From student to scientist 2022 October / November edition

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Who is willing to go first ?

Raija Kemiläinen Leader
Point

To Excellent Science

- **Scientific ideas, innovative**

- **New scientific areas and questions**
  - Ready to be stupid
  - Big risks

- **M.A. Schwartz (2008): Science makes me feel stupid**
  - I have gotten used to it

- **A research problem**
  - Nobody knows the answer beforehand

- **Science involves confronting our ”absolute stupidity”**
  - Our way to unknown

- **Productive stupidity**
  - The more comfortable we become with beeing stupid, the deeper we will wade into unknown and the more likely we are to make big discoveries
- **From student to Scientist**

Own experience: Ready to be stupid

- **Nucleation (1985)**
  - Do you understand that this problem cannot be solved?
  - No, I don't (Ph.d. thesis 1988) / The difference between theory and experimnet was: 10^{30}
  - Now: The difference ca factor of 2 or even less
- **Chernobyl (1986)**
  - Why to stop all other investigations and collect samples?
  - Now: Science diplomacy
- **Aerosol Physics**
  - Kulmala is not doing any usefull research
  - Now: Over 35 Nature and Science papers etc
    - Significant impact
- **SMEAR (1991,1995)**
  - Too complex, waste of money
  - Now: Comprehensive datasets, Global SMEAR network proceeding e.g. in China, Feedback mechanism

Stupid actions continue

- **Atmospheric Nucleation**
  - Does it occur?
  - Observations: Värriö 1994, Bananas in Hyytiälä 1996
  - 50-90 % of aerosol particles globally
- **Atmospheric neutral clusters**
  - Do they exist?
    - Theoretically (2000) estimated concentration 100 000 /cc
  - Why to put all money to cluster studies?
  - Observations : Hyytiälä 2011
    - 10 000 – 100 000 /cc
  - Improved theoretical understanding 2012
- **Biosphere – aerosol - atmosphere – climate interactions and feedbacks**
  - Are they crucial? How to study?
  - SMEAR results; EARTH system models

Steps towards (high level) scientist

- M. Sc.
- Ph.d.
- Post Doc
- Docent/Senior Scientist
- Professor
- Academician

Important:

1) High international level
2) Leadership, vision, initiatives
3) Networking

Crucial

- From Student to Scientist
- Towards Ph.D.:
  - Learn to
    - think
    - write
    - use methods
- Post docs
  - New ideas, new perspectives, new science
  - Learn new things
- Independence vs co-operation

From ideas to implementation

- Every idea implemented
  - Too small number of ideas
- Plenty of ideas - no implementation

- What id the fraction of your ideas what You do implement?
  - Less than 10%, 10-20%, 20-35%, 35-50%, 50-70%, over 70%

Buiding up CV

- Publications
- Teaching
- Obtained funding: national, international
- Memberships and duties in scientific sociates
  - Academy memberships
- Journals: reviewer, board member, editor
- Organising meetings, conferences, workshops, etc
- Organising expeditions, research campaigns

- Positions of trust
- Patents
- Invited talks
- Leadership profile
- Supervised students and post docs
  - What they have achieved afterwards
- Hosting visiting professors, senior scientists
- Review proposals, thesis, acting as opponent
- Panel memberships, chair positions
- Outreach (TV, Radio, Interviews, written articles for general public)
- Career breaks
- Visiting professorships, research visits
- Degrees, In-service training

…

- CV + publication list
  - H-factor, citations, visible papers
  - Position in citation ranking
- Awards (science, teaching)
- Ideas, initiatives
- Networking and partnership
- International visibility
  - PI, Coordinator
- **CV building takes time**
- **Compare with your own performance/development**

Start of a new field

If I could remember the names
of all these particles I'd be a botanist.
-Albert Einstein

Own experience

- M.Sc. 1983
- Own research group since 1983, in the present form since 1990
- FAAR 1983
- Phil. Lic. 1985: Nucleation, condensation, gas phase chemistry
- Tshernobyl accident 26.4. 1986: Material and energy fluxes
- Vienna 1987; Ph.D. 1988
- SMEAR I Värriö (1990/1991 -)
- SMEAR II Hyytiälä 1995-
  - First nucleation events observed 1996
- SMEAR III Helsinki 2004-, SMEAR IV Puijo 2008
- Ph. D. 1988
- EAC 1988 (Lund), EAC 1995 (Helsinki), ICNAA 1996
- APFE 1990
- Professor 1996
- First Nature paper 1997

- **FCoE 2002-2007, 2008-2013, 2014-2019**
- **BACCI (2003-2007), CBACCI 2003-, CRAICC 2010-2015**
- **iLEAPS/IGBP 2004-**
- **EUCAARI 2006; ERC: AdG 2008, 2017**
- **2009: Top 10 in Geosciences, most Nature/Science papers in Finland**
- **2010: ICOS**
- **2011 - : 1st in Geosciences (ISI WoS)**
- **2012: PEEX**
- **2013: BC**
- **2015/2016: ACTRIS**
- **2015/6: Foreign Academician (CAS)**
- **2017 Academician (Finland)**
- **2019: Foreign Academcian (RAS)**

On research

- Vision, outlines, initiatives
  - what to do and why, own line, my/our way
- How to us your time
  - New methods
  - Conceptual thinking and development
  - Relevant research questions
- Deep understanding
  - Over boundaries
  - Research chain
- Networking, partnership

- Continuous and sustained work, to results and end products
  - Group big enough, critical mass
  - cross-, multi- and interdisciplinary
  - multiscale
- Motivation
- Co-operation
  - within our group and with others
    - encouraging, group spirit
  - benefit using the best possible knowledge
  - partnership and networking
- Spirit of publication
- International reputation
- Publish in best journals, work with best scientists

What to do – in practise

- Research questions
- Research
  - Theory, models, laboratory experiments, filed obervations, instrument development
- Writing scientific text and outreach
  - Reports, proposals, papers
  - Press, tv, radio, social media
  - Information to policymakers and other stakeholders

How to write Scientific text ?

- Logical and in such way that other scientists are able to repeat your work
- Find out what is already known; find relevant litterature
- References
- Figures, figure captions, tables
- Language – simple and clear sentences

Why to write ?
Publication / Proposal

- End Product of Scientific work
- To get other people interested in and to know your work
- To show your activity
- To obtain funding for you and/or your group
- to be able to start/continue interesting and important research

On Your topic

- New scientific results -> Publish it
- lab measurements, field campaigns, development of new devices and new methods, basic theories, modelling
- How much material in one paper?
- In principle all scientific work will result as publication: if not look your supervisor/advisor

Publication Chain

- Abstract
- Extended abstract
- Real paper in International Journal
- Nature/ Science paper

- Thesis (M.Sc. / Ph.D)
- Reports

Planning research activities

Towards international/global leadership

0. Tshernobyl accident 1986
1. SMEAR II 1995-
2. ICOS HO 2010 .. 2016 -
3. ACTRIS HO 2015 … 2021 –
4. Utilisation (works like block of flats – all floors needed
   1. Climate Analytics Finland
   2. Climate University

Report / Your MS

- Title
- Author list, Addresses, e-mails
- abstract
- Introduction
  - aims
- materials and methods
  - short, what methods and data you are using
- Results and discussion
- Conclusions
- References
- Figures and tables
  - captions
- Appendix
  - extra figures with figure captions / extra material
  - Scripts, datasets with metadata