Working on Biomedical Nuclear Imaging (and Beyond...)

Magdalena Rafecas

Institute of Medical Engineering
Universität zu Lübeck
Director: Prof. Dr. T. M. Buzug

Outline

1. Introduction
2. Medical Imaging
3. Multi/interdisciplinarity of Medical Imaging
4. Towards a permanent position
5. Changing Paths
6. Career Paths from/in Medical Imaging
7. Further examples
8. Some advices

I. Introduction: About myself

Present: Full Professor for Instrumentation in Medical Imaging

- Institute of Medical Engineering, University of Lübeck
- Research on Nuclear Imaging

I. Introduction: About myself

- Studied Theoretical Physics, University of Valencia (Spain)
- Started a PhD in Theoretical Physics
  - University of Valencia
  - Theoretical Division, CERN

.... but after two years, I quit!

https://chroniclevitae.com/news/2015-just-another-piece-of-quit-lit

https://www.lmarecruitment.com/File.ashx?path=Root/Images/skydive.png

I. Introduction: About myself

Then…

- Tried different jobs / career paths
- Worked in different countries
- Looked for “a professional vocation”

https://www.lmarecruitment.com/File.ashx?path=Root/Images/skydive.png

I. Introduction: About myself

And finally found the way!

Medical Imaging

I. Introduction: About myself

My career in Medical Imaging

- Nuclear Medicine Department, Klinikum rechts der Isar, TU München, Germany
  - Awarded a Marie Curie Individual Fellowship for Doctorates (extincted programme)
  - PhD and postdoctoral fellow
- Universidad de Valencia, Spain
  - Independent research scientist, Institute of Particle Physics
  - Associate Professor (tenured), Faculty of Physics
- Department of Preclinical Imaging and Radiopharmacy, University Hospital, Universität Tübingen, Germany
- Institute of Medical Engineering, Universität zu Lübeck, Germany

II. Medical Imaging

*… refers to **several different technologies** that are used to view the human body in order to diagnose, monitor, or treat medical conditions. Each type of technology gives **different information** about the area of the body being studied or treated, related to possible disease, injury, or the effectiveness of medical treatment. [U.S. Food & Drugs Administration]*

→ Very broad field: many technologies

- Much different physical principles
- Large variety of applications

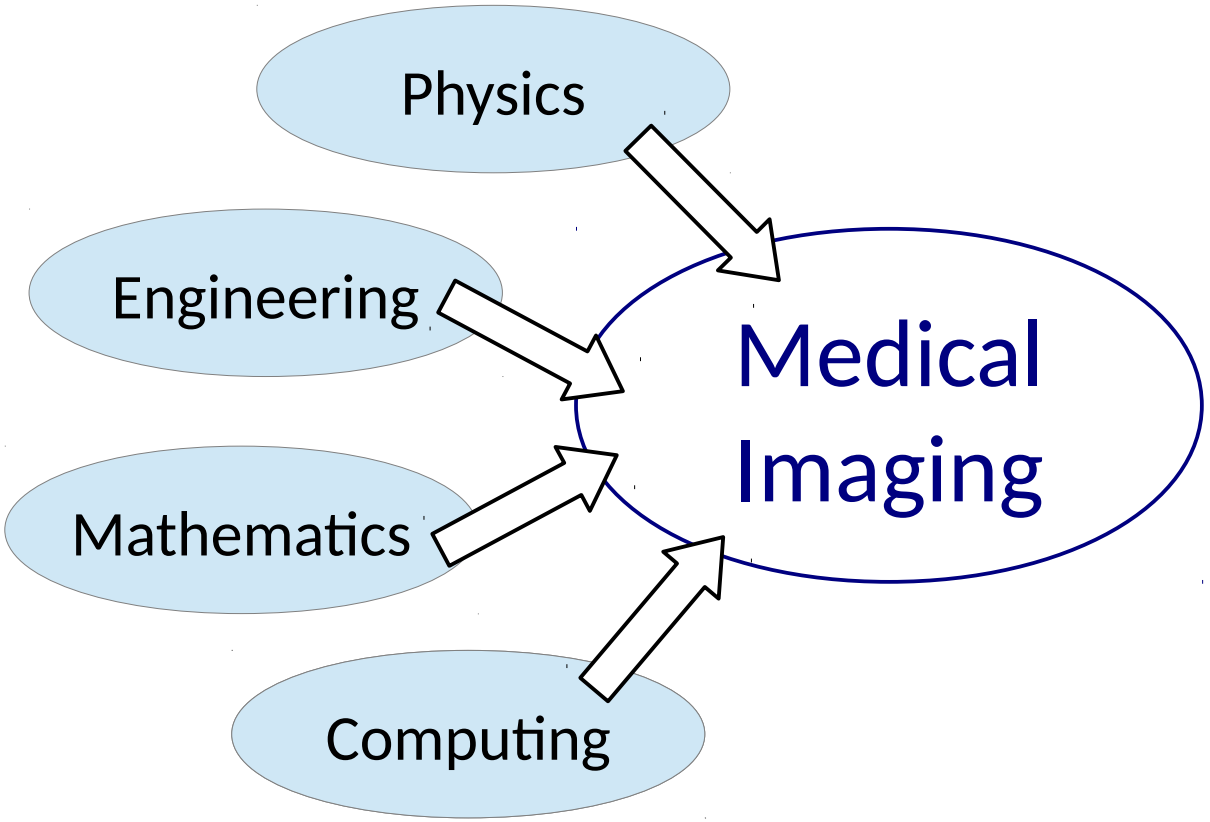
II. Medical Imaging

… refers to several different technologies that are used ***to view the human body*** *in order to diagnose, monitor, or treat medical conditions. Each type of technology gives different information about the area of the body being studied or treated, related to possible disease, injury, or the effectiveness of medical treatment. [U.S. Food & Drugs Administration]*

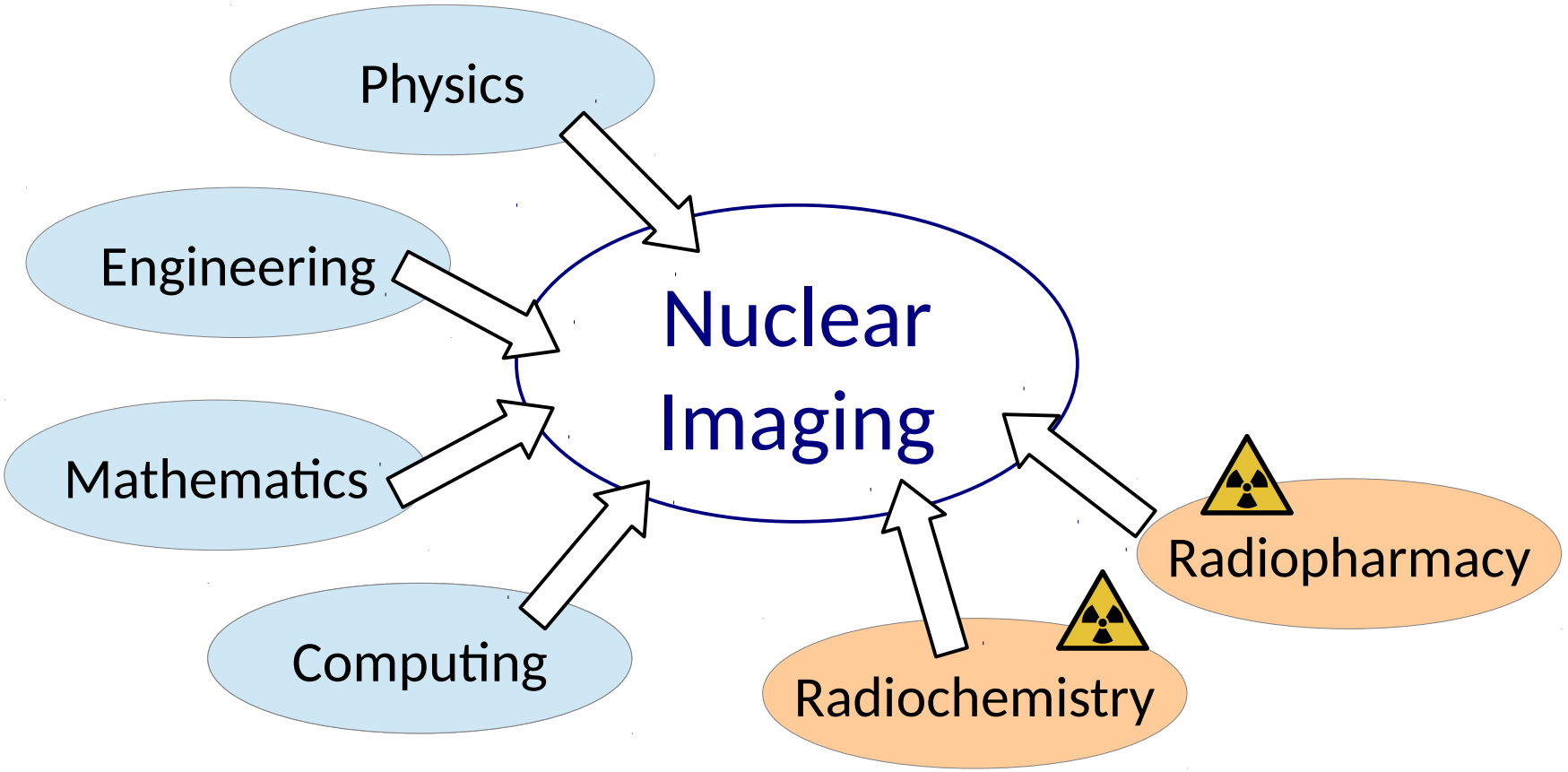
Common goal:

To make the invisible visible!

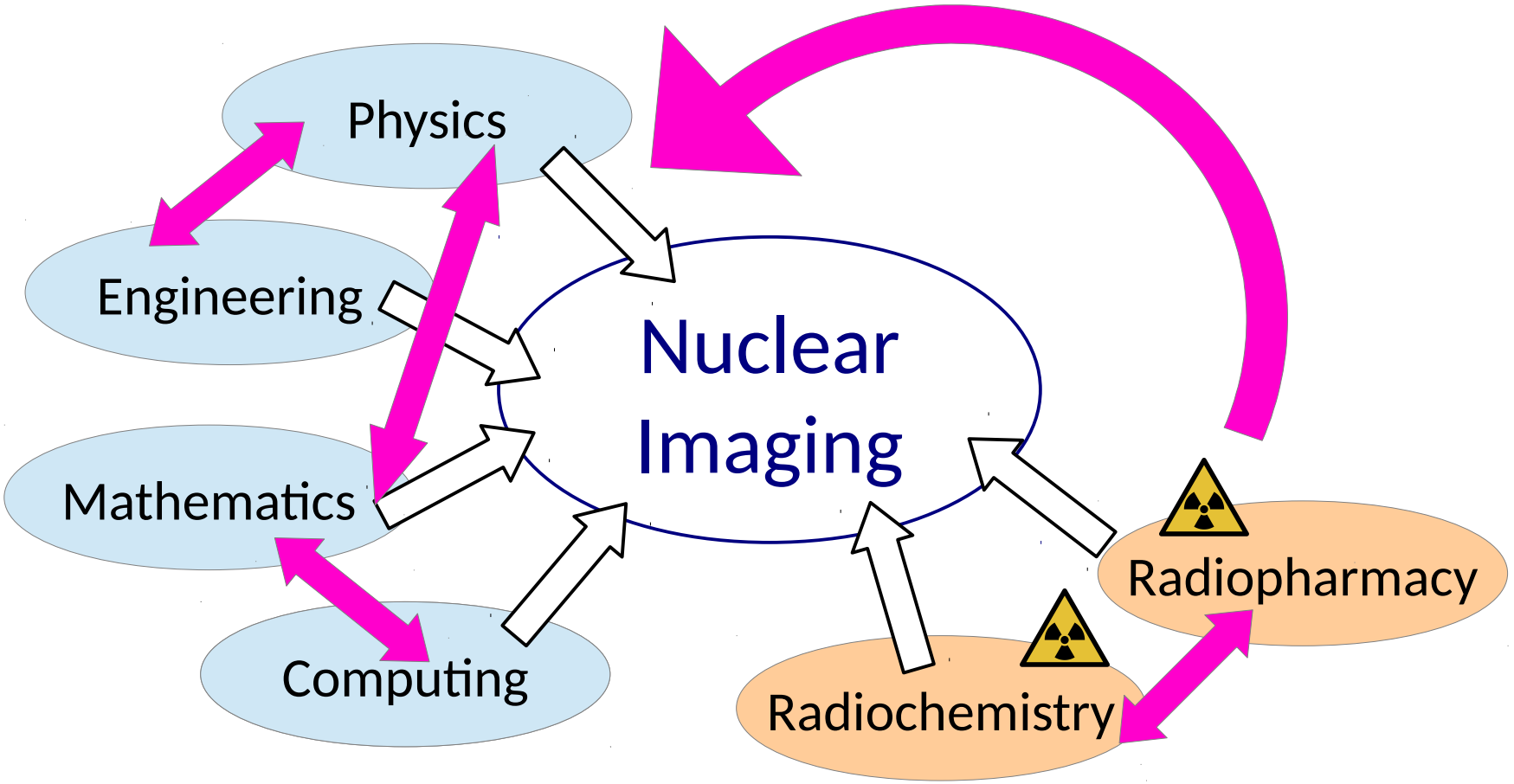
II. Medical Imaging



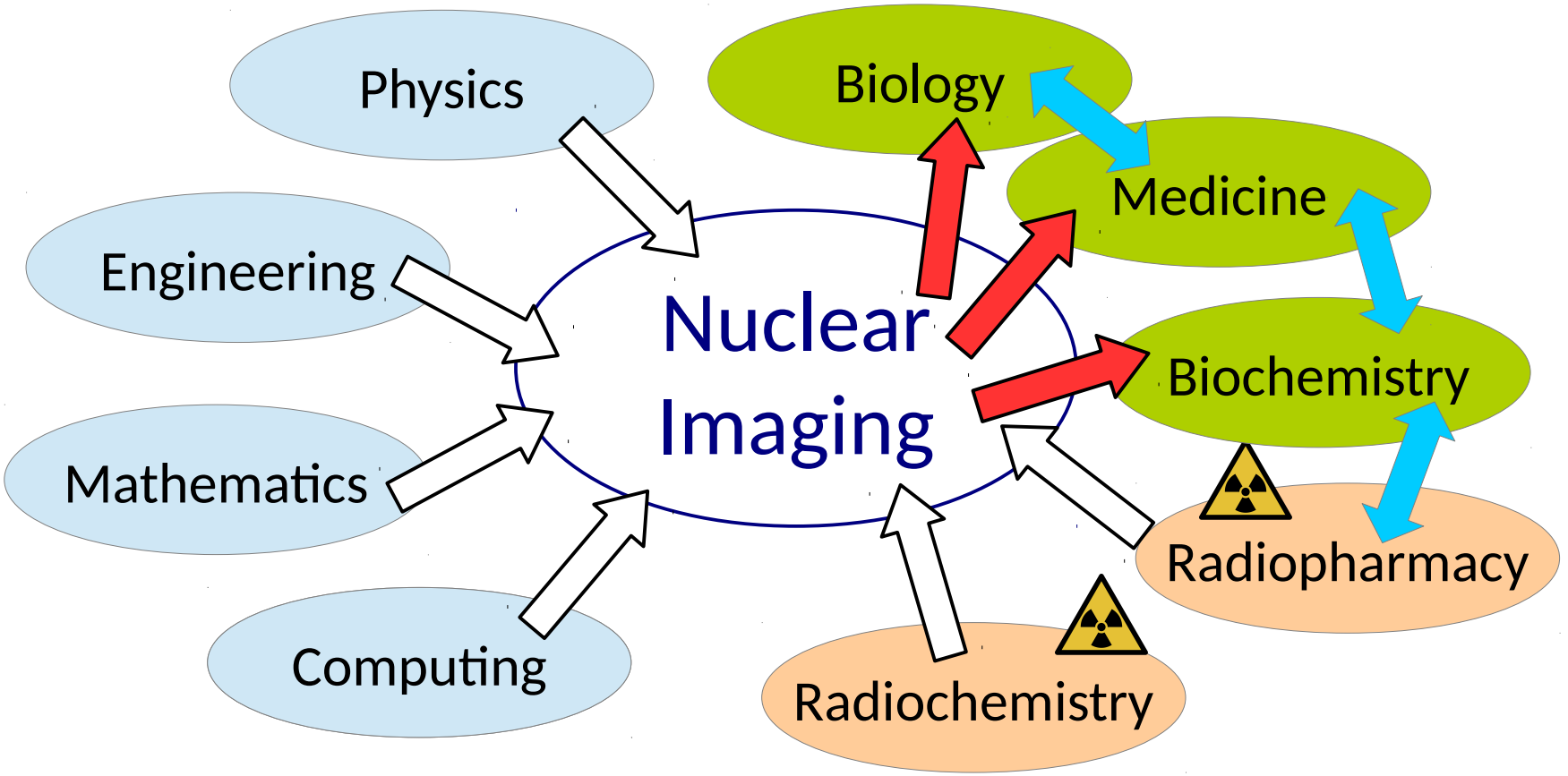
II. Medical Imaging



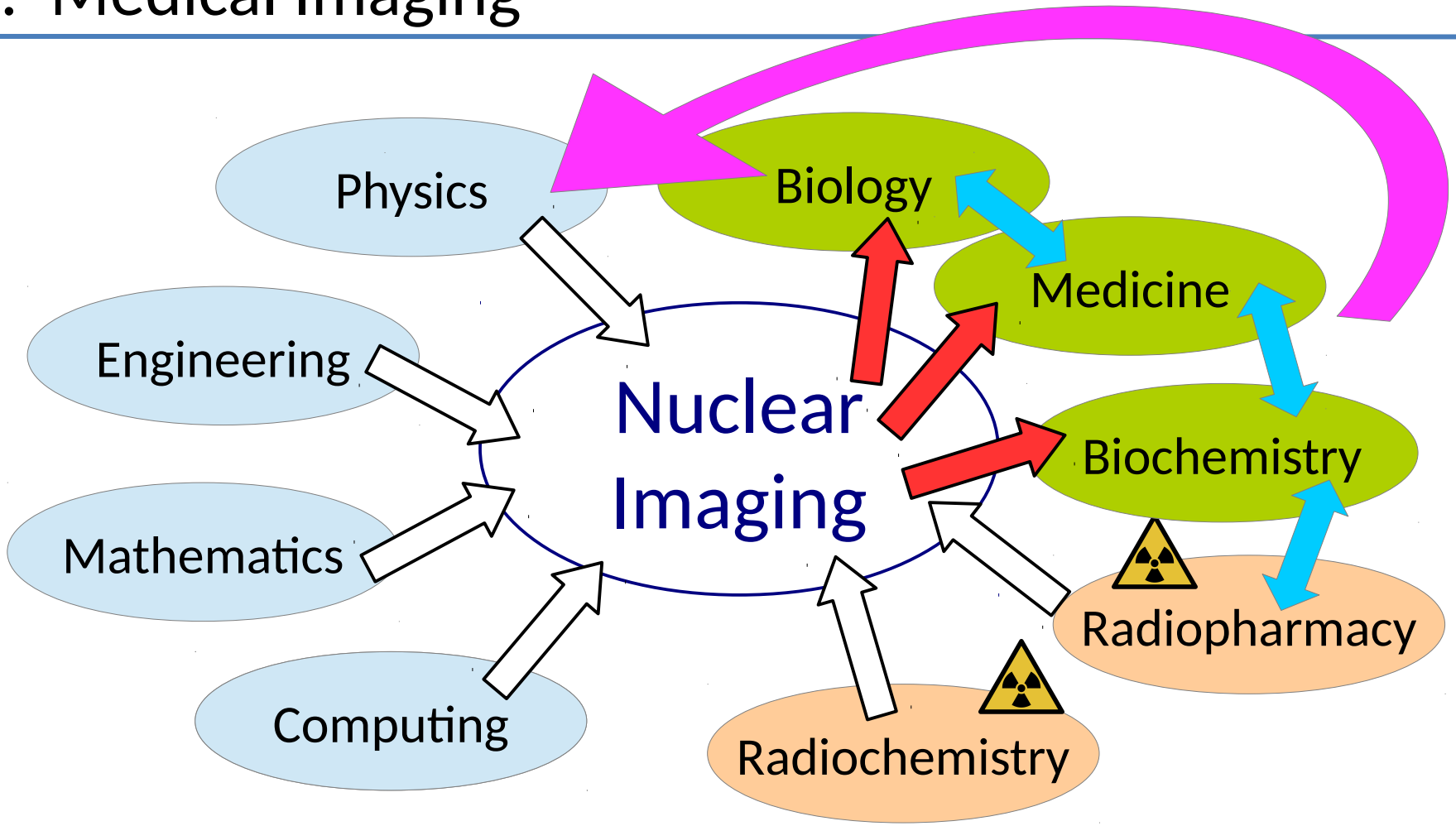
II. Medical Imaging



II. Medical Imaging



II. Medical Imaging



→ A multi /interdisciplinary field!

III. Multi & interdisciplinarity of medical imaging

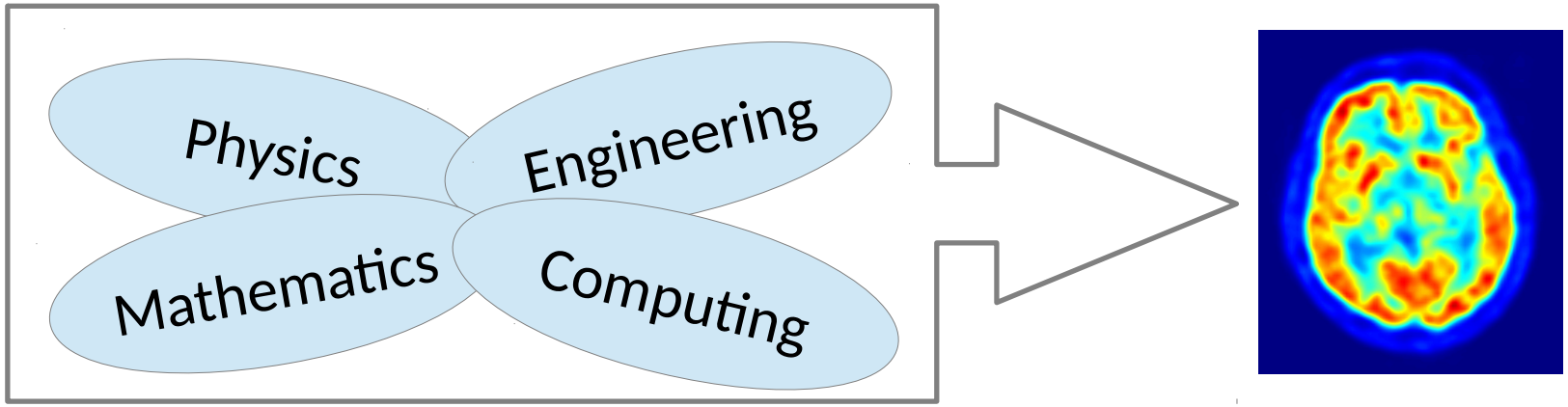
- Medical imaging is **multidisciplinary** → **1 +1 = 2**

  It combines and involves more than one discipline
  - Concepts and/or methods from more disciplines are used together
  - People from different disciplines work together

- Medical imaging is **interdisciplinary** → **1+1 > 2**

  It integrates knowledge and methods from different disciplines

  → synthesis of approaches



III. Multi & interdisciplinarity of medical imaging

An example: Myself

- Worked at
  - University Hospital → Clinic of Nuclear **Medicine**
  - Research Institute of Particle Physics → Section of Experimental **Physics**
  - University → Institute of Medical **Engineering**
- Past and present collaborators
  - Physicists, computer scientists, mathematicians, biomedical engineers
  - Medical & animal doctors, biologists, biochemists
  - Radiochemists

III. Multi & interdisciplinarity of medical imaging

Interdisciplinarity of medical imaging:

Blessing or Punishment?

Example: Evaluation panels / Research Grants

Often lack of a specific panel

III. Multi & interdisciplinarity of medical imaging

Interdisciplinarity of medical imaging:

Blessing or Punishment?

- you know a lot about many disciplines → **generalist** ☺

  but

- you are not a **specialist** in any single discipline ☹

III. Multi & interdisciplinarity of medical imaging

Interdisciplinarity of medical imaging:

Blessing or Punishment?

- you know a lot about many disciplines → **generalist** ☺

  and

- you **are** ~~not~~ a **specialist** in medical imaging! ☺

III. Multi & interdisciplinarity of medical imaging

Interdisciplinarity of medical imaging:

Blessing or Punishment?

- you know a lot about many disciplines → **generalist** ☺

and

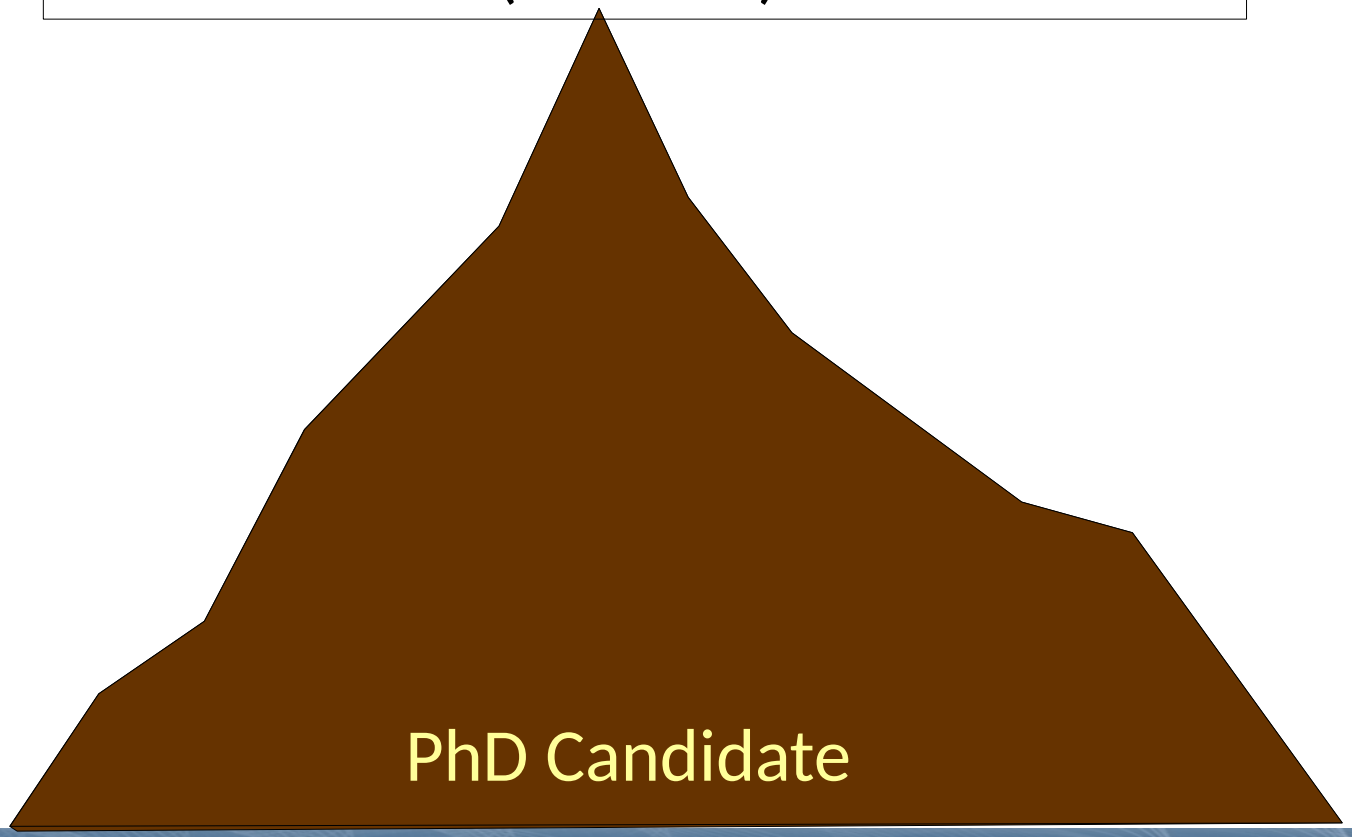
- you **are** ~~not~~ a **specialist** in medical imaging! ☺

As a **generalist**, you have transferable skills and knowledge
→ career flexibility, wide range of career options

As a **specialist** you have very valuable skills and knowledge
→ expert role, narrower career path but possibly higher positions

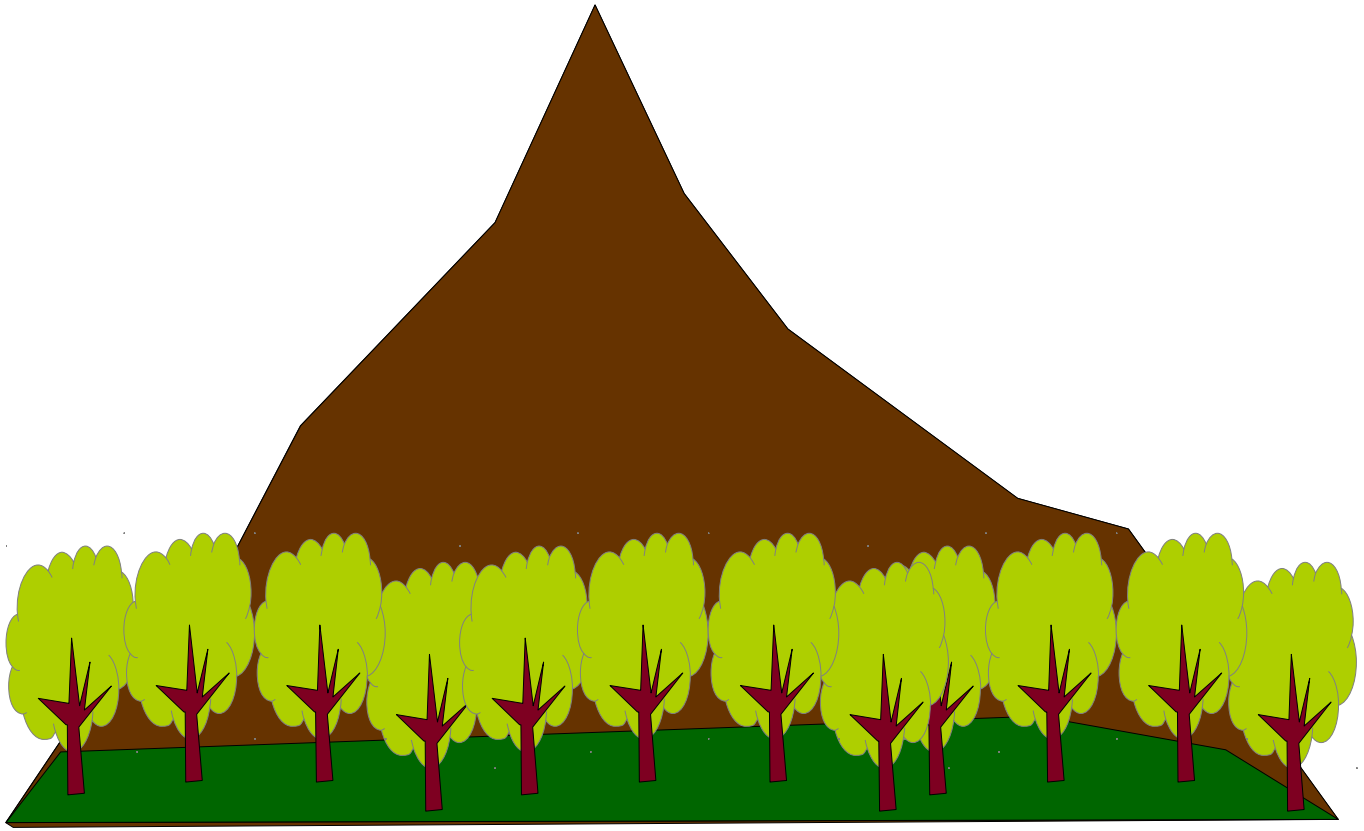
IV. Towards a permanent position

professor, senior research scientist, ...
(tenured)



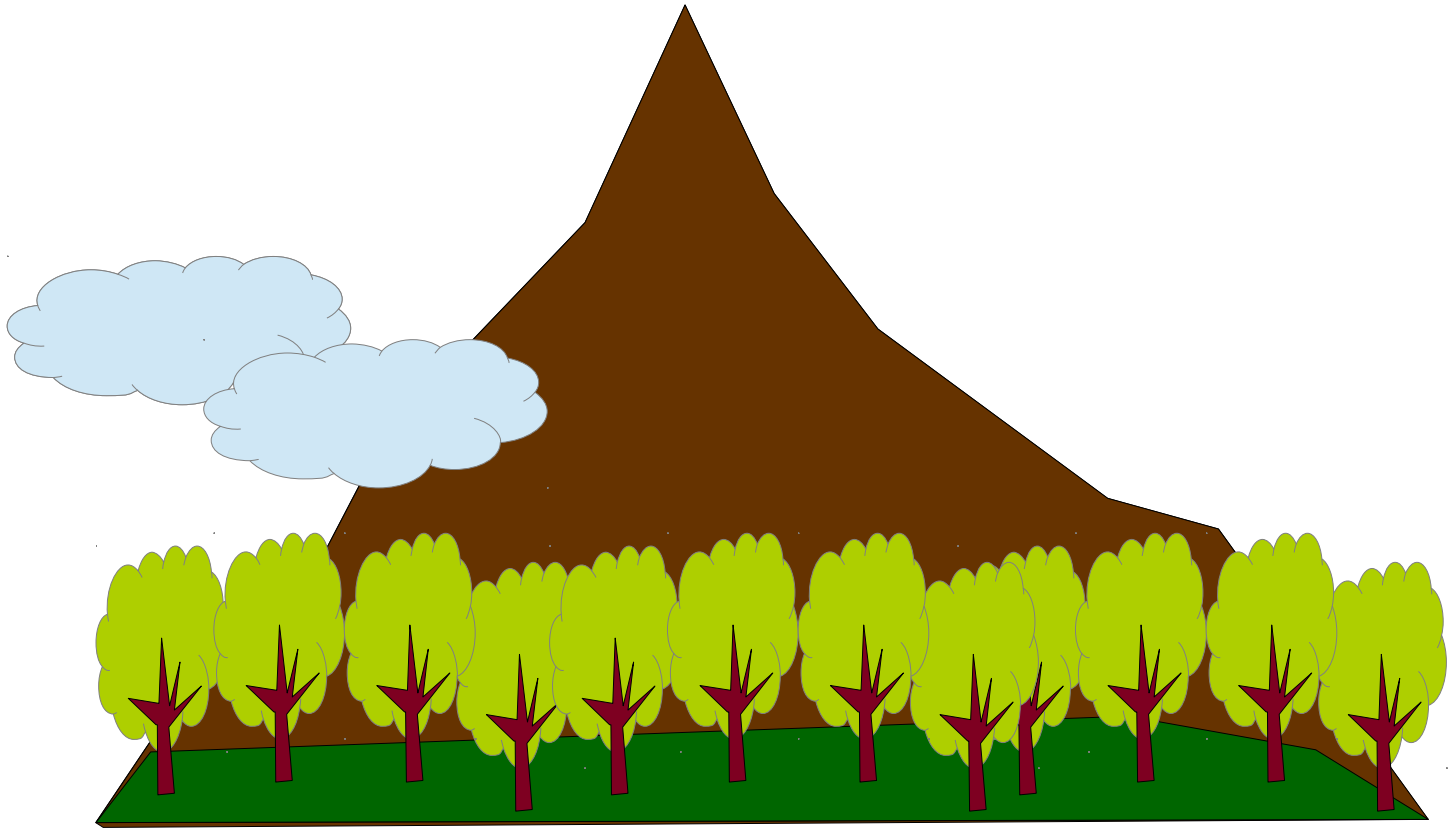
IV. Towards a permanent position

The PhD years…



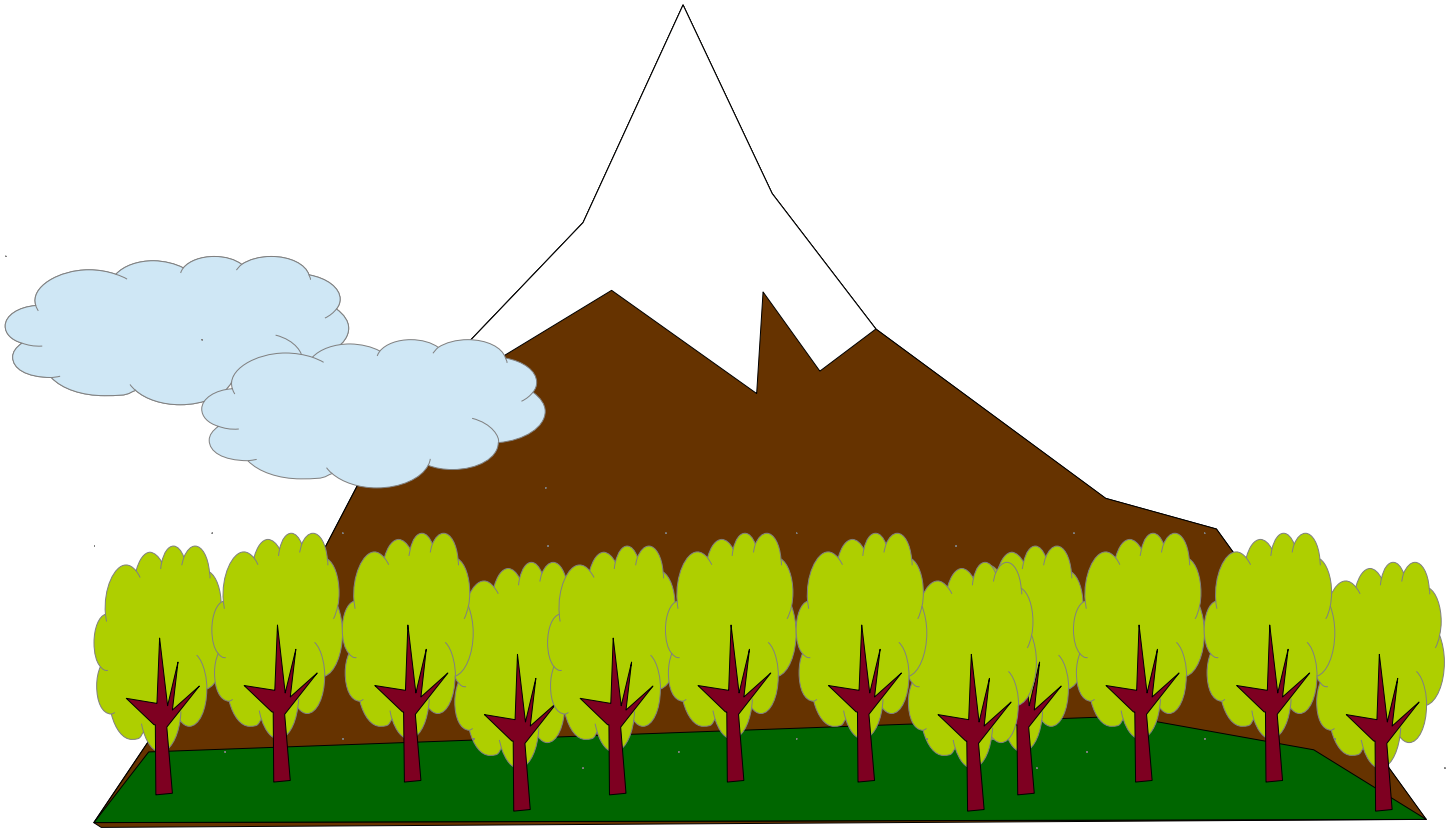
IV. Towards a permanent position

As a young postdoctoral fellow



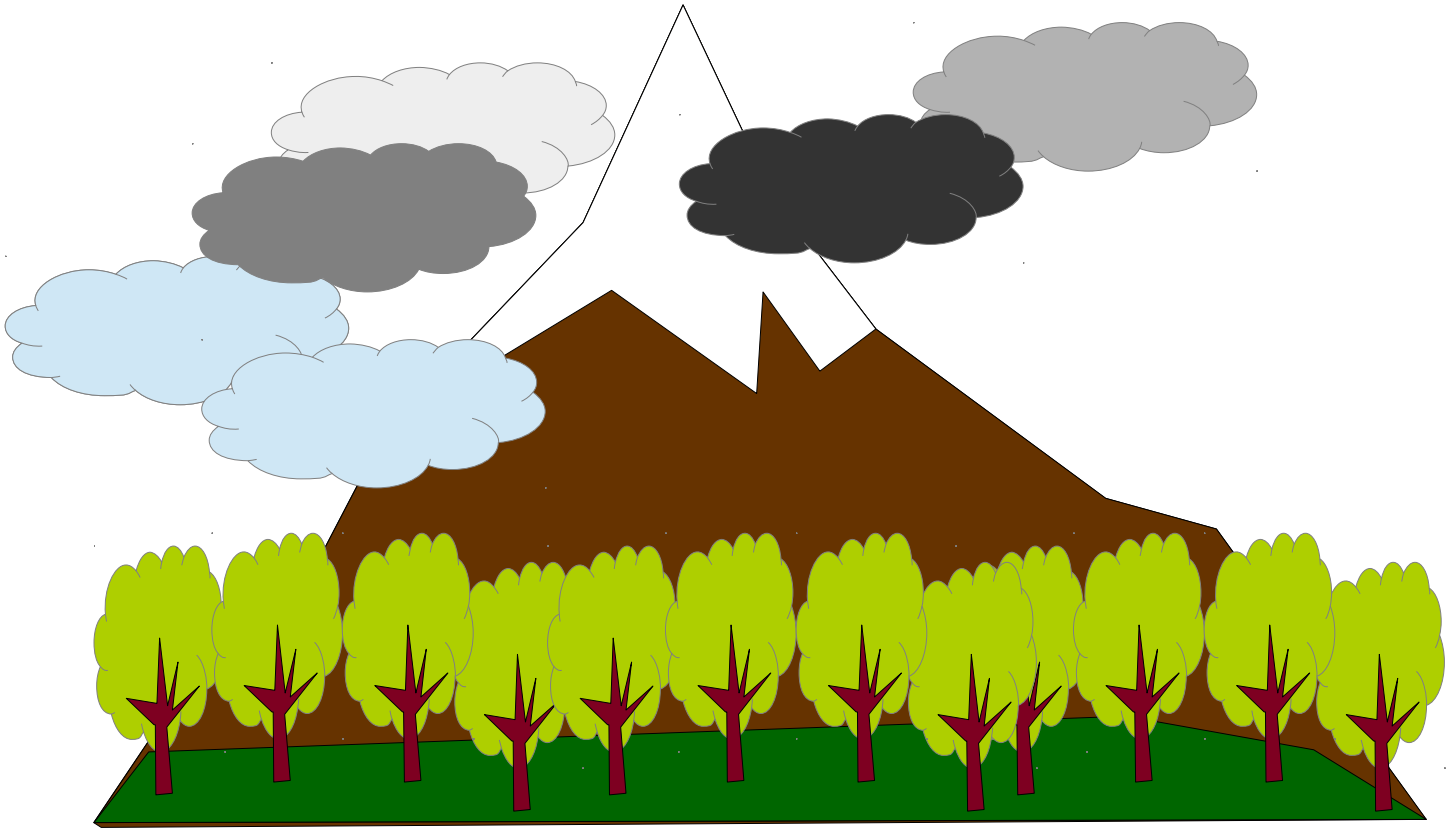
IV. Towards a permanent position

Your second postdoctoral contract...



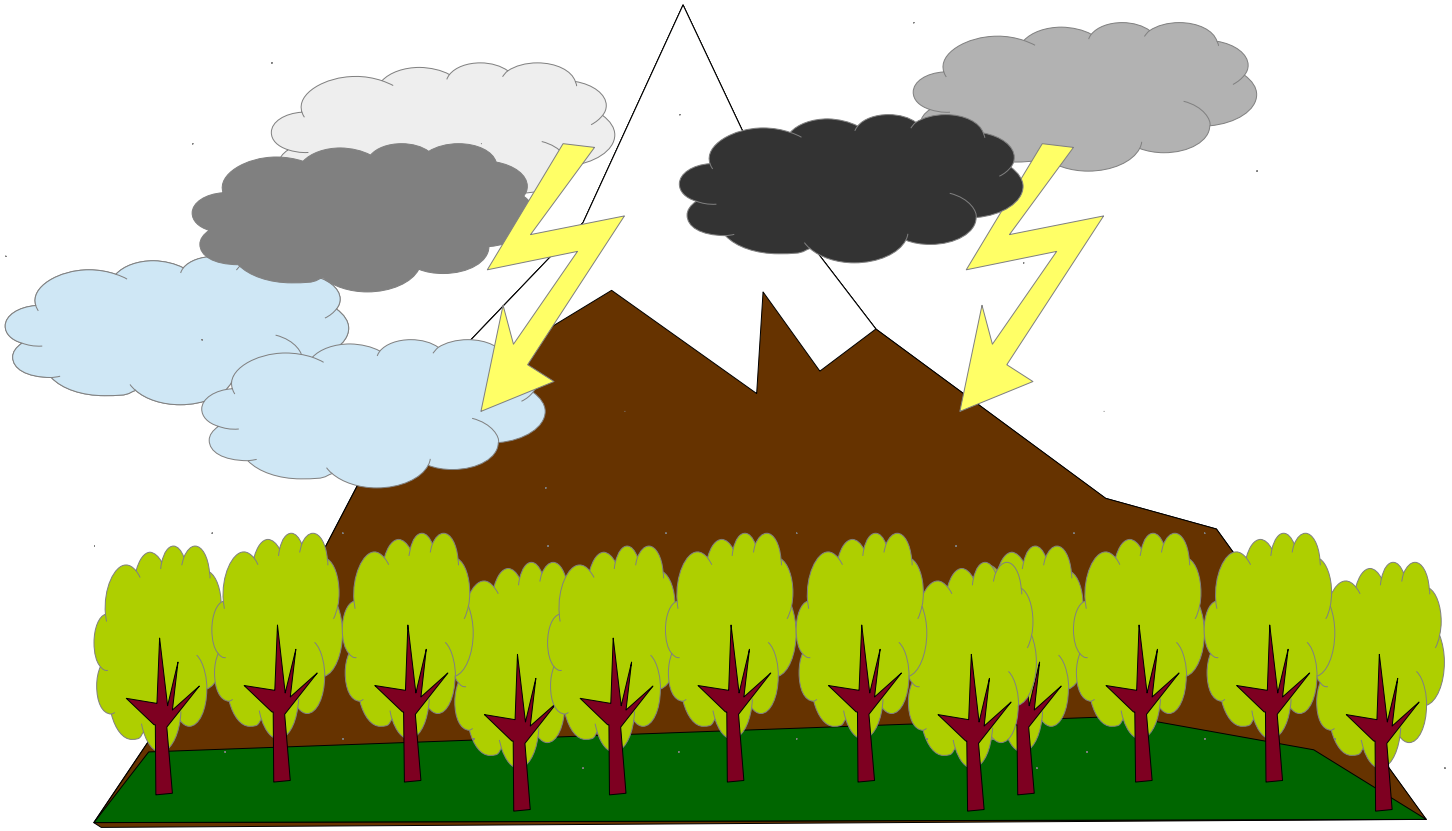
IV. Towards a permanent position

… and time goes by …



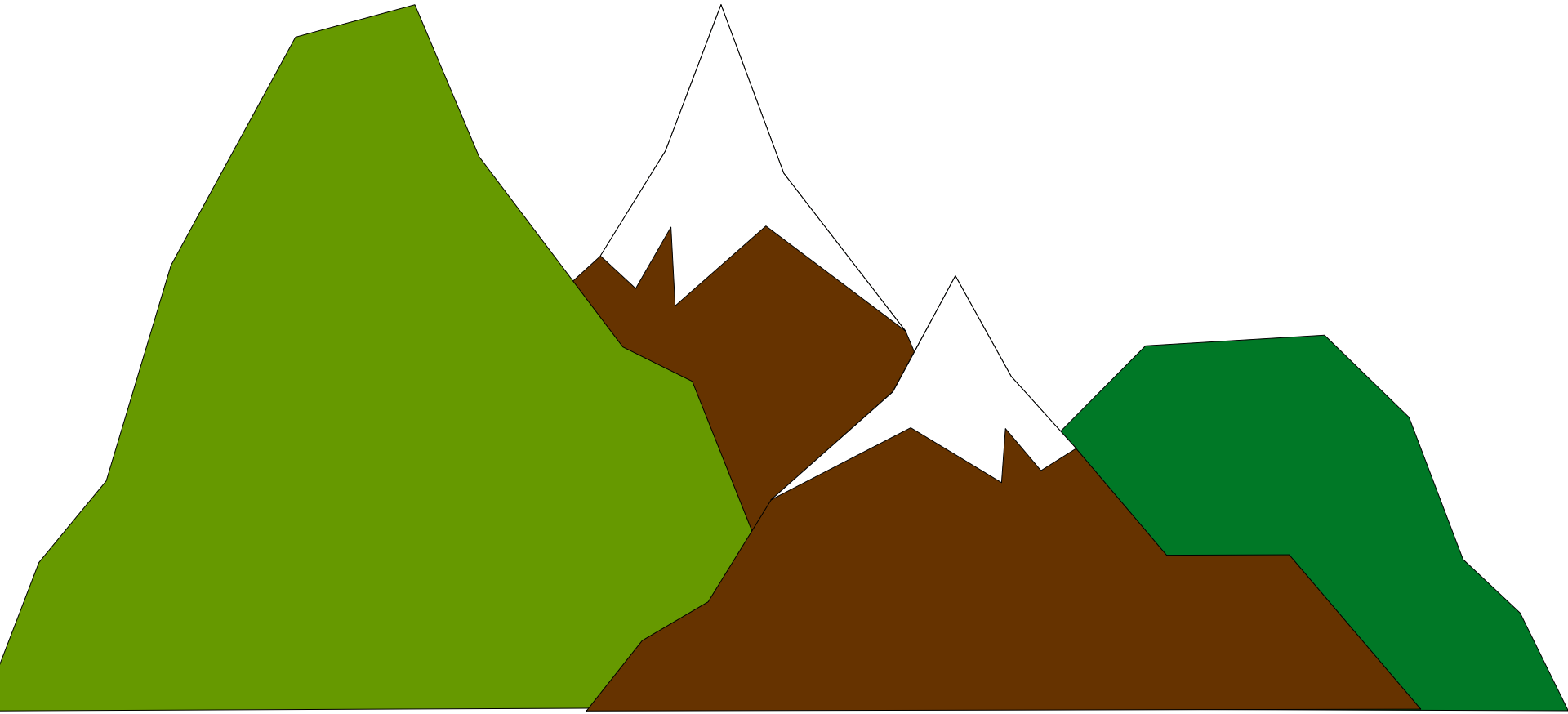
IV. Towards a permanent position

Should I stay or should I go?



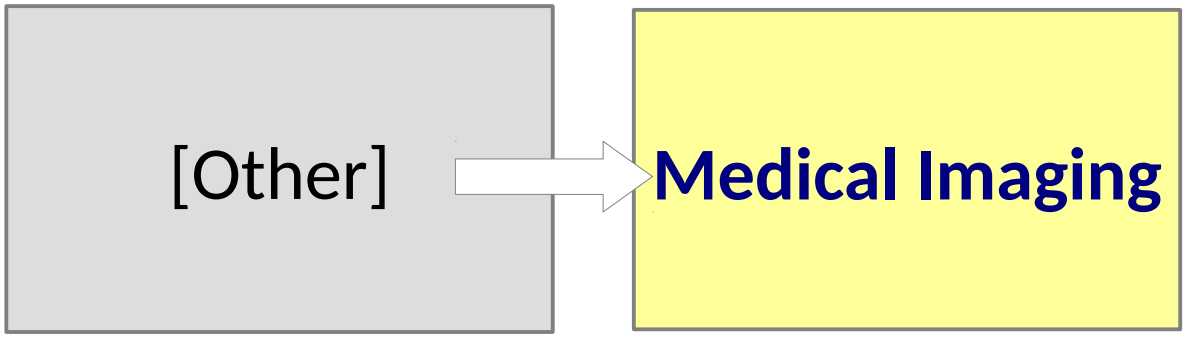
IV. Towards a permanent position

Changing paths



V. Changing paths

Easier from/to an interdisciplinary field!



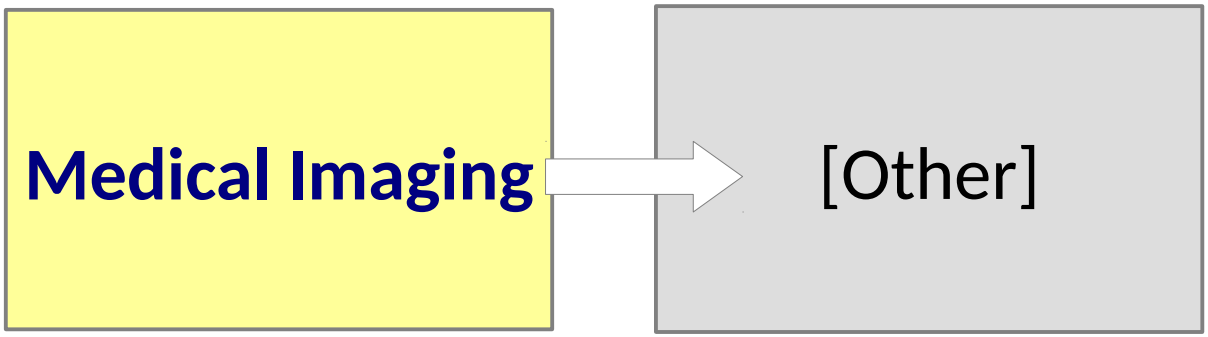
PhD → Postdoc

Postdoc → Advanced Postdoc

PhD
Postdoc
} → Other

V. Changing paths

Easier from/to an interdisciplinary field!



PhD → Postdoc

Postdoc → Advanced Postdoc

PhD
Postdoc
} → Other

V. Changing paths

Start: PhD

- Academia Field A → Academia Field B
- Academia → Industry
- Academia → Industry → Academia
- Academia → Others

When to change?

- Rule of thumb: *The sooner, the better*

  → after your PhD

  → few years as a postdoctoral researcher

- But the exception proves the rule!

V. Changing paths

From nuclear imaging to non-medical imaging

- Besides medicine and life sciences, imaging techniques based on ionizing radiation are applied to other fields
  - Astrophysics
  - Geophysics, seismology
  - Homeland security
  - Archeology
  - Waste management
- Modelling, software development, numerical optimization, image processing… are also required in many other fields.
- It also works the other way around:

  From [*other*] to nuclear imaging

V. Changing paths

Some Examples (real cases)

- Degree in Astrophysics
- PhD in medical physics
- Several years as postdoc in medical imaging (Different countries)

⇩

- Now working at *Ion Beam Accelerators*

V. Changing paths

Some Examples (real cases)

- Degree and PhD in theoretical physics
- Postdoc in theoretical physics

⇩

- Several years as postdoc in nuclear imaging

⇩

- Now working at *Bruker*

V. Changing paths

Some Examples (real cases)

- Degree in Computer Sciences
- PhD in Medical Imaging

⇩

- Now working at *BMW*

VI. Career Paths from/in Medical Imaging

R&D

Hospitals	Academia	Industry
Med Physics Expert	Lecturer / Professor	Research Scientist
	Research Scientist	Clinical Scientist
		Project Manager
		Scientific User Support

Defence Agencies and other public bodies

Certification bodies

VI. Career Paths from/in Medical Imaging

Other

Certification bodies

Product Certification

Technical Inspection

Metrological Services

Regulatory standards

Media

Science writing & co

Academia

Research management

Technical support

IP management

Dissemination

Transfer

Industry

IP management

Patent attorney

...

Patent Offices

Patent attorney

Patent examiner

VII. Further examples

Academia → Industry → Academia

- PhD in medical imaging
- Postdoc in medical imaging

⇩

- R&D in industry (incl. *Philips*)

⇩

- Now tenured research scientist / group leader in a public research institute

VII. Further examples

Academia → Industry → Academia

- PhD in medical imaging
- Postdoc in medical imaging

⇩

- R&D in industry (*Siemens*)

⇩

- Now full professor and department chair (staff > 100p)

VII. Further examples

Academia → Industry → Academia

- PhD in medical imaging
- Postdoc in medical imaging

⇩

- R&D in industry (*Philips*)

⇩

- Now scientific director of a small animal imaging facility

R&D experience in industry is also very valuable to get a permanent position in academia

VII. Further examples

Academia / Industry → Others

- PhD in medical imaging (in cooperation with *Philips*)

⇩

- Now permanent position as examiner in the *European Patent Office*

… and free-lance photograph in his free time.

VII. Further examples

Academia → Others

- PhD in medical imaging (in cooperation with *Philips*)
- Postdoc in medical imaging

⇩

- Now at *Clarivate Analytics / Web of Science*

VIII. Some advices

When you think of the future,

identify your priorities:

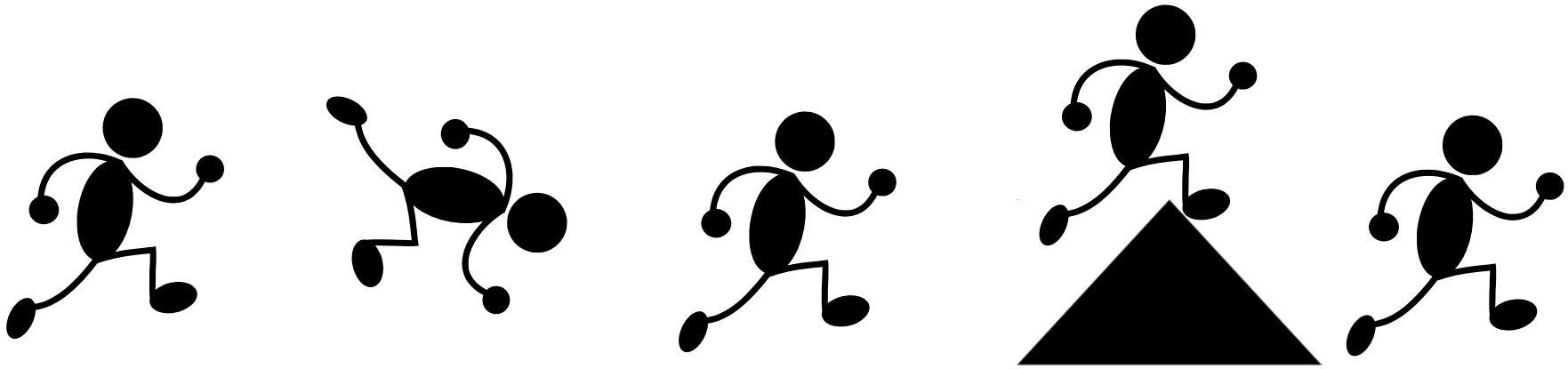
- Vocation
- Salary
- Security
- Free time
- Flexibility
- (…)

VIII. Some advices

Once identified,

be persevering…

endure failures (there will be some…)



https://svgsilh.com/es/image/309053.html

VIII. Some advices

Once identified,

be persevering…

endure failures (there will be some…)

https://svgsilh.com/es/image/309053.html

…but realistic

know your limitations

VIII. Some advices

If you want to stay in academia

- Work hard (unless you are a genius)
- Be flexible
  → ready to change places & countries
- Be patient
  → ready to cope with uncertainty (temporary contracts…)
- Keep your motivation alive
  → enjoy the bright side of academia / research
- Be positive → It is going to work out well
- Otherwise: The world is big !
  → There will be certainly a job which suits you better / which can make you happier

VIII. Some advices

And be open!