

# YOUR THESIS COMMITTEE

Also known as: an impossibly difficult group to get together in one room but who nevertheless hold your future in their hands depending on their ability to reach a civilized consensus.



## Your Professor

Simultaneously your biggest ally and your worst enemy. Will be the first to suggest you do more work.



## The Guru

Only here for the free cookies. Don't forget to bring cookies.



## Adversary ~~The Asshole~~

Has bitter rivalry with your Professor and will argue the exact opposite view. Work this to your advantage.



## The Strawman/woman

Nice guy.  
No opinions.



## The Assistant Professor

Still doesn't believe just a few months ago they were on the other side just like you. Pretends to be an adult.

NONE OF THEM WILL ACTUALLY READ YOUR ENTIRE THESIS.

# CAP7003E

## Doctoral Research Strategies in Engineering or *"Ensuring a successful doctorate"* (Session 2)

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WORLD-CLASS ENGINEERING

POLYTECHNIQUE  
MONTRÉAL



# Difficulties encountered or anticipated – Assignment 1

## Information gathering

- Familiarize with a new field
- Finding publications on new subject
- **Select pertinent information**

## Definition of the research project

- Understanding the scientific and technological interactions in the research projects **of the team**
- **Definition of my project**

## Self discipline

- Balance between classes and research
- **Organizational**, time management challenges
- **Lack of balance between time needed to get things done right and planning time to do things that needs to be done.**

## Personal, professional development

- Technical skills to develop
  - Programming
  - **Writing** (reporting, organizing, writing **scientific papers**)
- Motivation issues
  - **Staying motivated**
  - Truly integrating that achievement comes from a succession of small failures

## Social integration

- Language
  - Understanding, **mastering French**
  - **Improve fluency in English**
- **Motivation** issues
- Missing friends, family

# Topics you would like to be addressed in this series of workshops – Assignment 1

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About writing	<ul style="list-style-type: none"><li>• Writing techniques</li><li>• Writing a research proposal, a paper, a technical report</li><li>• Writing a thesis: paper or traditional format?</li></ul>
About originality	<ul style="list-style-type: none"><li>• What is an original contribution; find good research topic</li><li>• What is the impact of the choice of field or approach; “high risk, high impact” versus “low risk, lower impact”.</li></ul>
About building confidence	<ul style="list-style-type: none"><li>• Setting realistic, relevant, and exciting research objectives, writing a good research proposal in a new field</li><li>• Handling a lack of background in some specific areas</li></ul>
About communication	<ul style="list-style-type: none"><li>• Handling language barriers<ul style="list-style-type: none"><li>• Mastering technical English</li><li>• Integration in the French community</li></ul></li><li>• Writing skills</li><li>• Communication with my supervisor</li></ul>
About the route to a Ph.D. and beyond	<ul style="list-style-type: none"><li>• Phases of a Ph.D; planning the major milestones; typical duration</li><li>• DOs and DON'Ts; common mistakes and pitfalls</li><li>• Critical milestones: comprehensive exam<ul style="list-style-type: none"><li>• Preparation early on for the preliminary exam</li></ul></li><li>• Planning for after the Ph.D.</li></ul>

# Topics you would like to be addressed in this series of workshops – Assignment 1

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About getting a job	<ul style="list-style-type: none"><li>• What is the <b>job market for PhDs</b>?</li><li>• How to take benefit of a PhD in a resume?</li><li>• How can the problem of “Over qualification” be overcome?</li><li>• Does our future career depends on the Ph.D. field?</li></ul>
About supervision, mentoring	<ul style="list-style-type: none"><li>• How do I <b>get the attention</b> of my research advisor?</li><li>• How do I <b>get support and \$ from</b> my research advisor?</li><li>• How do I get the most from my research group?</li><li>• <b>If I couldn't achieve what my supervisor wanted!!!</b></li></ul>
About time management, motivation, and work-life balance	<ul style="list-style-type: none"><li>• <b>Dealing with dissatisfaction, lack of motivation</b></li><li>• Entertaining interest in the work, self-motivation</li><li>• <b>Managing and controlling time, being efficient</b></li><li>• Balancing activities</li><li>• <b>Manage conflict with my supervisor</b></li></ul>
About taking care of yourself	<ul style="list-style-type: none"><li>• <b>Keeping a good balance of social life</b> during the Ph.D.</li><li>• Seizing, creating, increasing socializing opportunities within the School, the University</li></ul>
About growing and maturing	<ul style="list-style-type: none"><li>• Being <b>creative</b></li><li>• <b>Avoiding procrastination</b></li><li>• Evaluating and managing risks, dealing with failure.</li></ul>



# Assignment 3 – Research proposal

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- Part I - *Writing the first version of your proposal*  
→ Due date: Thursday, **February 6<sup>th</sup>** at **12:00 (noon)**;
- Part II - *Critical analysis of 3 research proposals*  
→ Due date: Thursday, **February 13<sup>th</sup>** at **12:00 (noon)**;  
“Each student will have to evaluate the research proposals of three of your colleagues”.
- Part III - *Preparing and submitting the revised version of your proposal*  
→ Due date: **Friday, February 21<sup>st</sup>** at **12:00 (noon)**.

# End of Week 1

## Answer #3

**What do you expect from your thesis advisor?**

**What are, in your opinion, the expectations of your research advisor from yourself?**

***The quality of the interactions between the Ph.D. student and his/her advisor is one of the most important factors in ensuring a successful doctorate***



# ETH Zurich Survival guide

([http://www.aveth.ethz.ch/sg/AVETH\\_survival\\_guide\\_2012.pdf](http://www.aveth.ethz.ch/sg/AVETH_survival_guide_2012.pdf))

What does your supervisor expect from you ?	What should you expect from your supervisor ?
<ul style="list-style-type: none"><li>✓ To be <b>independent</b>.</li><li>✓ <b>To do not always ask what am I going to do next ?</b></li><li>✓ To have ideas and <b>proposals</b>.</li><li>✓ To show <b>original thought</b>.</li><li>✓ To be of scientific stringency.</li></ul>	<ul style="list-style-type: none"><li>✓ To be supervised.</li><li>✓ To be supervised regularly as opposed to whenever it is convenient for your supervisor or once you have nearly completed your dissertation.</li><li>✓ To make (written) comments not only on the details of the work but also on the overall progress of the study.</li></ul>

Jean Nicolas, adapted from ETH Survival Guide

# ETH Zurich Survival guide

([http://www.aveth.ethz.ch/sg/AVETH\\_survival\\_guide\\_2012.pdf](http://www.aveth.ethz.ch/sg/AVETH_survival_guide_2012.pdf))

What does your supervisor expect from you ?	What should you expect from your supervisor ?
<ul style="list-style-type: none"><li>✓ To produce <b>written work before meeting with him.</b></li><li>✓ <b>To have regular meeting with you</b></li><li>✓ <b>To be honest</b> when reporting on your progress</li><li>✓ <b>To follow her/his advice</b> when you ask for it.</li><li>✓ <b>To surprise her/him</b> and become an expert in your field.</li></ul>	<ul style="list-style-type: none"><li>✓ To read your work <b>in advance</b> of a meeting.</li><li>✓ <b>To be available when needed.</b></li><li>✓ <b>To be rather an advisor</b> than a judge.</li><li>✓ <b>To be constructively critical.</b></li><li>✓ <b>To have a good knowledge of the research area.</b></li></ul>

Jean Nicolas, adapted from ETH Survival Guide

# **You must develop a constructive relationship with your advisor... and the rest of the team**

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## **BE EXPLICIT!!!**

- **Agree on mutual expectations**
- **Agree on methods of interactions (meetings, writings, etc.)**
- **Express your needs**
  
- **You must be responsible and professional**
- **You are “changing” rapidly, so are your needs**
  
- **You will most likely be evolving within a team**

# Six areas a student should manage with is advisor

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**“It is recommended that the student should:**

1. Attempt at the outset to **ascertain the supervisor’s own views** of the staff-student relationship.
2. Agree with the supervisor the **routine aspects** of the relationship (and take responsibility for their implementation).
3. Produce **written lists of queries prior to** meetings with the supervisor.
4. Keep **written notes of meetings** with the supervisor and **submit copies**.
5. Agree with the supervisor on the **nature and timing of progress reports** to be submitted.
6. Agree with the supervisor on the **nature and timing of draft chapters** to be submitted.”

Excerpt from: John A. Shapr, John Peters, and Keith Howard, The management of a student research project – Third edition, Gower Publishing Company, Burlington (2002)

## Question

What are the **criteria** for a quality doctorate?

*or*

How will you know that you are **ready to defend** your thesis?

# Criteria for success

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## Advisor's criteria

- x seminars, y lectures, z articles, w patents
- Building a prototype, instrument, sensor, ...
- Creating code, developing an algorithm
- Creating a new database
- Inventing a new method

## University requirements

- 0-15 course credits
- Study plan
- Comprehensive examination
- Writing and submitting a thesis
- Defending a thesis

## Your criteria

- Completing the study program in X years
- Obtaining prizes and awards
- Balancing academic success and personal/family life
- Building a professional network
- Building a strong portfolio (scientific, professional, personal)
- Completing an internship (industry, academic laboratory)
- Developing professional skills
- Learning languages

## Universal qualities of a dissertation

# The OUTSTANDING ENGINEERING dissertation

### WRITING AND PRESENTATION

- Well written
- Clearly states the problem and why it is new and important
- Writing demonstrates clear thinking
- Sets out ideas clearly and concisely
- Presents a convincing argument
- Includes many details

### CONTENT and OUTPUT

- Is original, significant, insightful and creative – puts things together in unique ways
- Shows intellectual effort, depth, and tenacity
- Takes knowledge to a new level;
- Is based on mathematical or physical science
- Addresses a new problem, large class of problem, or a problem that has been of great interest to the field
- Is thoroughly researched
- Invents new methods or devices
- Results in an elegant solution or a general method that applies to a broad class of problems
- Obtains results that are of interest to the larger community
- Results in several publications in top-ranked journals in different areas
- Opens new areas of research

Barbara E. Lovitts, Making the implicit explicit: Creating performance expectations for the dissertation, Stylus Publishing, Sterling, Virginia, 2007.



## Universal qualities of a dissertation

# The VERY GOOD ENGINEERING dissertation

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### WRITING AND PRESENTATION

- Well written
- clear

### CONTENT and OUTPUT

- **Very solid**
- Comprehensive and coherent
- **Original** but not significant
- Lacks the sparkle of elegance
- Is lacking in one of the key components (theory, methods, data analysis)
- Problem is not broad or significant
- Has **solid theory, methods and data analysis**
- Data and **results are described in detail**
- Misses several opportunities
- Has some obvious loose ends
- Makes a modest contribution to the field

Barbara E. Lovitts, Making the implicit explicit: Creating performance expectations for the dissertation, Stylus Publishing, Sterling, Virginia, 2007.

# Universal qualities of a dissertation

## The “almost” ACCEPTABLE ENGINEERING dissertation

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### WRITING AND PRESENTATION

- Difficult to understand
- May need strong editorial work
- Introduction is sloppy
- Does not place the work in context

### CONTENT and OUTPUT

- Good work but feels incomplete
- Demonstrates the student can do research but does not demonstrate true mastery of the area
- Project is narrow in scope
- Is original but not very significant
- Does not make the case for why the research is new and important
- Is not particularly interesting or creative
- Shows lack of understanding of how referenced papers fit together
- The theory and methods are marginal
- The experiments are not exciting or do not work
- Connections are missed, not fully explored or made in a tenuous way
- Has some applications
- Is a small, weak contribution

...could often be returned with major corrections...

Barbara E. Lovitts, Making the implicit explicit: Creating performance expectations for the dissertation, Stylus Publishing, Sterling, Virginia, 2007.

# Traditional vs. manuscript-style theses

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## Traditional thesis

### Typical outline

- Introduction
- Literature review
- Methods
- Results
- General discussion
- Conclusion and recommendations

## Manuscript style thesis – Option 1

### **Articles are integrated in the body of the text**

### Typical outline

- Introduction
- Literature review
- Overall methodology showing the coherence of the articles with respect to the objectives
- Results (several articles)
- Overall discussion
- Conclusion and recommendations

## Manuscript style thesis – Option 2

### **Articles are placed in an Appendix**

### Typical outline

- Introduction
- Literature review
- A chapter providing a synthesis of the work
- Overall discussion
- Conclusion and recommendations
- Articles in Appendix

# *When to stop???*

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1. You have worked hard to define the objectives of your project, to cut it out, to set up a timetable and to follow it, to evaluate and mitigate the risks (plan B) and to manage your project and the changes: **so you have clearly and systematically defined the perimeter** of your project. **So you know when to stop!** Respect your perimeter!
2. Ask yourself: **Have I met the criteria and competencies set by the institution and the objectives of my project** to obtain a doctorate? If so, you should stop!
3. Of course, discuss all this with your research director: It is very preferable that **the decision to stop is common!**
4. This is not the time to be distracted by: "**We could write another paper before your defense?**" ... But it's still your decision to accept or refuse!

# CAP7003E – Work Plan

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## **Session 1 – A successful doctorate at Polytechnique: What are we talking about?**

*Objectives of doctoral research and of an engineering research project. General process governing a research project. Quality criteria and characteristics of doctoral research: strategies and resource mobilization. Expertise. Original and significant contributions. Collaboration and research partnership. Research results and impacts. Objectives and content of a thesis.*

## **Session 2 – Doctoral journey, milestones, and expectations**

*Transition from research topic to research project. Major steps of a research project: organization and structure of the project. Emergence of the project and publication strategy. Phase of realization. Application: development of a first version of your research proposal and methodology of implementation.*

## **Session 3 – Leading a research project**

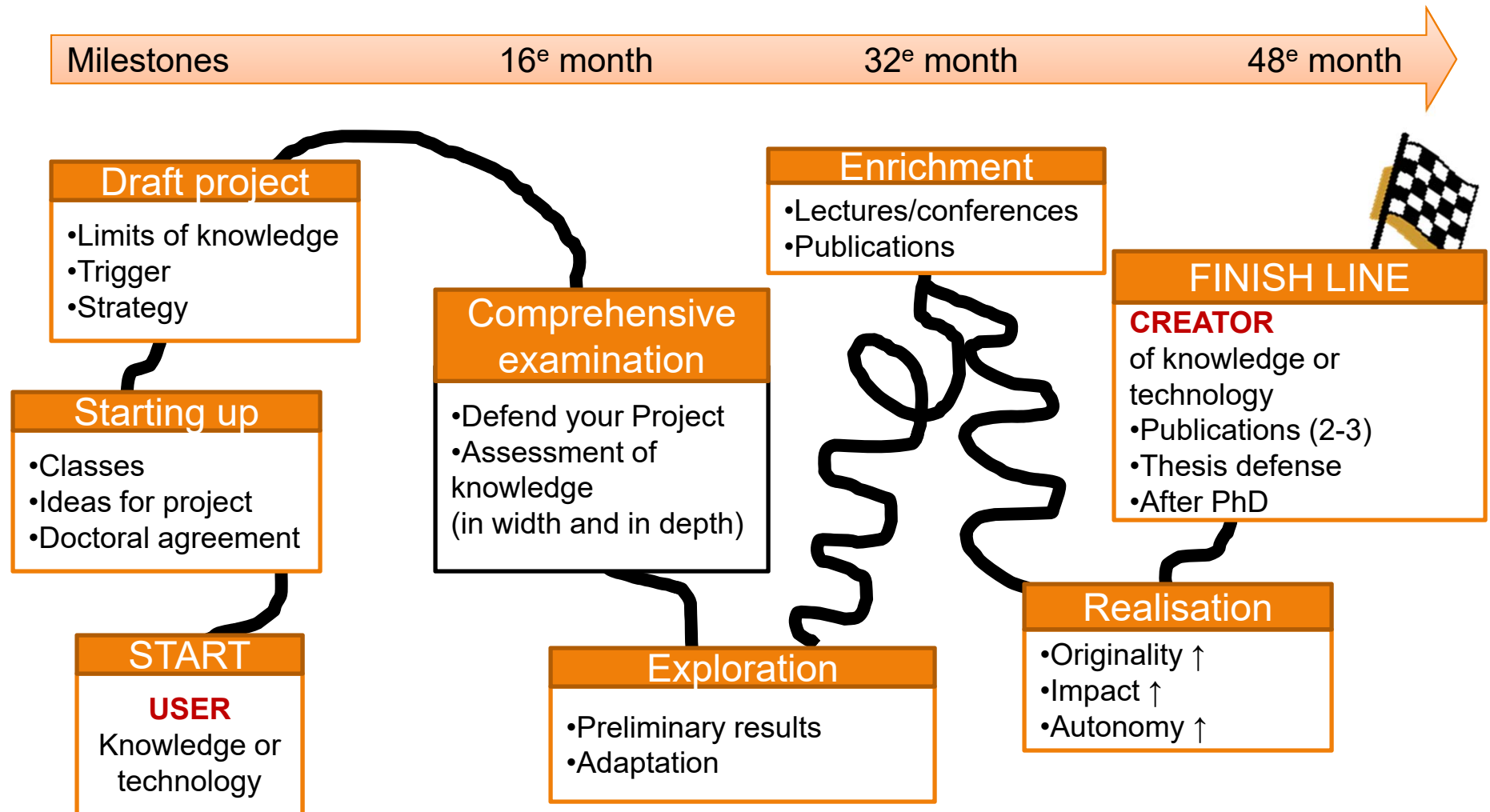
*Processes associated with basic research, applied research, technological development and innovation. Conduct and management of a research project: definition, planning, execution and completion. Work breakdown structure. Organization of time, schedule. Milestones. Deliverables. Management of risks, risk mitigation. Human Resources and Industrial Partnerships. Cost planning. Application: critical evaluations of research proposals of doctoral colleagues.*

## **Session 4 – Strategy for success during and after the doctoral program**

*Potential pitfalls related to a research project; strategies to avoid them. Management of time. Management of intellectual property. Research ethics Research ecosystem. Career management and expected skills of an engineering researcher. Application: self-assessment and review of your first version of your research proposal.*

# Typical doctoral path

...on a tentative basis



# On the importance of a quick start

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Even though a Ph.D. can take 4 or 5 years to complete, **one must start early**, with the **end** in mind.

A “long” Ph.D. can have a **negative** impact on some employers.    **← TO AVOID !!!**



## Question #1

**What are the key milestones of the Ph.D. journey?**

**Which one “stimulate” you the most and why?**

**Which one do you “fear” the most and why?**

*(Teams: **green** color)*

## **Answer #1**

**What is the milestone of the Ph.D. journey that you “fear” most and why?**

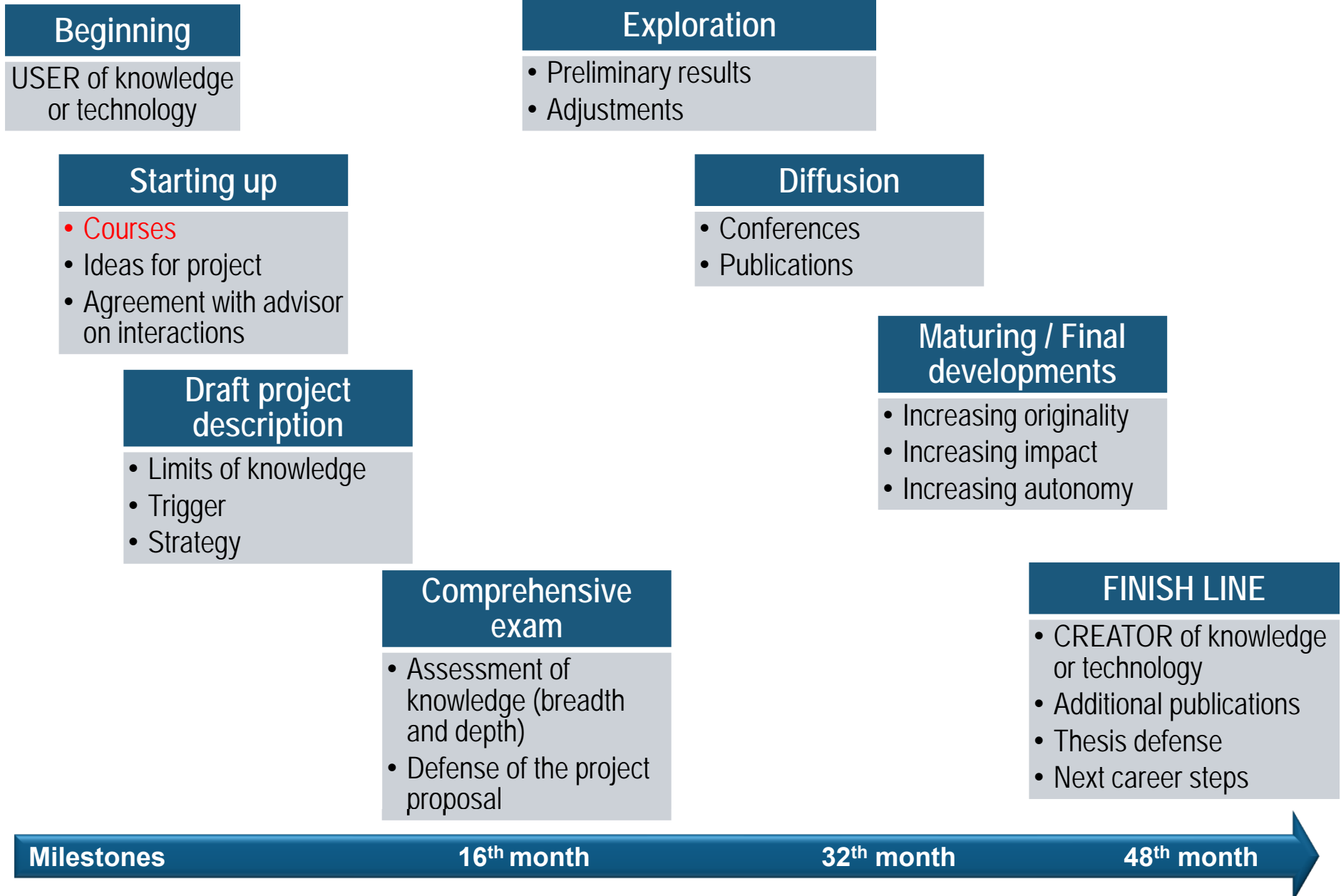
**For many people, this is the comprehensive exam**

**The intensity of your involvement in your project and the motivation in your doctoral journey...**

**...in shape of a CAMEL ?**



# Typical doctoral journey

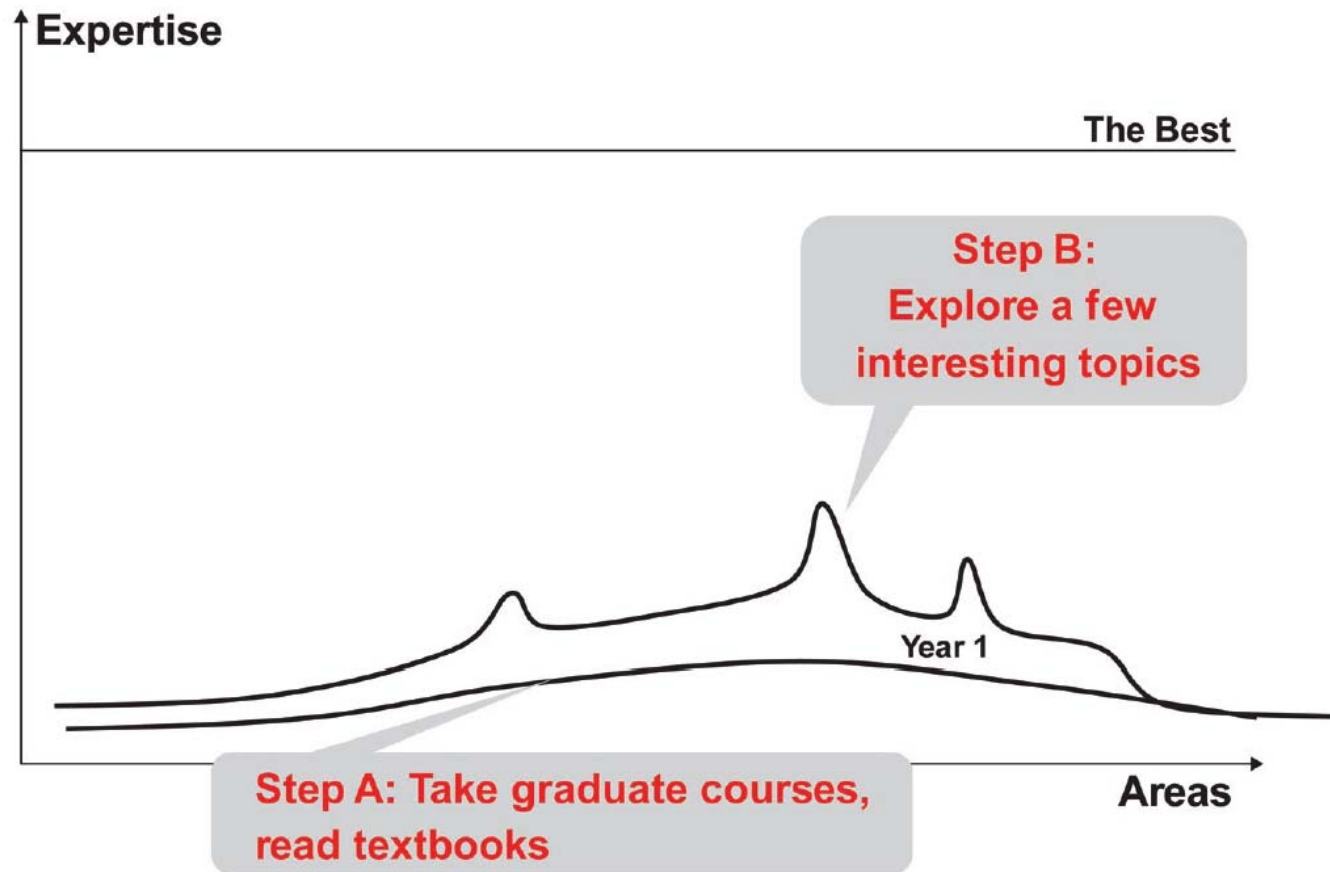


# Courses

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- **What are YOUR criteria for choosing which courses to take?**
  - Do you think your advisor will have a different point of view?
  - If so, how will you proceed to reconcile these views?
  
- **How many courses do you plan to take?**
  
- **Do you plan to take courses outside Polytechnique?**
  
- **Which workshops are you interested in?**

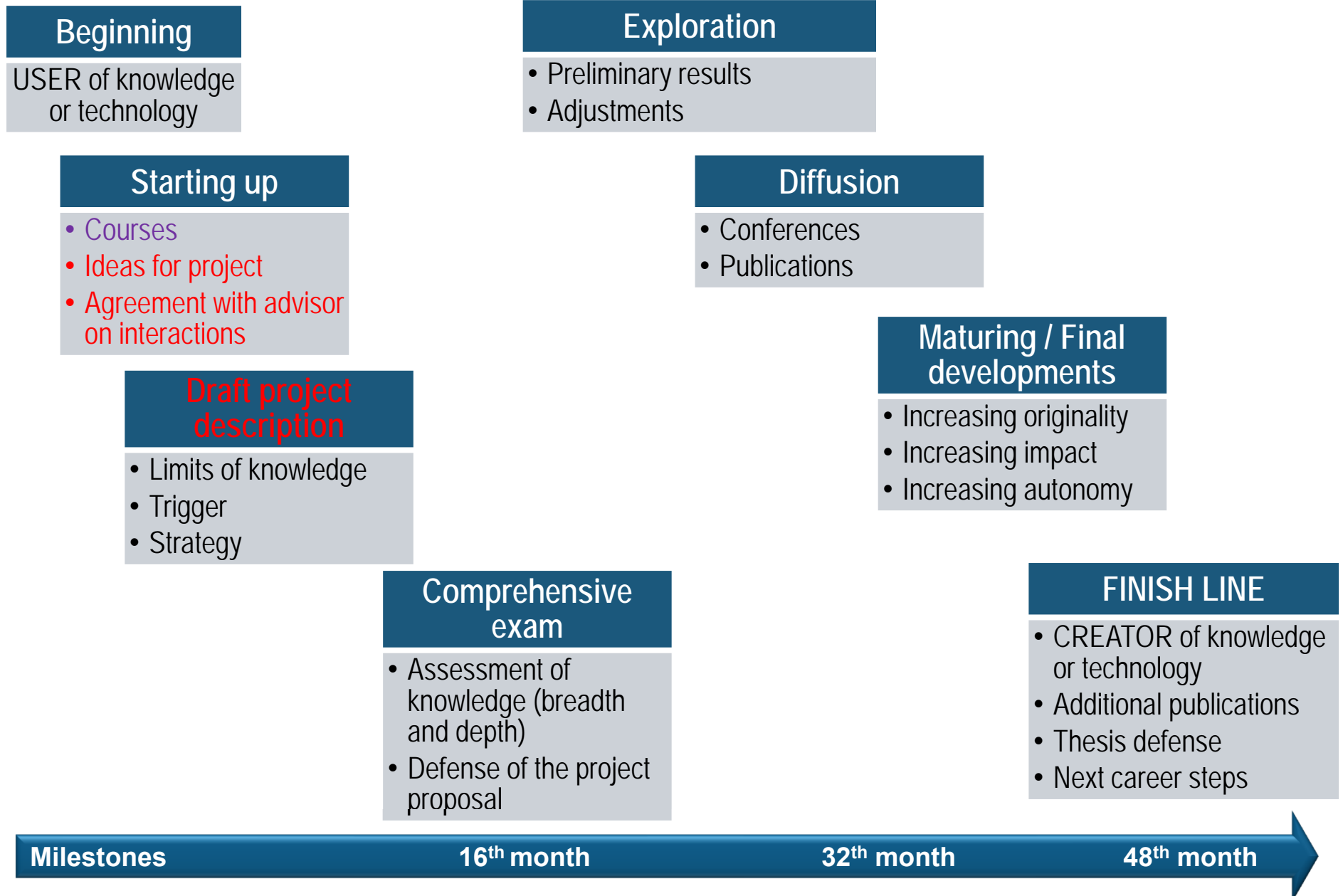
# Progress in the first year



**FIGURE 3.1:** Progress in the first year: taking courses (Step A), and then exploring a few areas (Step B).

C.X. Ling, Q. Yang, "Crafting your research future: A guide to successful master's and Ph.D. degrees in science and engineering", Morgan and Claypool Publishers (2012).

# Typical doctoral journey





# Drafting your project...

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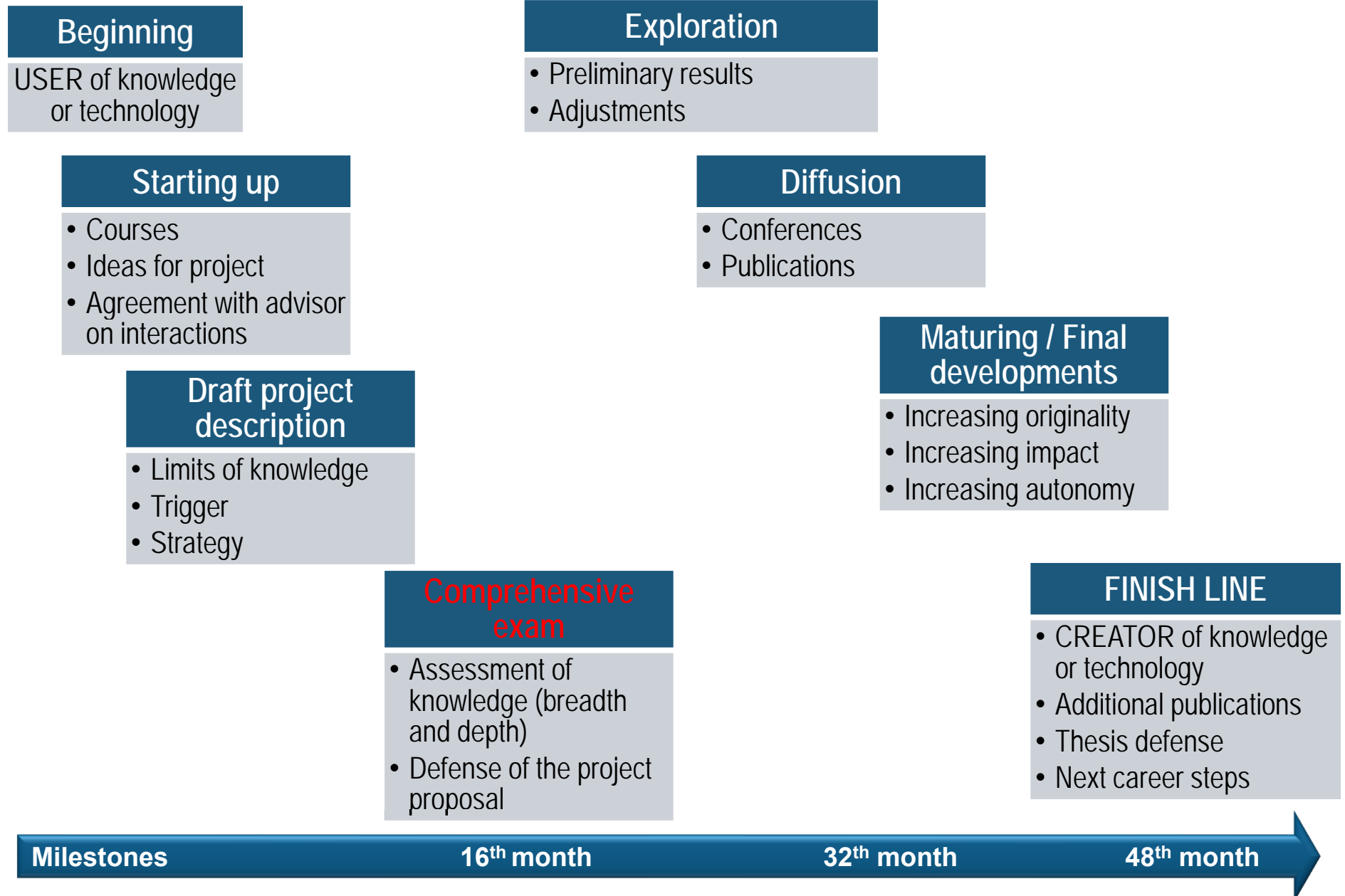
## From TOPIC to PROJECT

Writing it down forces you to :

- Formalize your thinking
- Eliminate ambiguities
- Discuss explicitly the originality and significance
- Have an overall view of the project

Writing it down can help you have fruitful interactions with your advisor

# Typical doctoral journey



## Question #2

**What are in your opinion the objectives of the comprehensive examination?**

*(Teams: **Blue** color)*

## Answer #2

**What are in your opinion the objectives of the comprehensive examination?**

**Two parts:**

- (i) Validating the understanding of the bases in the discipline**
- (ii) Evaluating if the proposed research is original, and if the candidate is capable of carrying out the proposed project**

# The comprehensive exam at Polytechnique

<http://www.polymtl.ca/registrar/en/studies/graduate-studies-1/comprehensive-exam>

## *Graduate studies – general regulations*

<http://www.polymtl.ca/registrar/en/studies/general-and-specific-regulations-graduate-studies>

## *Section 75: Comprehensive Examination*



### GENERAL COMPREHENSIVE EXAMINATIONS

Procedures for the use of graduate programs coordinators (CPES, which stands for *coordonnateurs des programmes des études supérieures*), research supervisors and doctoral candidates, as agreed upon at the March 18, 2002, meeting of the Sous-Commission des études supérieures (last update: November 2011).

These procedures are intended to be general. The goal is not to confine the various individuals involved to a rigid and restrictive process, but to define the basic parameters that are common to all. The people in charge retain the flexibility and freedom to develop and apply specific operating procedures regarding the comprehensive examination, in order to respect the needs and cultures of each department. However, the following procedures must be respected with regard to the new regulations concerning general comprehensive examinations.

- 1) Students must be informed that they must quickly—within the first two semesters—undertake the comprehensive examination procedures. By eight months after the student's first registration, the CPES will create the comprehensive examination board based on the research supervisor's suggestions. Lastly, the Registrar's Office will remind the student, within his/her second semester of study, of the importance and urgency of moving ahead with the comprehensive examination procedures.
- 2) Soon thereafter, the board chair will send the student (with copies to the research supervisor and CPES) a letter, memo or form (see the attached example) specifying the topics of study for the comprehensive examination, the required documents, the submission deadlines for these documents, and the deadlines for the written and oral examinations.
- 3) The comprehensive examinations must begin by the 14th month after the student's first registration, at the latest. The CPES must be informed of any change of examination dates.
- 4) By two weeks before the beginning of the oral examination, the candidate must submit his/her research proposal to the board members, along with a critical literature review on his/her research topic. The form and content of this document are at the department's discretion. This document is the minimum requirement within the present procedure. Depending on the specifics of the program and the board's requests, complementary documents may be required. The candidate must inform the CPES in writing when these documents have been submitted.
- 5) The written examination may take place over several days, but must be finished within two weeks at most. Access to documentation during the examination may or may not be permitted, as per the procedures established based on the board's specific requirements.
- 6) The written examination (corrected by board members or external collaborators) is given to the board. No grade is provided to the candidate, posted or made public regarding this examination. The comprehensive examination is a package (including the written and oral examinations) for which a single grade is given. As such, an interim grade may not be given, even for the written examination. The board contacts the student and informs him/her of the next steps following the comprehensive examination. The board may inform the student of the strengths and weaknesses in the written examination; it may even suggest that the student intensify his/her studies on certain points. The board may also require additional work or require that the written examination be re-taken.

# The comprehensive exam at Polytechnique

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**Departments have a lot of freedom in the format of the exam as long as the following objectives are maintained:**

Article 75.1 Structure of the comprehensive examination (simplified)

- The comprehensive examination consists of **two** distinct parts, a written and an oral test.
- The **written test** is for **judging the knowledge** and **capacity for critical analysis and synthesis** acquired by the student in the field related to their program.
- **The oral test** allows, in connection with the written test, to judge the **expertise, agility and originality** of thought of the student, and its capacity for synthesis and analysis. The oral exam covers the synthesis capabilities for the written test and **submitting a research proposal**. The presentation of the research proposal must demonstrate that the research topic of the student is **original and well defined**, that he masters the scientific **literature** relating to it, and that the **work plan** and **timeline** are realistic.

# THE COMPREHENSIVE EXAM AT POLYTECHNIQUE:

## The written test

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Format varies widely from one department to another, and even between sections in large departments

- Comprehensive, **in-class written exam** on the core topics of the **undergraduate** curriculum
- **Take-home exam** on the core topics of the undergraduate curriculum
- In-class written on **specific subfields** of the discipline
- **Essays on questions specifically chosen** as a function of your background and research topic

**Learn about the details of the exam in your program in order to maximize your chances of success**



# THE COMPREHENSIVE EXAM AT POLYTECHNIQUE: The written test

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**How will you prepare  
for this exam?**

# THE COMPREHENSIVE EXAM AT POLYTECHNIQUE:

## The written test

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How will you prepare  
for this exam?

### Some hints:

- Go to your department graduate office and ask for the specific requirements for the comprehensive exam in your department or section (in large departments).
- Ask your supervisor for a list of specific articles, papers and books (or chapters of books) that you should read or study to prepare yourself. Discuss with him the different topics or subfields on which you should concentrate your studies.
- Think larger than too specific.
- Write a summary of your overall understanding of the different topics or subfields (writing helps to better understand and to synthesize things in your mind).
- If it is an open book exam, organize all your documents to know where to find rapidly the information.

# THE COMPREHENSIVE EXAM AT POLYTECHNIQUE:

## The oral test

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### Similar in all programs

- **Presenting and defending your research proposal**
  - Written document presenting the proposal
  - Oral presentation
  - Questions on your proposal and related topics

**Ask your advisor and senior students to tell you about the expectations in your program (length and organization of the proposal, types of questions during the oral exam, etc.)**

# THE COMPREHENSIVE EXAM AT POLYTECHNIQUE:

## The oral test

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**What needs to be done in order  
to be ready for such an exam?  
(besides writing the proposal)**

# THE COMPREHENSIVE EXAM AT POLYTECHNIQUE:

## The oral test

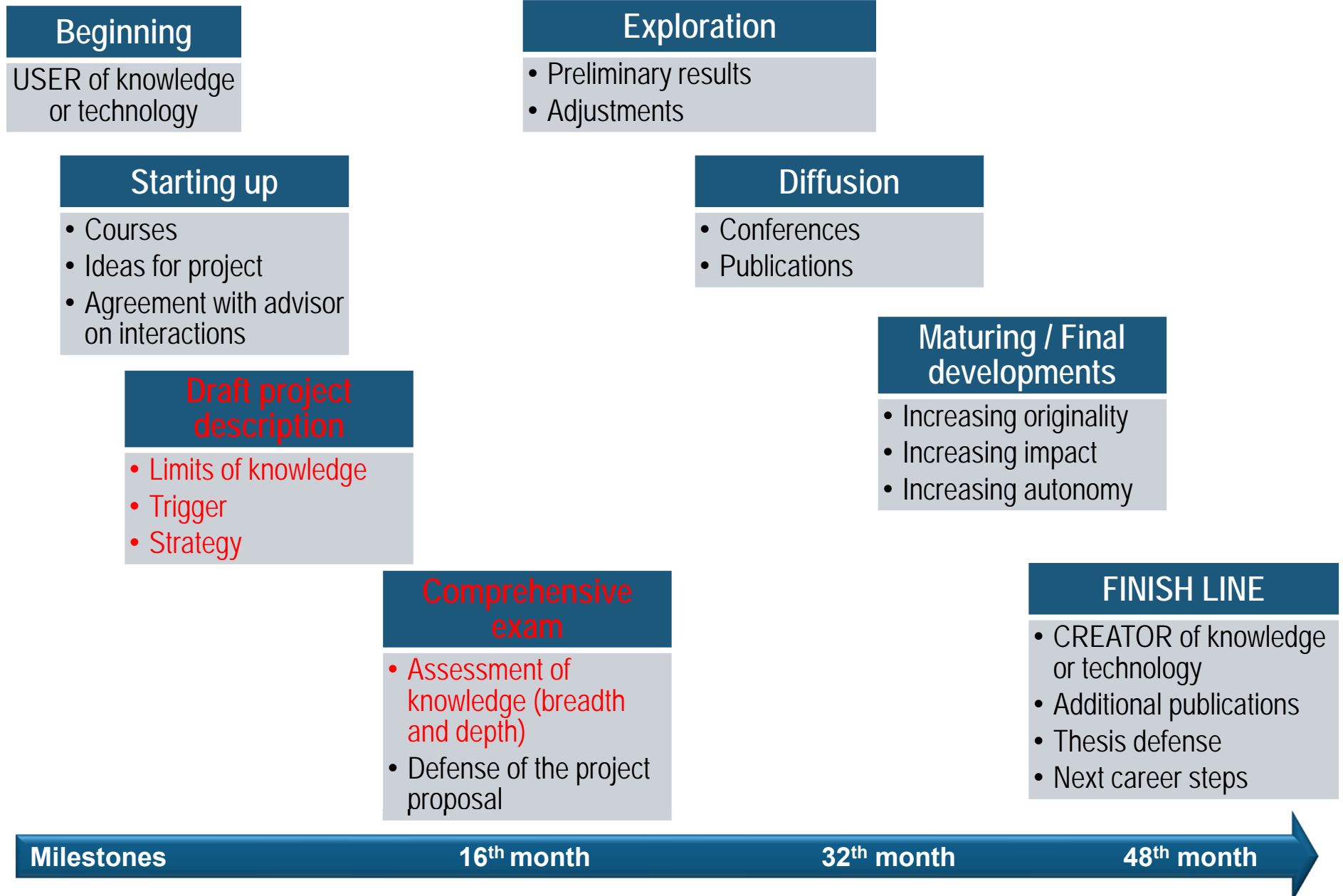
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What needs to be done in order  
to be ready for such an exam?  
(besides writing the proposal)

### Some hints:

- Prepare your oral presentation (around 40 to 45 minutes); try to put yourself looking to your presentation as you are one of the judge!!!
- Try your presentation with some colleagues on your research field and friends out of your field. Ask for their comments and check the time! Bring modifications to your presentation! Do some iterations...
- Do not put everything on your presentation; just what is needed.
- Speak slowly... and **relax!**

# Typical doctoral journey



## Question #3

**Please write down the outline of the Ph.D. proposal you plan to submit**

*We will ask you to produce:*

- a table of content of your research proposal in assignment 2...*
- a first draft of your research proposal in assignment 3 part I.*

## Answer #3

**Please write down the outline of the Ph.D. proposal you plan to submit**

***A research proposal is not a progress report, but a document for decision !***



# The research proposal: Key elements

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- The detailed structure of your proposal will strongly depend on the **culture of your field and on the specific requirements from your advisor.**
  - YOU MUST DISCUSS THIS EXPLICITLY
- Still, good proposals typically comprise:
  - A **clear, concise title** that reveals the originality of the research
  - Explanation of what **triggered** the project (context, problematic)
  - A **research question and/or an hypothesis or research objectives**
  - A statement of **originality** and significance; contributions; **impacts**
  - A **critical review** of the literature leading to the proposed project
  - Proposed methods / overall strategy (WBS)
  - **Potential risks**
  - Anticipated results (preliminary results, if available)
  - **Deliverables, publication strategy**
  - Proposed timeline / milestones (Gantt Diagram)
  - **Conclusion**
  - References

# Different fields, different cultures for framing the thesis

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Research is driven by:

An hypothesis

A question

Objectives

**The first and more important thing to do when defining your research project is to **formulate** or **write** your hypothesis, research question and general objective !**

# The Research Hypothesis

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- An anticipated answer to the question that guides the research ...
- Assumption that is made in response to the question ...
  - New theory, new applications to an existing theory,
  - Reformulation of a theory, a principle,...
  - The relationship between two or more phenomena that can be observed in reality,
  - Advanced solution track to solve a particular problem.

# One example of a research hypothesis or research question

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- **Research Hypothesis:**

- The addition of the element  $x$  in the reactor  $y$  allows to improve the  $z$  productivity by 10% while maintaining the same quality level of product  $w$ .

- **Research Question:**

- Will adding  $x$  to the reactor  $y$  will improve the  $z$  productivity by 10% while maintaining the same quality level of product  $w$  ?

# General objective and Specific objectives

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*The **general objective** concerns the **global contribution** that the researchers hope to bring through the study of a given problem.*

*→ Only 1*

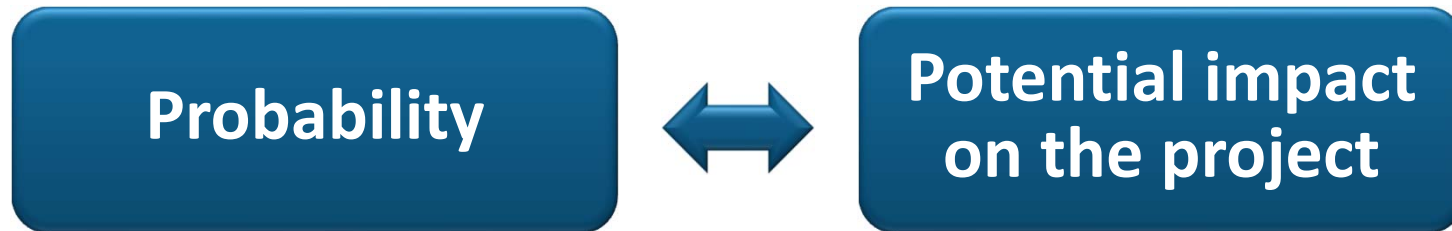
*The **specific objectives** concern the **activities** the researchers plan on undertaking with a view to achieving the general objective.*

*→ Normally between 3 to 5*

# RISKS

## Primary aspects to consider

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**Potential scientific and technological bottlenecks (intrinsic to the project)**

**Competition from other labs (depending on the field)**

**Potential human conflicts**

### Questions

How to minimize these various types of risks?

How to change “risks” into “opportunities”?

# **Publishing and disseminating your work**

# On the importance of publishing

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« The goal scientific research **is publication** ».



# On the importance of publishing

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« **The goal scientific research is publication** ».

« Scientists, starting as graduate students, are measured primarily not by their dexterity in laboratory manipulations, not by their innate knowledge of either broad or narrow scientific subjects, and certainly not by their wit or charm; **they are measured, and become known (or remain unknown) by their publications.**

**A scientific experiment, no matter how spectacular the results, is not completed until the results are published.** In fact, the cornerstone of the philosophy of science is based on the fundamental assumption that **original research must be published.**»

# Publications (journal articles, letters, patents, etc.)

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- **Goals: diffusion, influence, recognition, ...**

*“The top responsibility of a researcher is to keep the scientific community informed of their discoveries” (A. Frappier)*

*“If it’s not published, it doesn't exist”*

*“Publish or Perish” → “Publish, be cited or perish...”*

*→ “Publish in a high-impact journal or Perish”*

- **An indispensable process for the scientific process:**

*research only has value if it is evaluated and recognized by peers*

## Question #4

If you already published an article, please tell us the **main difficulties** that you encountered during the **preparation** of the manuscript.

If you have not published an article yet, please **list the difficulties that you can foresee.**

*(Teams: **Red** color)*

## **Question #4-B**

**What is your publication strategy?**

# Importance to establish early your publication and dissemination strategy

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- What do you want ?
- What does your advisor want?
  - You have to have an agreement at the beginning!

## Publication strategy:

- When to publish
- What to publish
- How to publish: criteria, authors, in which journal ?

# When/What to publish

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## Content of a paper:

### Normally:

One paper = 1 question (not 2 or 3), 1 idea, 1 concept or 1 topic  
(not 2 or 3)

One paper = 1 result or one group of results which answer 1  
question which bring to 1 conclusion...

Ask you this question:

What is this scientific contribution of this paper?

# Creating an Integrated Research and Publication Plan \*

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There is a balance to be struck between trying to produce a “dream paper,” which may never get done, and sending out a set of fragmentary observations.

**One way to find this balance is to integrate your plans for publication into your research plans.**

\* Excerpt from: Burroughs Wellcome Fund and Howard Hugues Medical Institute, Making the right moves: A practical guide to scientific management for postdocs and new faculty – 2<sup>nd</sup> edition (2006)

# Creating an Integrated Research and Publication Plan \*

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- **Think graphically;** imagine how each set of results will be displayed in a figure, graph, or table. Put your ideas in writing at the outset, sketching out the hypotheses you want to pursue, the methods you intend to use, and the results you hope to get.
- **By integrating research planning, the development of displays of your data, and interpretive writing,** you force yourself to **focus your energy** and you move your project forward **(as well as your paper!)**
- **As you write,** you will uncover gaps in information and shaky conclusions. Eventually, you should be able **to decide that you have a set of results that warrants publication.**

\* Excerpt from: Burroughs Wellcome Fund and Howard Hughes Medical Institute, Making the right moves: A practical guide to scientific management for postdocs and new faculty – 2<sup>nd</sup> edition (2006)



# Importance to establish early your publication strategy

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## Publication strategy:

- When to publish
- What to publish
- How to publish : criteria, authors, in which journal ?

# Publications (journal articles, letters, patents, etc)

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## ▪ Choice of journals

- Prestige (→ Impact factor): research a high impact factor for an excellent article, or a lower one if the article is less good or if publication is urgent
- Efficiency of diffusion
- Investment, feasibility
- Qualify the choice based on the specificities of each journal: specialized journals vs. new ideas vs. geography (USA, Europe)

## ▪ Order of authors:

1<sup>st</sup> = principal investigator / writer

2<sup>th</sup> = research director / principal researcher

3 - (n-1)<sup>th</sup> = collaborators **with scientific contributions**

n<sup>th</sup> = head of the research team (senior researcher), with a scientific contribution

- Must reflect the effort made
- Max: ~6
- Each author must understand and support the entire article
- Exclude: technicians/research assistants, observers, correctors, computer experts/statisticians (unless they have a significant contribution)

# Publication criteria

## Example: Biomacromolecules - American Chemical Society

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**Your article must meet the inclusion criteria of the journal!**

- Biomacromolecules is an interdisciplinary journal publishing original research focused on the science occurring at the interface of polymer science and the biological sciences. The emphasis will be on original and fundamental research that **integrate knowledge** in both **polymer science** and the **biological sciences**.
- Biomacromolecules will provide a home for interdisciplinary investigations exploring the interactions of macromolecules with biological systems and their environments as well as biological approaches to the design of polymeric materials.
- Applications include biomedical polymers, tissue engineering, bioresorbable polymers, coatings and adhesives, polymeric drugs, bioinspired polymers, biocompatible surfaces, multifunctional surfaces, active surfaces, and polymers for electronics, photonics, packaging and consumer products and engineering applications, e.g. in life sciences.

# Publication criteria

(detailed in CAP7005E – 4<sup>th</sup> meeting)

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**Nature** journals receive many more submissions than they can publish. Therefore, we ask peer-reviewers to keep in mind that every paper that is accepted means that another good paper must be rejected.

To be published in a Nature journal, a paper should meet four general criteria:

- Provides strong evidence for its conclusions.
- Novel.
- Of extreme importance to scientists in the specific field.
- Ideally, interesting to researchers in other related disciplines.

**In general, to be acceptable, a paper should represent an advance in understanding likely to influence thinking in the field.** There should be a discernible reason why the work deserves the visibility of publication in a Nature journal rather than the best of the specialist journals.

# Example of Impact Factor (*J Biomech*, 2008)

## Journal Impact Factor

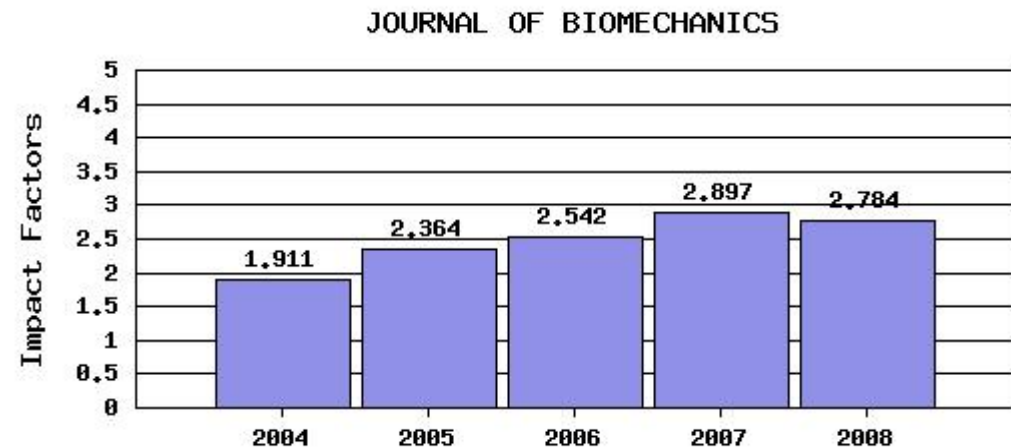
Cites in 2008 to items published in:	2007 = 1003	Number of items published in:	2007 = 473
	2006 = 1269		2006 = 343
	Sum: 2272		Sum: 816

Calculation:  $\frac{\text{Cites to recent items}}{\text{Number of recent items}} = \frac{2272}{816} = \mathbf{2.784}$

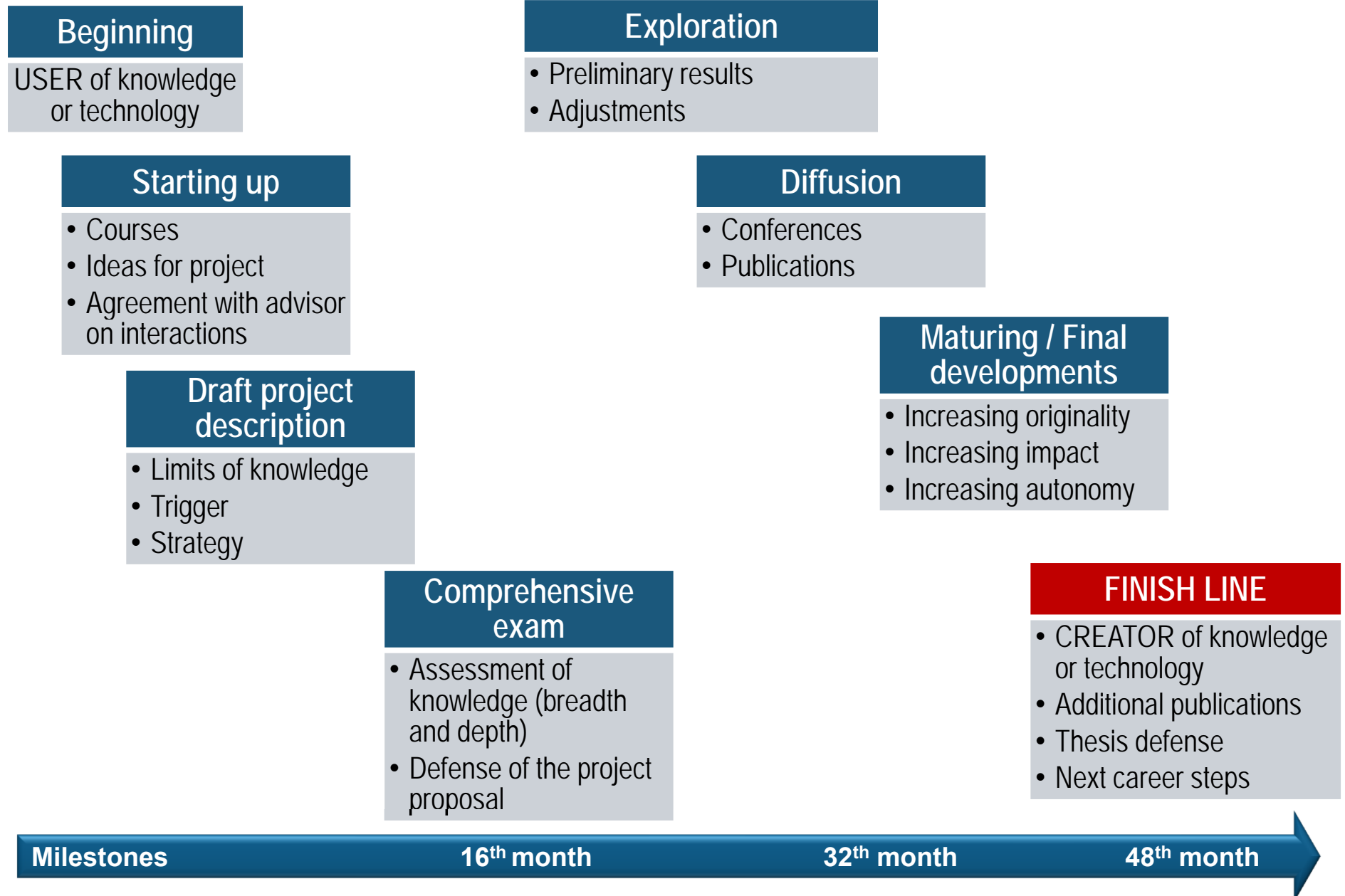
## 5-Year Journal Impact Factor

Cites in {2008} to items published in:	2007 = 1003	Number of items published in:	2007 = 473
	2006 = 1269		2006 = 343
	2005 = 1213		2005 = 278
	2004 = 969		2004 = 220
	2003 = 903		2003 = 208
	Sum: 5357		Sum: 1522

Calculation:  $\frac{\text{Cites to recent items}}{\text{Number of recent items}} = \frac{5357}{1522} = \mathbf{3.520}$



# Typical doctoral journey



# Traditional vs. manuscript-style theses

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## Traditional thesis

### Typical outline

- Introduction
- Literature review
- Methods
- Results
- General discussion
- Conclusion and recommendations

## Manuscript style thesis – Option 1

### **Articles are integrated in the body of the text**

### Typical outline

- Introduction
- Literature review
- Overall methodology showing the coherence of the articles with respect to the objectives
- Results (several articles)
- Overall discussion
- Conclusion and recommendations

## Manuscript style thesis – Option 2

### **Articles are placed in an Appendix**

### Typical outline

- Introduction
- Literature review
- A chapter providing a synthesis of the work
- Overall discussion
- Conclusion and recommendations
- Articles in Appendix

# The thesis defense

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- **Oral presentation followed by questions from the members of the jury**
  - Jury will read the thesis and authorize (or not) the defense (may ask for a modified version in the case of major corrections)
  - The defense is normally “public” at Polytechnique
  - Jury/committee: president, advisor(s), member, external member
  - Director of graduate studies representative
  - Several rounds of questions
- **Verdict**
  - Minor corrections
  - Major corrections (student has to produce a modified version, possible new defense)
  - Must be unanimous; otherwise, a second jury will be formed
  - Thesis rejected (no possibility of a second jury)
- **Elements to discuss**
  - What can go wrong ?
  - Formats in other countries and institutions



# The advisory committee

# Advisory committee: a potentially useful tool

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The **advisory committee** is a group of three or four experts who, by sharing knowledge and skills constructively, **supports the supervisor in the task of mentoring the doctoral candidate and offers advice to the candidate throughout his training.**

An advisory committee **is optional** at Polytechnique. The advisory committee is **created as soon as possible and no later than one year** after the date of first registration to a PhD program. The advisory committee **meets at least once a year** to review progress on the course of the doctoral student.

# Why a PhD Advisory Committee?

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- Provide advice and guidance to the PhD candidate
- Provide increased motivation
- Support the research director in his leadership
- May challenge the views of the director, provide alternate avenues
- Improve monitoring and follow-up
- Accelerate the start of the project and help fulfill the success criteria within reasonable time
- Improve quality by regularly assessing and questioning the progression of the work
- Help unlock critical situations, both scientific or interpersonal
- Promote interbreeding between disciplines and between sectors

Adapted from Jean Nicolas, CAP7001 Classnotes

# Assignment 3 – Research proposal

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- Part I - *Writing the first version of your proposal*  
→ Due date: Thursday, **February 6<sup>th</sup>** at **12:00 (noon)**;
- Part II - *Critical analysis of 3 research proposals*  
→ Due date: Thursday, **February 13<sup>th</sup>** at **12:00 (noon)**;  
“Each student will have to evaluate the research proposals of three of your colleagues”.
- Part III - *Preparing and submitting the revised version of your proposal*  
→ Due date: **Friday, February 21<sup>st</sup>** at **12:00 (noon)**.

# Assignment 3 – Evaluation sheet of a research proposal

	Score
<b>1. Title</b> The title is clear and concise The title reveals the originality of the research	/5
<b>2. Trigger</b> The motivation of the project is clearly explained	/5
<b>3. Frontier of knowledge</b> The literature review is sufficiently detailed and clear to situate the project The literature review shows that the writer is thoroughly familiar with his field of research The literature review is a true synthesis, not just a compilation	/5
<b>4. Question/hypothesis</b> The research question or hypothesis is clearly and adequately formulated	/5
<b>5. General and specific objectives</b> The general and specific objectives are clearly and adequately formulated	/5
<b>6. Strategy (methodology)</b> The overall strategy is appropriate considering the scale of the proposed investigation The research design is clearly explained	/5
<b>7. Expected results, originality and impact</b> The proposed project is highly original The potential contribution is significant and will advance the field	/5
<b>8. Anticipated risks and approach to manage them</b> The researcher has considered potential problems and provided contingency plans	/5
<b>9. Principal resources required</b> The proposed resources are appropriate and justified	/5
<b>10. Proposed timeline</b> The proposed timeframe is realistic	/5

# Possible items in a research proposal

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1. Project title
2. Introduction
3. Definition and overview of the research project, the work to be done and its benefit (research question/hypothesis, objectives)
4. Literature review and presentation of work already done on the subject
5. Proposed research design, methodology and experimental approach
6. Proposed articles to be published
7. Timeline
8. Conclusion
9. References