The background is a complex, low-poly green pattern. A large, light-green triangle is centered, containing the text '2+2=5' and 'INTERDISCIPLINARITY'. Several smaller, semi-transparent green triangles of varying shades are layered around the central one, some containing the numbers '2' or '5'.
$$2+2=5$$

INTERDISCI  
PLINA  
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AARHUS  
UNIVERSITY  
HEALTH

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MD, DMSc LISE WOGENSEN BACH,  
VICE-DEAN FOR TALENT DEVELOPMENT, AARHUS UNIVERSITY, HEALTH

## Think outside of the box – and benefit the future

Interdisciplinarity is still a catch phrase in research, and this is also the case at the PhD degree programme at Health, where we today clearly support the idea that 2+2 can give 5.

We want junior researchers to think outside the box and to embrace and be nourished by academic insight that lies outside of their own, narrow academic identity. We believe that this will open up new and necessary research-based solutions to some very complex societal challenges. And we believe that it will be beneficial for both researcher and society.

“

**We follow one of the pieces of advice given to us in 2016 by Health's Advisory Board**

In this way we follow one of the pieces of advice given to us in 2016 by Health's Advisory Board – to promote research projects across disciplines.

The interdisciplinary approach is also visible in the “The Graduate School of Health's Strategy and Action Plan 2016-20”, which we are about to implement at the Faculty of Health. This points towards interdisciplinary PhD projects being able to increase networking across the disciplines – also at supervisor level.

The faculty is in line with the priority given to interdisciplinary projects when Aarhus University's strategic funds are allocated via the “Committee for Research and External Cooperation”. And we are in line with the university's major strategic interdisciplinary initiative for 2012-2016, which will be internationally evaluated in 2017.

In continuation of this, The Graduate School of Health prioritises problem statements that are clearly interdisciplinary when applications for full, strategic PhD fellowships and grants are dealt with in the four annual rounds of applications. This approach is also paving the way for Horizon2020 applications.

Until now, this prioritisation has faced the challenge of having only a few applications that sufficiently meet the interdisciplinary aspect. A group of interdisciplinary researchers has therefore discussed and identified these challenges in order to find a path to further developing the field. Furthermore we have produced this brochure, where we ask a handful of researchers with interdisciplinary experience in the health sciences field, to describe what it – in their opinion - is about.

### Interdisciplinarity:

- Can be a decisive factor for securing funding for a research project e.g. Horizon 2020

MD, DMSc OLE STEEN NIELSEN,  
ACTING DEAN, AARHUS UNIVERSITY, HEALTH

## Can the battle be won from one discipline?

Many large foundations and the EU wish to see a focus on interdisciplinarity in the applications they receive. This wish has not arisen out of the blue. Rather, it is due to the necessity of interdisciplinarity for solving the challenges facing society today.

One example is the aging population: Can we imagine that challenge being solved by one subject area? No. It reaches deep into disciplines across the traditional boundaries.

Another example is nutrition: How do we avoid people becoming obese and ill? How do we get people to eat in the right way and exercise? That is a common challenge. And what about the neuro-area? The fight against Alzheimer's disease and other neurodegenerative diseases. Is that a battle that can be won from one discipline?

But, of course, interdisciplinarity is not without its own challenges. These arise first and foremost because researchers from different disciplines do not necessarily speak the same language.

Neither do the members of the foundation's assessment committees when they meet to assess applications from e.g. Faculty of Health. The risk is therefore that they assess each part of an interdisciplinary project based on their own academic identity, and on this basis, they may think that a project is maybe not quite ambitious enough. This places great demands on the applications.

Finally, it is important to remember that you must still be good within your own academic field when getting involved in an interdisciplinary project: Because the very basis for your involvement in the project in the first place is precisely your own, good academic identity and skills.

### Bigger piece of the cake for interdisciplinary research

There is an increasing demand from politicians for research to help in solving society's greatest challenges.

These challenges are by their very nature often interdisciplinary. This means that both public and private – as well as European – funders are to a growing extent prioritising funding to research that is itself interdisciplinary.

In the three figures, we have looked at the key Danish public and private, as well as European, sources of funding for research. Funding targeted at challenges facing society, and thereby funding for interdisciplinary research, is highlighted in green.

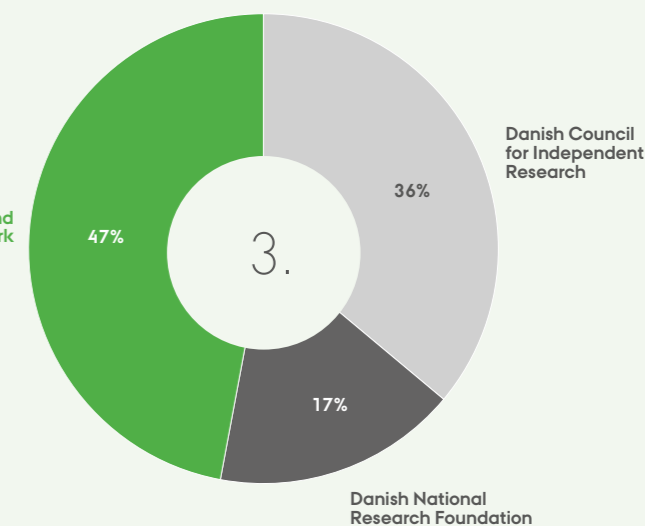
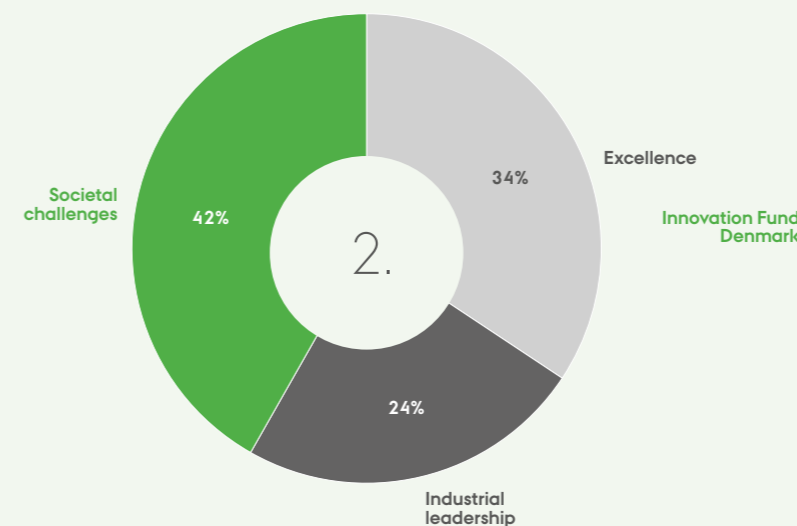
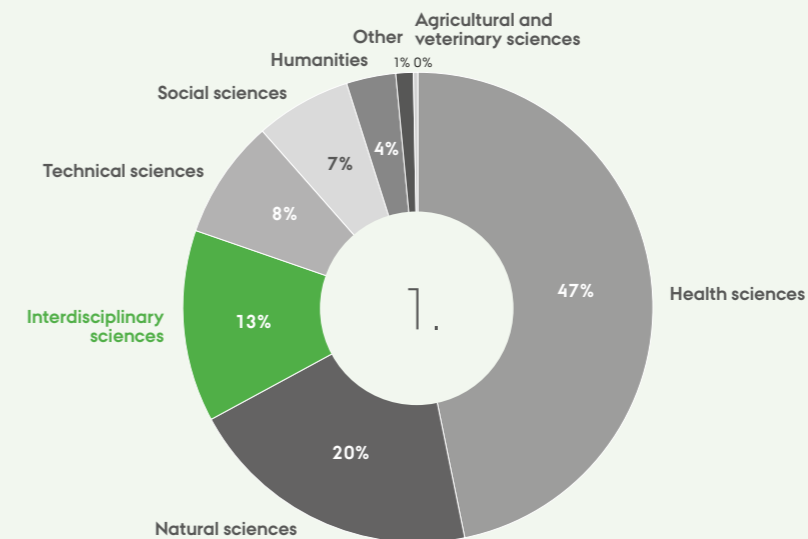


## figures

1 GRANTS FROM PRIVATE FOUNDATIONS TO RESEARCH 2012-14

2 PILLARS OF HORIZON 2020

3 LARGEST PUBLIC FOUNDATIONS



PROFESSOR, MD, PhD KIM OVERVAD

## None of us can do it all on our own anymore

Disciplines have become more and more specialised, and the opportunities to uncover more sides of an issue are greater than ever before. But none of us can do it all on our own anymore, and collaborative groups therefore become larger – and sometimes they become interdisciplinary.

Take one of my PhD students as an example. She is right now looking into the correlation between atrial fibrillation and the intake of certain fatty acids that interact with one another and compete for the enzymes in the body. The frequency of atrial fibrillation increases with age, and is associated with a higher risk of stroke. Atrial fibrillation is thus a major public health issue.

This project calls for:

1. Physiological and biochemical understanding
2. Insight into atrial fibrillation, which requires collaboration with clinicians
3. Collaboration with experts in human genetics
4. Collaboration between epidemiologists and biostatisticians regarding complex analyses of data to explore the potential association between intake of fatty acids and atrial fibrillation

We collaborate with our local biostatisticians. But as the enzyme activity is in part genetically determined, there is also a collaboration with the metabolism centre at The University of Copenhagen. They deliver 500,000 pieces of information about every person with atrial fibrillation – that amount of data requires working with bio-informatics experts from Science and Technology.

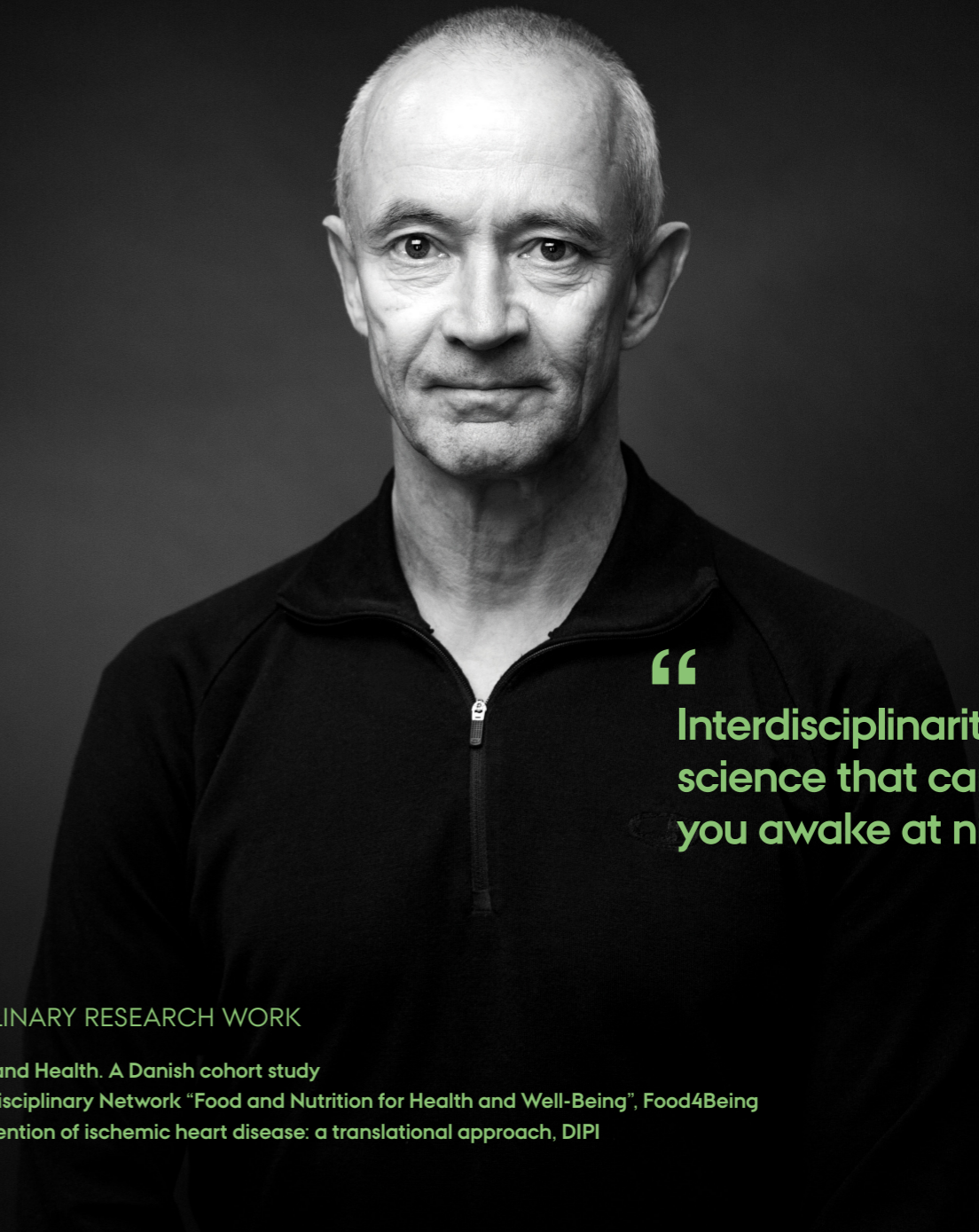
In other words: It may require an interdisciplinary package to solve or shed light on a public health issue.

Interdisciplinarity is science at a higher level. Things become more arduous than they would otherwise be; it can keep you awake at night; there is plenty of doubt during the process; perhaps you end up in a dead end, where it turns out that you should not have gone in that direction... It is exciting, it has substance, and it leads to new knowledge.

This type of project has good chances of securing funding, as there are a number of people sitting in the private foundations and assessing applications who think in the same way – that is to say, they also become interested and committed when it looks like there is something at stake in the project.

### An interdisciplinary project

- Is difficult and requires dedication
- Means that everyone learns from one another – an epidemiologist can learn from a biostatistician, who learns from a clinician etc.
- Demands more than a copy-paste project that closely resembles previous projects
- Has a good chance of securing funding
- In the case of PhD projects, it needs a supervisor team who can cover the entire academic area



“  
Interdisciplinarity is  
science that can keep  
you awake at night!”

#### INTERDISCIPLINARY RESEARCH WORK

- **Diet, Cancer and Health. A Danish cohort study**
- **The AU Interdisciplinary Network “Food and Nutrition for Health and Well-Being”, Food4Being**
- **Diet and prevention of ischemic heart disease: a translational approach, DIPI**

“

Collaboration between researchers from distant fields might increase the chance to find an answer.



#### INTERDISCIPLINARY RESEARCH WORK

##### “Learning”

Centered around the effects of music training, expertise and individual traits on the brain as measured with neuroimaging methods, behavioral ratings, psychological tests, and genetic mapping. Center for Music in the Brain.

PROFESSOR, MA, PhD ELVIRA BRATTICO

## An opportunity to address the real needs of today

A project is intrinsically interdisciplinary when it combines researchers and skills from different fields to answer an overarching question.

Nowadays the borders across disciplines are less clear. For instance, scientific methods and technological tools are ubiquitous and easily available. Hence, they are sometimes used even by humanists, traditionally adverse to reductionist accounts.

In this respect, it has become more relevant than before to address questions related to human nature with the scientific methodology, hence forcing researchers to join forces with experts from other fields.

In turn, the social and creative nature of the modern world has transformed questions that were traditionally scientific or technological into aesthetic and social ones, motivating scientists to interact with humanists in order to achieve true progress.

In interdisciplinary projects we gain the opportunity to address the real needs that we have nowadays. For instance, even for questions such as finding the origin of a pathological condition, collaboration between researchers from distant fields might increase the chance to find an answer, e.g., by profiting of bioinformatic advancements, and to provide real help to the affected patients, e.g., by involving alternative therapeutic approaches.

In biological psychiatry consortia of several universities and laboratories to address a single problem are becoming common. The imaging genetic approach combining genetic mapping with measures of brain function and neuropsychological assessment of behavior is a successful example of interdisciplinary, since it has allowed to identify new functional gene variations linked with diseases such as Alzheimer's, schizophrenia and autism.

So should anyone aim to participate in interdisciplinary projects nowadays? I think they should - but indeed an interdisciplinary project requires a certain attitude. The main components of such attitude are respect for the other person, humility of personal achievements, combined with self-confidence of own contribution and competence.

### Interdisciplinary projects requires:

- Respect for the other participants
- Humility of personal achievements, combined with self-confidence of own contribution and competence
- Enthusiasm for learning and continuously updating knowledge

“

(...) our result confirms the long-held belief that interdisciplinary proposals have lower funding success rates, providing the basis for further investigation into the development and evaluation of interdisciplinary research.<sup>1)</sup>

“

(...) journals also find it difficult to select reviewers who can evaluate interdisciplinary research. This particularly affects young researchers, which is why they opt to be a part of the conventional discipline structure rather than delving into interdisciplinary research.<sup>2)</sup>

“

The 2014 Research Excellence Framework (REF) — a multiyear UK exercise that assessed universities' research strengths in 2008–13, and which thus determines funding — found that, when academics were asked to submit cases of research to REF that had significant impact outside academia, 80% were interdisciplinary.<sup>2)</sup>

“

(...) academics who delve into interdisciplinary research face several challenges when it comes to receiving funding, gaining recognition, and even getting published.<sup>2)</sup>

<sup>1)</sup> Broham et al.: "Interdisciplinary research has consistently lower funding success". *Nature/Letter* **534**, 684–687 (30 June 2016)

<sup>2)</sup> Rick Rylance\*: "Grant giving: Global funders to focus on interdisciplinarity". *Nature/Comment* **525**, 313–315 (17 September 2015)

\*Chair of Research Councils UK and member of the governing board of the Global Research Council

“

Disciplinary research  
is disintegrating.

#### INTERDISCIPLINARY RESEARCH WORK

- Aarhus University Network for Interdisciplinary Drug Resistance Research, IDRRES
- Center for study and prevention of the Neurodegenerative Inflammation, NEURODIN

PROFESSOR WITH SPECIAL RESPONSIBILITIES, MSc, PhD, DMSc THOMAS VORUP-JENSEN

## An answer to handling scientific data

A generic interdisciplinary project is difficult to define, because it assumes the existence of well-defined disciplines.

But disciplinary research is disintegrating. For example, my subject (chemistry) was once something reasonably well defined. Today, however, studies published in chemistry journals could just as well be thought of as immunology. Rather than trying to strictly define interdisciplinarity, time is usually better spend on what makes a need for interdisciplinarity for the individual project.

In this way, you are brought to involve people from different disciplines early in a project, which enables shared contributions to the fundamental hypotheses.

It is a truism that any idea has its origin in one brain only. Even so, ideas, once vocalized, are often significantly matured and improved together with other people. A current scientific article contains a greater amount of scientific data than it did twenty-years-ago. In my mind, this questions if one or a few specialized scientists now can manage on their own.

New technology and instruments drive much of this development: The more technology makes possible, the more impossible it becomes for one scientist to remain updated, and the more specialists must work together. A sound approach to handle this situation seems to require a broader team of investigators than we were used to just a few years ago.

As just one example, developments in methods to analyse large biological molecules have made advanced techniques such as X-ray crystallography a significant and widely important element in biomedicine. But providing and analysing such data still takes scientists with specialized insights. In this light, interdisciplinarity is a response to handle multiple and complex scientific data.

### Interdisciplinarity demands:

- That you have a social instinct
- That you possess personal inclusiveness
- That you have confidence in the rest of the group
- That everyone in the group works together as peers
- That everyone in the group is a specialist and that each is held responsible for their field
- That the participants do not regard one another as either main or sub-suppliers

# Selection of interdisciplinary research networks and centres at Aarhus University and Faculty of Health

**iPSYCH**  
The Lundbeck  
Foundation Initiative for  
Integrative Psychiatric Research  
[ipsych.au.dk](http://ipsych.au.dk)

**MIND**  
Membrane Receptors  
in Neuronal Disease.  
A Lundbeck Foundation  
Research Centre  
[mind.au.dk](http://mind.au.dk)

**MEMBRANES**  
Center in membrane  
proteins  
[membranes.au.dk](http://membranes.au.dk)

**CENTRE  
FOR MUSIC  
IN THE BRAIN**  
[musicinthebrain.au.dk](http://musicinthebrain.au.dk)

**NCA**  
Neurocampus Aarhus University –  
bridging basic and  
clinical research  
[neurocampus.au.dk](http://neurocampus.au.dk)

**CENTRE  
FOR ARCTIC  
HEALTH &  
MOLECULAR  
EPIDEMIOLOGY**  
[cah.au.dk/centre-for-arctic-health](http://cah.au.dk/centre-for-arctic-health)

**FOOD4BEING**  
Food and Nutrition for Health  
and Well-Being.  
Interdisciplinary  
Network  
[food4being.  
au.dk](http://food4being.au.dk)

**iSEQ**  
Centre for  
Integrative Sequencing  
[iseq.au.dk](http://iseq.au.dk)

**MINDHOOD**  
The Child Mental  
Health Research Program  
[mindhood.au.dk](http://mindhood.au.dk)

**CFIN/  
MINDLAB**  
Center of Functionally  
Integrative Neuroscience  
[cfin.au.dk](http://cfin.au.dk)

**CIRRO**  
Centre for Interventional  
Research in Radiation  
Oncology  
[cirro.dk](http://cirro.dk)

**DANDRITE**  
The Danish Research  
Institute of Translational  
Neuroscience  
[dandrite.au.dk](http://dandrite.au.dk)

**CIRRAU**  
Centre for integrated  
Register-based  
Research  
[cirrau.au.dk](http://cirrau.au.dk)

**ARC**  
Arctic Research Centre  
[arctic.au.dk](http://arctic.au.dk)

**iNANO**  
Interdisciplinary  
Nanoscience Center  
[inano.au.dk](http://inano.au.dk)

PROFESSOR, MSc, PhD EVA CECILIE BONEFELD-JØRGENSEN

## Our data becomes more usable

An interdisciplinary project is difficult! We all start off sitting in our own bubble and each with their own field – the challenge is to get the bubbles to talk together. I remember that at the beginning of e.g. the FETOTOX project, we could not really understand what one another were saying... So interdisciplinarity involves at least having the energy and the desire to understand what the others in the group are saying.

When we are several disciplines together, we might experience an increased number of “challenging” questions, where you are puzzled for a moment, but which still get you to think: Perhaps there is something in it? And this challenge is necessary, especially if we from the natural and health sciences also have to cover the human aspect of our field of research.

FETOTOX includes researchers from Denmark, Norway, Greenland and Shanghai on the one hand, and researchers from several disciplines on the other: epidemiologists – or molecular epidemiologists – chemists and toxicologists carry out the experimental part, while midwives and nurses are in close contact with the people in the study population involved in the research project.

In my own research group, The Centre for Arctic Health & Molecular Epidemiology, I work together with chemists, with doctors, with molecular medical students, with health scientists and with human toxicologists. But we may go even further and invite more people to join us, so we can really exploit the strength of the interdisciplinary. So perhaps we will expand the group with a protein crystallographer or a geneticist.

Of course, an interdisciplinary approach does not have the answer to everything. We still need basic research that digs deep into a corner of a scientific field. But, in my experience, the applicability of our data improves with interdisciplinarity, for example when we involve the research groups who work closely with people.

I have previously worked with others who were like me and had the same background; they worked in the same way as me and within the same discipline, but my experience is that the project is improved when more expertise contributes and works together.

And today I actually think that it would be really boring if we were just four molecular biologists /human toxicologist sitting together and corroborating one another.

### An interdisciplinary project requires:

- That you acknowledge the limitations of your own knowledge
- That you are open to the fact that an idea can be unfolded even further together with others
- That something in the collaboration makes progress
- That you trust one another

“

**In an interdisciplinary project, we all start off sitting in our own bubble and each with their own field – the challenge is to get the bubbles to talk together.**

#### INTERDISCIPLINARY RESEARCH WORK

- Multidisciplinary project on the interaction between mother-fetus exposure to environmental toxicants and risk for abnormal development, FETOTOX
- Centre for Arctic Health & Molecular Epidemiology

ASSOCIATE PROFESSOR, MA, PhD FINN OLESEN

## Academic identity is changing – and a new arena is emerging

Today, research foundations often have very specific problems and needs that they want to find answers to, and they do not take into account how academia at the university is divided by traditional monodisciplinarity and discipline-bound problem solving.

When the problem defines what you have to collaborate on, many researchers and PhD students will be orientated towards both the university and the private sector, just as the national and regional sectors play a growing role. My own field – information studies – was interdisciplinary from birth; it involves the humanities, computer science and sociology, and today I even work with partners outside of the university, for example from healthcare and industry.

Practical problems will always be complex, even though you often try to solve them in a monodisciplinary fashion. They should, therefore, be dealt with by more than one discipline – there are simply some problems that we cannot uncover and handle without the help of others.

When you work with cross-disciplinarity, you contribute with your established academic skills, they come **into play**. But you do not just let go completely. That is what you do in interdisciplinarity, where there is a shared obligation to put the monodisciplinary identity **at stake**. Such an interdisciplinary project takes a long time to mature, if you do not know the others in advance, because you spend a long time learning to understand each other and each other's competences. It requires commitment to achieve **genuine disagreement**, which

is needed to allow for the important discussions – because the process also requires you to touch on one another's academic competences and to dare to get to the core of them.

So the question is this: Am I willing to give up my hard core monodisciplinary approach? This is what happens with interdisciplinarity. So – in my own case – when I am working in an interdisciplinary manner, I am doing 'poor' philosophy in a monodisciplinary sense. But in true interdisciplinary work, academic identity transform into a new academic field.

Is this even possible in a PhD project? Yes, it is – with a supervisor who is well-versed in interdisciplinarity and who respect other academic standards different from her own – then interdisciplinarity can be achieved in a three-year project.

I see it as a shared commitment to bring academic identity into play in interdisciplinary projects, and in my own case, I am today both a traditional philosopher on the one hand, and an interdisciplinary, tech-philosopher on the other.

### Interdisciplinarity

- Presupposes a high level of academic identity and a willingness to bring it into play with the expectation of creating added value

### INTERDISCIPLINARY RESEARCH WORK

- Chairman, AU Telemedicine
- Founding member, Centre for Science, Technology and Society Studies

“Research foundations do not always take into account how we have divided up academia at the university.”

“

From early 2009 to early 2012, the four original ARCs\* produces 93 coauthored publications, compared with 15 published by similar coauthors during the three years prior to ARC development.

Katya Ravid et al. "Building Interdisciplinary Biomedical Research Using Novel Collaboratives". Academic Medicine, Vol.88, No.2, 2013

\* interdisciplinary research groups termed affinity research collaboratives (ARCs)

5