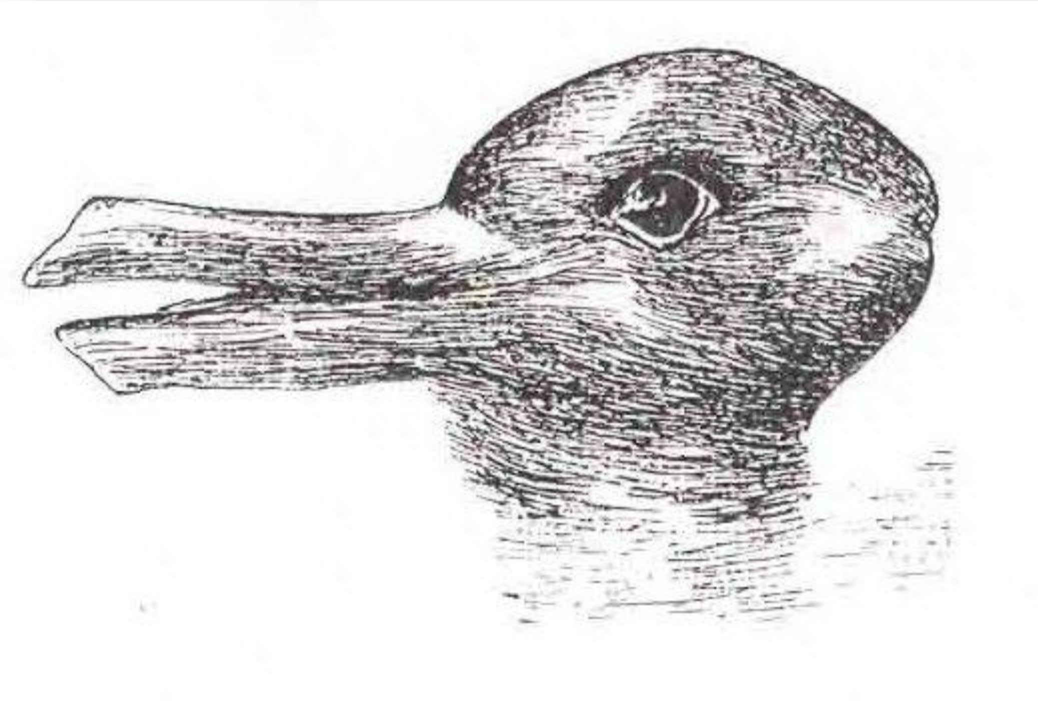
Autism is a disorder of reciprocal social interaction, behavioral repertoire, and language and communication disabilities.[1] Because the phenotype ranges from manifest disability to specific performance elevation, the term autistic spectrum disorder (ASD) is now commonly used to denote the Diagnostic and Statistical Manual of Mental Disorder,

4th Edition (DSM-IV)-defined group of pervasive neurodevelopmental disorders encompassing autistic disorder including Asperger's disorder, Rett's disorder, and pervasive developmental disorder not otherwise specified (PDDNOS).[1,2] A fraction of cases have a defined genetic cause, but the apparent increase in prevalence of ASD as reviewed is suggestive of an environmental contribution.[3,4] Changes in awareness and diagnostic criteria may explain some of the rise but a true increase in prevalence has not been excluded.[6,7] Elevated ASD rates in urban versus rural areas are consistent with an environmental contribution.[8,9] Recently, Weissman and colleagues pointed to several underlying pathophysiological mechanisms in autism, including altered neurite morphology, synaptogenesis and cell migration due to abnormalities in distinct ensembles of proteins and pathways. In a cohort analysis, they reported that defective mitochondrial oxidative phosphorylation is an additional pathogenetic basis for a subset of individuals with autism.[10] Impairment of energy metabolism due to mitochondrial

Correspondence: Afaf El-Ansary
Biochemistry Department, Science College, King Saud University, P.O. Box 22452, Riyadh, 11495, Saudi Arabia
Tel +9614682184
Fax +9614769137
Email afafelansary@yahoo.com; elansary@ksu.edu.sa

The famous duck-rabbit ambiguous image.

- When one looks at the duck-rabbit and sees a rabbit, one is not interpreting the picture as a rabbit, but rather reporting what one sees.



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Thank you!