Course materials for Module 6

[Note: Here are some key points extracted from Module 6. The best way to experience the self-studying skills is to go through the examples, videos and self-tests on-line.]

6a. Information search skills for life science students

Google Scholar

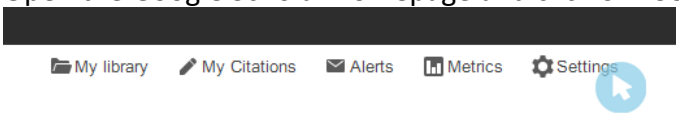
Google Scholar indexes academic papers from sources over the Internet, so it is very useful especially when you are familiar with common search operators like these:

" ... "	**Quotation marks**: Used to search for an exact word or phrase. Example: "3t3 l1"
*	**Asterisk**: A placeholder for one or more than one word. Used with quotation marks to search for a phrase part of which you are not sure of. Note: An asterisk not surrounded by spaces will be ignored. Example: "g protein * receptor"
OR	**Capitalized OR**: Used between words to search for pages containing one of the words or both. Without the OR, only pages that contain both words will be shown. Example: swiss albino 3t3 OR 3t6
-	**Dash**: Used immediately before a word to exclude results that contain that word. Useful for refining a broad topic. Example: yeast -saccharomyces -baker

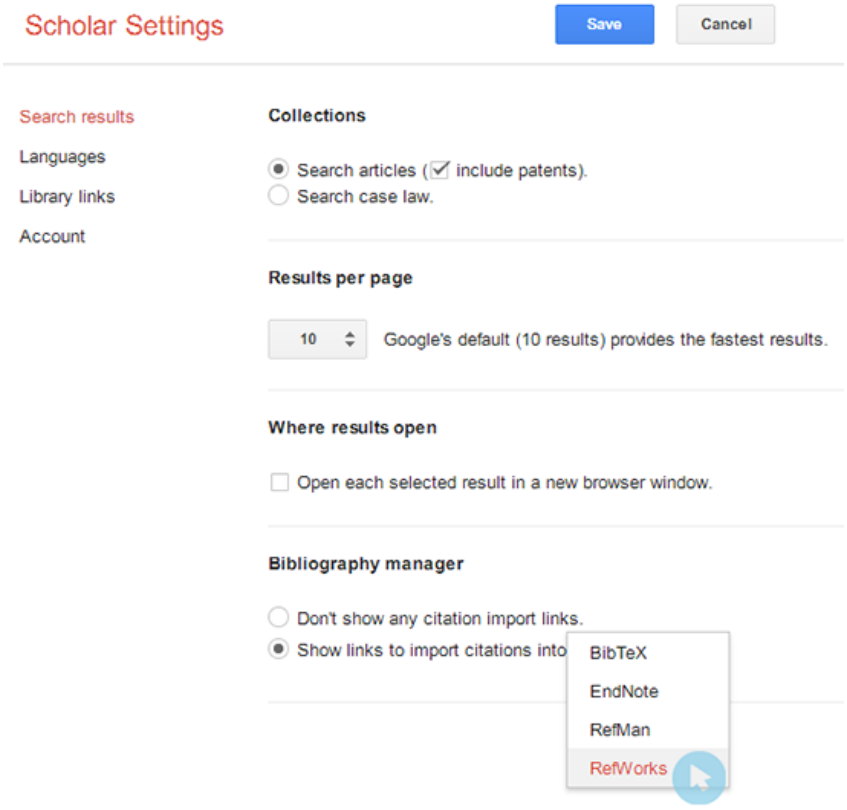
You can search Google Scholar by simply typing your keywords into the search box, or click on the downward arrow to specify your search further.

6a.1.1 Setting up preferences on Google Scholar

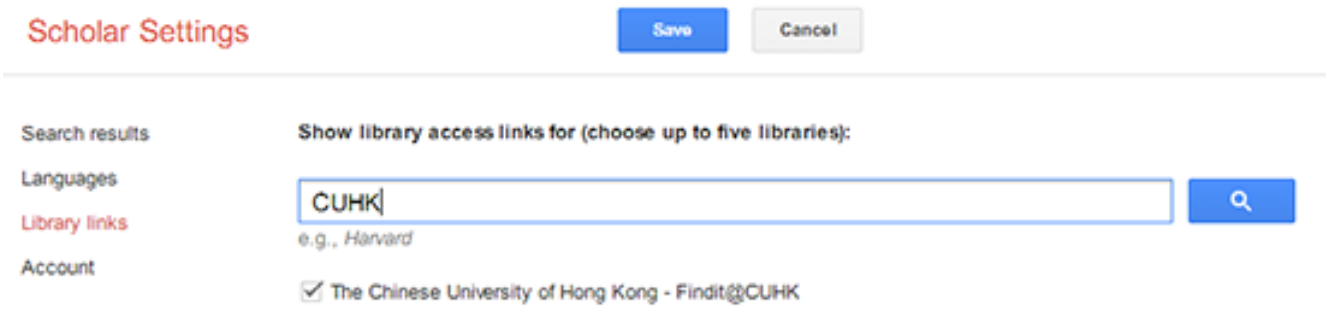
Open the Google Scholar homepage and click on “Settings”.



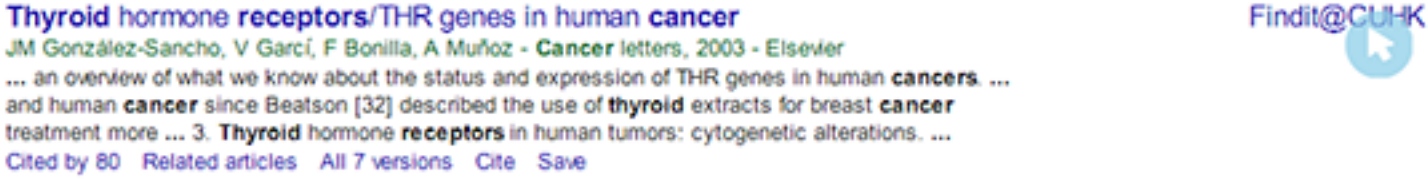
In the "Search results" tab, choose RefWorks as your bibliography manager. The University Library has subscribed to RefWorks so you can use it to organize your references later on. Learn how to sign up for a RefWorks account here.



In the "Library links" tab, type "CUHK" into the search box and hit the search icon. With "The Chinese University of Hong Kong - Findit@CUHK" checked, click on “Save”.

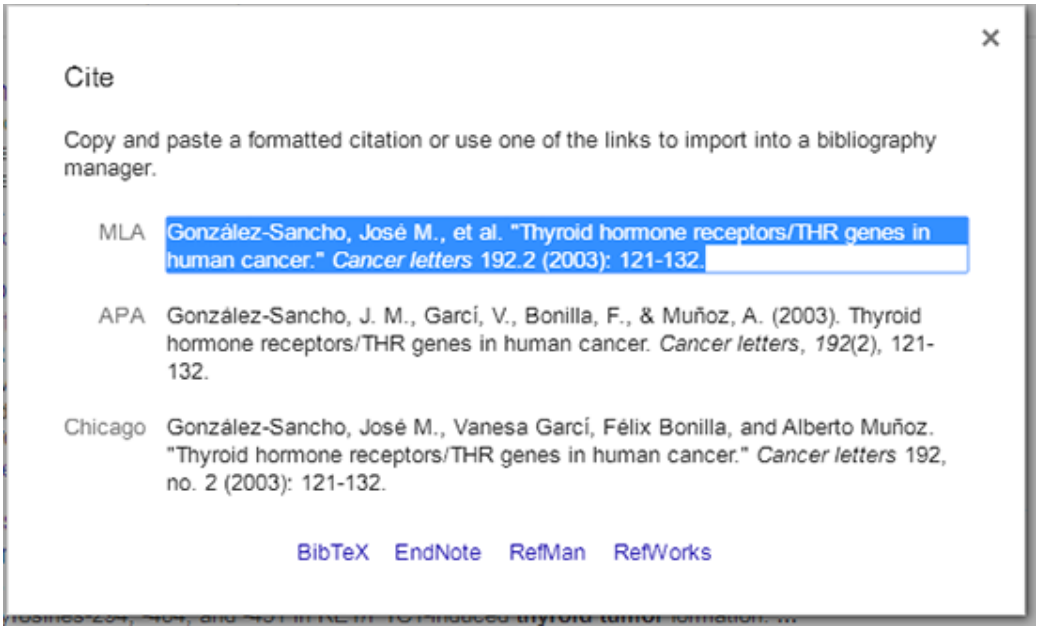


Now as you search Google Scholar for articles, a "Findit@CUHK" link will appear if an article is part of the University Library's subscribed content. You can click on the link to access the full text.



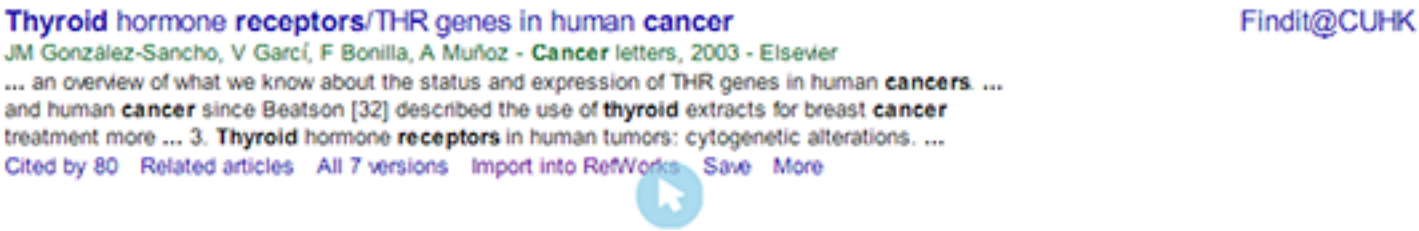
6a.1.2 Saving references from Google Scholar to RefWorks

Note that the "Cite" link below a search result provides citations formatted in the MLA, APA and Chicago styles. If any of the styles is acceptable for your course assignment, you can copy and paste the citation into a Word file.



[Note: More about citation styles in Section 6a.3.]

If you have chosen RefWorks as your bibliography manager in “Settings” > “Search Results”, an "Import into RefWorks" link will appear below each search result in place of "Cite".



The link will take you to your RefWorks account and you will find the reference in the “Last Imported” folder. If you are not logged in, the link will take you to the log in page. Log in and click on the import link in Google Scholar again to copy the reference to RefWorks.

PubMed

PubMed by National Center for Biotechnology Information (NCBI), the US National Library of Medicine (NLM) is a free-to-use database of citations and abstracts in biomedical fields. PubMed covers 5,600+ journals from NLM's MEDLINE database, plus in-process and ahead-of-print citations, etc.
To search PubMed, simply enter your keywords in the search box or use the Advanced feature to specify the fields to search (e.g. Author, Journal and Title) and add AND/OR/NOT operators.

6a.1.3 Using MeSH to create a targeted PubMed search

MeSH (Medical Subject Headings) is a collection of tags for indexing journal articles on PubMed. Searching with MeSH terms gives more relevant results.

Watch this video by NCBI to learn how to find out and use the MeSH terms for your topic of interest.

6a.1.4 Saving references from PubMed to RefWorks

Perform a search and check the result(s) that you want to save. (1) Click on "Send To" at the top of the results list, (2) choose "Citation manager" and then (3) click on "Create File". Save the .nbib file onto your computer.

In your RefWorks account, mouse over "References" in the toolbar and click on "Import". Set "NLM PubMed" as "Import Filter/Data Source", and "PubMed" as "Database". Upload the .nbib file you have just saved and click on "Import". The imported reference(s) should appear in the "Last Imported" folder.

6a.2 Life sciences databases & resources

In addition to PubMed and Google Scholar, there is also a long list of subscription-based databases and resources available through the University Library.

BIOSIS Citation Index 1926 – present Tutorial	Combines the BIOSIS database content with the citation indexing of the Web of Knowledge platform. Sources from 5,000+ journals and covers various areas in the life sciences e.g. molecular and cell biology, pharmacology, endocrinology, genetics, neurosciences and infectious diseases. Supports export to RefWorks.
ProQuest Science Journals 1986 – present Tutorial	Covers 1,200+ journal titles in applied science and technology subjects. Supports export to RefWorks.
Scopus 1823 – present Tutorial	Includes the abstracts and references of 10,000+ peer-reviewed journals in the life and health sciences. Includes all titles covered in MEDLINE. Supports export to RefWorks.

NCBI databases and resources

The NCBI has on top of PubMed a wide range of free resources for students and researchers. You may find these resources useful as you study for your courses or try your hand at a research project.

6a.4 Reference management with RefWorks

RefWorks is web-based, meaning you can access your account from anywhere you can access a web browser. This ProQuest tool for citation management enables you to:

- Save your search results from Google Scholar (Section 6a.1.2), PubMed (Section 6a.1.4), and many other bibliographic databases.
- Build and organize your references.
- Create reference lists of desired styles (e.g. CSE and Vancouver) and file types (.doc, .htm , .odt, and .rtf).
- Insert in-text citations, footnotes, and reference lists into Word files.
- Customise a citation style – for advanced users.

Before you can try out the above features you have to sign up for an individual account through the University Library's webpage.

This section intends to give you a quick guide to using RefWorks for the above purposes. To learn what more you can do with RefWorks, you are encouraged to check out the useful and comprehensive videos ProQuest has on YouTube.

6b. Elements of a scientific paper

6b.1 Why do we read scientific papers?

Reading scientific papers in addition to your textbooks enables you to:
- keep up to date with developments in particular areas of science, and
- learn more about research conventions in the science discipline.

For research students, good papers (especially research articles) provide essential information about:
- experiments or procedures that they may want to carry out in their own lab,
- the current findings available for discussion and verification, and
- the types of data to expect for certain experimental conditions.

A paper also contains the researchers' explanation and conclusion of their study, which could be some food for thought for a critical reader.

6b.2 Types of scientific papers

Broadly speaking there are three categories of scientific papers of various lengths and formats and serving different purposes.
- Reviews / Perspectives
    - Usually invited by the journal editor, based on a predefined topic
    - Peer-reviewed and edited
- Letters / Short communications
    - Short reports of original research with significant contribution to the field
    - Peer-reviewed and edited
    - Published more rapidly than original research articles
- Articles / Original articles / Research articles
    - Relatively complete, comprehensive reports of original research that give advanced understanding of an important problem and have immediate implications
    - Presenting an extensive study and showing the raw experimental data
    - Peer-reviewed and edited

6b.3 Organization of a scientific paper

Despite their varieties described in the previous section, scientific papers in general do have a unique structure that sets them apart from other types of publications. The picture below shows what the first page of a paper typically looks like. Some of the elements will be described in this section, along with the major features of a scientific paper.

Title of article

- give readers an instant idea what the paper is about.
- The title of a review often takes the form of a noun phrase, to indicate the topic being discussed. On the other hand, the title of a research article is often a complete sentence (without the full stop) that proclaims the most important finding of the study.
- Compare "Barriers to the free diffusion of proteins and lipids in the plasma membrane" [J Cell Biol (2015) 208:259-271] as the title of a review and "Protein kinase Gin4 negatively regulates flippase function and controls plasma membrane asymmetry" [J Cell Biol (2015) 208:299-311] as the title of a research article.

Author(s) and affiliation(s)

- The person(s) who performed the study, and the institute(s) at which the work was carried out.
- Multiple authors: The first author was usually the main participant in the study, and the last is usually the one that led the project.

Abstract/Summary

- It gives a brief background of the study and describes concisely the major findings of the paper.
- It is an opportunity for you as a student to review what you know about the topic.

Introduction

- The background knowledge necessary for you to understand why the findings presented in the paper are an advance in knowledge in the field.
- You can skip this part in your first reading if you are very familiar with the topic.

Materials and Methods

- Information about the materials used in the experiments and the procedures under which the experiments were carried out. A detailed description enables other researchers to replicate the work in their own lab.
- You can skip this part in your first reading and refer back when clarification is needed.

Results

- The reasons why the experiments were done and the experimental results.

Discussion

- Interpretation of the data presented in the Results section. As you read this part, check for analysis of results with controls taken into consideration. Note how you may interpret the results differently from the way the author(s) do. Be aware of overstated importance of the findings.

Acknowledgments

- An expression of gratitude for the contribution to or support for the study, e.g. financial support from a research grants provider, collaborative efforts from other research teams and sources of technical support.

• References

- Bibliographic information about the previous studies cited in the text of the paper.
  [Note that quoting without referencing can constitute plagiarism]

6c. Reading and understanding a scientific paper

6c.1 How to read and understand a scientific paper fast and effectively

There are actually ways for you to read fast while understanding the key contents.
Take a read of the sequence and try it out next time when you have an article to read. You will develop your own style as you have more experience reading articles.

1. The main result in a general context
2. Interpretation of specific results and the reasoning leading to conclusions
3. Background, motivation and importance of the study
4. Experimental data presented in figures and tables
5. Technical procedures of the study

6c.2 How to read a scientific paper critically

When reading a paper you find useful, always try to identify the strong points and where possible, the confusing aspects of the study as well.

Here are a few questions to ask yourself as you read different parts of the paper.

Abstract	Can you understand quickly the objectives of the study, the major findings and the conclusion made before reading the full paper? Having finished reading the paper, does the abstract give a true reflection of the findings and conclusions? Are they relevant?
Introduction	Did the authors • include clear background information and valid reasons for performing the study? Was the study done to extend or challenge current knowledge, or to start a new knowledge area? *(You could mark the relevant references for later readings, to understand the background in greater detail)* • state their hypothesis clearly? How was the hypothesis based on current knowledge and posed to find out new information? *(Novelty is key in original research)* • mention their investigation strategy? *(Sometimes the strategy is described elsewhere in the paper, e.g. in the Results section)* • cite and explain the representative works from researchers in the field holding opposite views?
Materials & Methods	• Are the methods appropriate to address the questions in the study, or to achieve the aims of the study? • Are the methods clearly described in such a way that allows other researchers to replicate the experiments?
Results	Think about the coherence between description and data, the reliability and validity of the data, and the approach used for the study by asking: • Have the authors included sufficient data to support their ideas and conclusions? • Did the authors interpret the results correctly? Are the results convincing? • What is the sample size? What is the number of observations for each variable? Any control experiments done? • Any statistical tests to analyze the data? • Did the authors recognize the limitations of their methodology?
Discussion	• What were the significant points of the findings? • Did the authors make the right conclusions based on their interpretation of their data? Do you agree? • Did the data answer the questions/hypothesis raised by the authors? • How do their findings help to expand the existing knowledge? • Lastly, distinguish between conclusions proven by experimental data and speculations.
References	• Does the article include adequately relevant references to the study? Are those sources reliable and accurate? • Are the references up-to-date?

6d. Elements of scientific writing

6d.1 Sections of a scientific paper

Building up your language skills through reading well written papers helps you write your own papers in the future. This section aims to help you recognize good practices in research writing.

Preparation
• Get clear idea of the research question: Review articles in the topic area to get an overview of the field Read widely and critically • Keep record of all the articles reviewed, with bibliographical data for citing at a later stage. • Keep data safe and organized from the start of the study. • Be focus driven, not data driven. Make a clear plan on how to use the data collected.
Writing the paper
Introduction
What to include in a good introduction: • Relevant background information • Key terms definition if necessary • Identification of contentious issue(s) or problem(s) to be discussed • Overall purpose of the study • Clear and specific statement of hypothesis • Rationale of the way the research question was studied and answered
Methodology
• Describe each step clearly and comprehensively. • Ensure that the methodology is valid.
Result
• Point out the major findings. • Place graphical or tabular data in an appropriate place in the text and clearly to convey the results. • Present sufficient data for the reader to judge how the experiment turned out. • Emphasize the patterns or trends in the data. • Point out the significance of the results.
Discussion
• Draw convincing conclusions from the data. • Mention factors that could have influenced or accounted for the results. • Describe further planning or experiments to continue the research. • State your contribution to the field. • Relate your research to potential applications.

6d.2 Language skills

We will look at how the authors structure a paragraph to develop an argument and how they highlight their key findings while addressing the limitations of their study.
For a comprehensive textbook on paper writing skills, you are encouraged to check out Wallwork's (2011) English for writing research papers through this link.

Developing arguments in a logical sequence

- A sentence typically contains one specific idea. It is sometimes headed by a **transition word** that relates the idea to the previous sentence, e.g. "however" in Excerpt 1a. A sentence can also be headed by an adverb that alerts the reader to what lies ahead, e.g. "specifically" and "notably" in Excerpt B.
- A sentence with more than one idea is often longer (more than 30 words) so not always desirable. However, when you have to put two ideas in one sentence, you can use a **linking word**, e.g. "yet" and "which" in S2 and S6, respectively, in Excerpt A.

Using the right tone: Highlighting and hedging

Rather than simply presenting facts in plain language, authors of scientific papers often feel the need to make an emphasis at some point and to tone down a message at another.
Key findings may be worth **highlighting** by means of language, paragraphing or if the journal permits, subheadings, bullet points, etc.
Hedging, or the use of soft language, is often necessary when making a big statement about one's own findings and critiquing the work of others. Hedges make the author seem more humble.

Excerpt A (Chen et al., 2012)

Traditional drug discovery programs have been focused on the identification of direct, high affinity PPARγ agonists. However,	**S1**: 16 words **S2**: 35 words
of the two approved TZDs, pioglitazone is 10-fold less potent at activating PPARγ yet has equivalent or even superior therapeutic effects on hepatic steatosis, circulating lipid profile, and glycemia with fewer reported side effects (18, 36, 37). Mechanistic	**S3**: 19 words
studies have demonstrated that many of the side effects of TZDs are mediated through ectopic activation of PPARγ. For	**S4**: 25 words
example, mice lacking PPARγ in the collecting ducts of the kidney are protected from the plasma volume expansion and weight gain caused by rosiglitazone (11, 12). Activation of	**S5**: 13 words
PPARγ is also the molecular trigger driving white adipose tissue expansion (9, 10). Finally, administration of high doses of	**S6**: 31 words
rosiglitazone to obese mice is associated with an activation of PPARγ target gene expression profile in hepatocytes, which is abrogated by liver-specific deletion of PPARγ (this study and Refs. 13 and 14).	

The first two sentences raise the issue of focusing on PPARϒ for therapeutic effects.
The rest of the paragraph elaborates on the problems with PPARϒ activation. **Evidence from different perspectives** is cited.
Note that **repetition of the keywords** "activating PPARϒ / activation of PPARϒ" keeps the issue into focus throughout the paragraph.

Excerpt B (Prasad et al., 2014)

The approach outlined here allows the identification of host pathways boosting infection with viral vectors in any cell type of interest. Specifically, the cell impedance measurements can score cytopathic effects of virus infections in real time and a label-free manner and can identify both infection-enhancing and infection-inhibiting compounds in a semi-high-throughput format without the need to construct specific reporter viruses. Boosters of viral infection are needed to enhance and tune the efficacy of oncolytic virotherapies. Potential signaling branches downstream of the IRE-1 UPR node triggered by the small chemical GCA to enhance cancer cell killing are discussed in Fig. 8. Oncolytic therapies kill cancer cells, lead to inflammation, and, ideally, present tumor-associated antigens to immune cells to mount immune responses against tumors (27, 66). Viral oncolysis also crucially depends on efficient intratumoral transmission of the oncolytic agents and the ability of the virus to overcome innate immunity (67). Notably, the spreading of HAdV-C occurs by cell-free viruses after lysis of infected cells, yet spreading and oncolysis are limited both in cell cultures and in organisms (29, 68). Our data raise the possibility that viral oncolysis can be chemically tuned by manipulating the UPR and that this can be applied for cancer treatment.

S1: 21 words
S2: 40 words
S3: 15 words
S4: 25 words
S5: 22 words
S6: 23 words
S7: 27 words
S8: 25 words

This paragraph starts with a **topic sentence** (S1) with a **general idea** to be explained in **specific detail** later on.
The subjects of S1 to S3 are all related to experimental methodology. S3 also relates to the main topic of the paper (oncolysis, or killing of cancer cells). S4 addresses the secondary keyword in S1 ('pathways') while building on the oncolysis notion.
The rest of the paragraph expands on the use of oncolysis: its applications, requirements, and limitations. The paragraph closes with a statement about the significance of the study.
Again the **repetition of keywords** makes the paragraph more coherent and easier to follow.

Excerpt C (Tundo et al., 2013)

In this report, three major and closely correlated findings are reported, namely (i) IDE expression is stress-inducible in malignant and not-malignant cells; (ii) IDE concentration is *in vivo* markedly up-regulated in some tumors of the central nervous system; (iii) IDE down-regulation impairs SHSY5Y cell proliferation and viability, being accompanied by a decrease in the overall content of poly-ubiquitinated proteins, likely reflecting an influence of IDE on the ubiquitin-proteasome system.

69 words

The authors use a **numbering system** to highlight their key findings. Numbers are useful especially when you have to refer back to the items later on in your discussion

Sources of excerpts

Prasad, V., Suomalainen, M., Pennauer, M., Yakimovich, A., Andriasyan, V., Hemmi, S., & Greber, U. F. (2014). Journal of virology, 88, 13086-13098. http://dx.doi.org/10.1128/jvi.02156-14
Tundo, G. R., Sbardella, D., Ciaccio, C., Bianculli, A., Orlandi, A., Desimio, M. G., Arcuri, G., Coletta, M., & Marini, S. (2013). Journal of Biological Chemistry, 288, 2281-2289. http://dx.doi.org/10.1074/jbc.m112.393108
Chen, Z., Vigueira, P. A., Chambers, K. T., Hall, A. M., Mitra, M. S., Qi, N., McDonald, W. G., Colca, J. R., Kletzien, R. F., & Finck, B. N. (2012). Journal of Biological Chemistry, 287, 23537-23548. http://dx.doi.org/10.1074/jbc.m112.363960

[More examples can be found in Module 6]

6e Elements of effective presentation

6e.1 Example: The critical distinctions

This 16-minute TED talk by cancer researcher Dr. Mina Bissell shows what an effective scientific presentation can look like. In her presentation, Bissell tells a story of her decades of questioning, hypothesizing and experimentation which have culminated in her important discoveries in the role of extracellular matrix in cancer development. As you watch the presentation, notice how the speaker uses her 36 slides as cues rather than simply presents from them. Then refer to the exercises in Module 6e.

http://www.ted.com/talks/mina_bissell_experiments_that_point_to_a_new_understanding_of_cancer

6e.2 Preparing your content

This section and the next will show you some ways to prepare and deliver a scientific presentation. The suggestions may be helpful for a start; you are encouraged to adopt them with modifications to suit your presentation personality. Many of the ideas are adapted from Wallwork's (2010) *English for Presentations at International Conferences,* which you can read online in its entirety through this link.

Sections of a research study

A scientific presentation often follows the same structure as a research article, with varying degrees of adherence depending on the particular presentation situation.
So instead of showing an opening slide with the bullet points Introduction/ Methods/ Results/ Discussion/ Conclusions and reading them out loud, you could go straight to your key points to let your audience know what they can expect to hear in your talk later on.

	Content to consider including	**What to do with the content**
Introduction	• The background leading to your research question • Research gap(s) • Research objective(s) /Hypothesis(-ses)	**Get the audience interested**
Methods	• Essential details for the audience to understand what you did and your results later on. • This section should be **brief** unless your study is all about methodology or you have no major results to talk about at this stage.	**Tell a story to sound interesting (i.e. not like a lab manual)**
Results	• The experimental findings, positive and negative, presented in graphs, tables, etc. • What is expected and what is not	**Explain very clearly**
Discussion	• Meaning of your results • Limitations in the study, if any • Reasons why the study is important	**Convince the audience that your study has significance for your field**
Conclusions	• Key message(s) revisited • Future work • How the study relates to the audience	**Sound enthusiastic**
Questions & Answers	Extra slides to show details of the study and the literature that are left out in the main presentation and that you think may help you answer questions from the audience.	**Answer the audience's questions with courtesy and confidence.**

Planning from scratch

Planning from scratch helps you clear your head after all your intense efforts in the lab. Described below is a "key message" approach that starts with your central idea.

- **First, describe your study in no more than 25 words.**
- **Design a 2-minute talk.** No PPT or visual at this stage. Just think and write in English as much as you can!
- **Do the 2-minute talk and record yourself.** Listen back to your talk and think how you could do better.

Expand the two minutes. Open a new PPT file and give your presentation a meaningful title. Think of your content points as part of a story; start with one slide for each point and pull in supporting graphics e.g. data tables, graphs, and pictures. Keep to only one or two graphics per slide, if possible.

When to use a slide?

Effective presenters use slides as a tool rather than as a substitute for talking. They often hit the stage having memorized the order of their slides; they do the talking, looking at the audience all the time except the brief moments when they have to refer to their slides.

So a slide is needed only when it:

- helps you make your points more effectively,
- helps your audience visualize or remember something more easily,
- makes abstract ideas seem more concrete, or
- attracts attention or entertains the audience (while staying relevant to the topic).

6e.3 Getting ready to present

Preparing yourself

The actual presentation is a lot more than just a slide show; you will be the one in charge of making your audience follow you every second you have your slides up. Your audience will listen to you, clinging onto your narration and commentary while trying to make sense of what you are showing them on the screen. So your preparation is not complete until you have prepared yourself.

You could **make file card notes** of your content points (just key words/phrases) in the order you will bring them up in your presentation. Writing out the important parts of your talk also helps you identify the key words you may not know how to pronounce. Some language issues are discussed below.

Language issues - you can work on using language with greater effectiveness:

- **Be concise (to save time!)** A wordy and uninformative intro such as "Today I'm going to give a presentation on this study entitled…" is not going to be as captivating as a simple "Good morning. My study is about . . .".
- **Talk about what your audience may not know from reading your slide** Repeating the figure legend that the green bars correspond to the average level of metabolite A in the treatment group and the red bars in the control group is not very helpful. Rather, allow a moment's pause and comment: "The treatment raised the level of metabolite A to six times the normal level".
- **Use audience-friendly language**
  Active voice (vs. the passive)
  Personal pronouns e.g. I, we, and you
  Verbs (vs. nouns, especially long nominalizations)
  Short sentences
- Using language with greater accuracy requires more careful attention. *For a start, Adobe Reader has a "Read Out Loud" function to check the **pronunciation of unfamiliar words**.*

Time management

When you are practicing your presentation, the rule of thumb is to **aim for a duration that is slightly shorter than the limit.** For example, if you are allowed 20 minutes you may want to plan for 15 minutes, since your actual presentation (in front of a real audience) is very likely to be longer than your trials. You can also **check your presentation language for conciseness**.

Non-verbal communication

Eye contact and body language

Practicing your presentation and knowing your slides should give you the confidence to do so. For an extra boost at the start of your talk: put up your title slide, take a deep breath and scan your audience as they read the screen; when you think they are finished, smile, greet them, and begin your presentation.

Pauses

Pauses are useful for pacing a talk and catching one's breath. A pause of two seconds or so gives time for the audience to read a new slide or to think about a question you have just raised.

Teamwork

Introduction and handovers

- The first speaker should introduce the topic and the structure of presentation in terms of who is going to talk about what. This structure could be reiterated at each transition with the current speaker saying, "So we've look at . . . I'll hand over to [next speaker's name] who'll tell you . . .".

Throughout the presentation

- The team's attention to the presenting member offers support and helps the audience concentrate. The subsequent speakers can make mental notes to adjust their own part where possible and appropriate.

Question and answer session

- It should be decided in advance who is going to take which type of questions. However, when a question falls outside the categories the group coordinator will have to decide on the spot who should answer. Whenever you have answered a question, it is useful to check if the rest of the team has anything to add. Likewise, wait for your turn if your team mate is answering a question and you have something helpful to offer.

Taking questions from the audience

To get yourself some extra time to respond to a question that you know the answer to, you could check with the questioner that you have understood his/her correctly by saying, "So you're asking me if . . ." You may take this opportunity to paraphrase the question into the terminology you are more familiar with, and go on to give your answer concisely.

To respond to a question that you cannot fully answer,for example a question about some obscure aspect of the background of your study, you could:

- describe a related aspect that you are more familiar with and what has been known in the field about it,

or

- say that as far as you know, the aspect in question has not yet been fully understood.

In any case, it is best to thank the questioner for his/her question first and make it clear that you regrettably cannot give a definitive answer. Keep your response concise and polite without losing confidence. **If you are completely clueless about a question,** thank the questioner and admit to not having considered the question before. You could make a note of it in mind or on paper and get back to the questioner in the future. Just keep your response polite and brief for now, and move on to the next question.

[NOTE: Please also go to the three sample presentations from former BCHE3090 students in Module 6e4]