

# THE PURSUIT OF NOVELTY

How Centers of Excellence nurture creativity

**Work hard**  
**- pursue excellence**

**Nurture trust**  
**and motivation**

**Collaborate,**  
**crossing silos**

**Interact**

**Be sloppy**  
*(in a controlled way)*

**Be theoretically**  
**open-minded**

**Take risks**  
*(responsibly)*

**Promote diversity**  
**and plurality**

**Encourage independence**  
**and originality**

# Preface

## HOW CENTERS OF EXCELLENCE PROMOTE IDEAS AT THE HIGHEST INTERNATIONAL LEVEL

When asked to elaborate on the promotion of creativity at her center, one center leader replied, "Well, this is what the center is all about, you know!"

Indeed, generating novel ideas is very much what science is about. Nonetheless, in recent years, it has become still more apparent – as many have been warning for years – that the ability of science to generate novel ideas is in decline. While researchers still struggle to find a robust way of measuring changes in scientific novelty, the overall image seems rather bleak, and Denmark is unlikely to be any different<sup>1</sup>. Some reports indicate that this decline is permanent.

A decline in creativity is a problem for all of us, increasingly dependent as we are on new ideas to provide solutions to societal problems such as those incurred by climate change. This forces us to look for other ways of promoting creativity and of forming highly creative and ambitious research environments.

We are often told, by new Centers of Excellence, that a highly ambitious culture evolves, and is actively nurtured, from the centers' very beginning. The establishment of such a joint research venture clearly unleashes new energy and is seen as the chance of a lifetime to think big, inspiring ambition in, and offering encouragement to, center staff.

In other words, centers contemplate and discuss how to do better than merely good: How will they make the most of six to ten years of stable, flexible funding? How will

<sup>1</sup> Degn, L. and Alnor, E.D: Creativity in research – current perspectives on the nature of, the conditions for, and the role of creativity in research. Danish Center for Research and Research Policy, August 2024. Danish research is furthermore losing ground in international competition when measured by citation impact, which is correlated with creativity. The citation impact from Danish research, that is, the visibility of Danish research, has declined since 2012, the "miracle year" (Schneider, J. W. and Norn, T.: The Scientific Impact of Danish Research 1980 – 2020. Danish Center for Research and Research Policy, August 2023)

the center pursue breakthroughs and ideas at the highest international level? How will they create an exceptionally creative, ambitious, and stimulating environment for early-career researchers?

We believe that actively forming the culture and organization of a center to facilitate extraordinary ideas – as opposed to a more laissez faire approach – is highly consequential to the success of the center. This is one of the reasons why center leaders must have proven themselves not just as scientists but also as leaders.

We have asked the centers to share their experiences about how to nurture creativity, about the dilemmas involved, and about optimal conditions for the generation of novel ideas. We wish to thank the centers for giving the topic serious consideration, and we are impressed by the nuanced and inventive ways in which centers push for novelty.

While many of the ideas may be well-known among researchers, we still share them to be used as a catalogue of ideas, with the hope that they may inspire other researchers and research leaders.



*Dorte Dahl-Jensen*  
Chair



*Christian S. Jensen*  
Vice chair



*Søren-Peter Olesen*  
CEO



## Work hard, pursue excellence

In a sense, it is trivial to state that a tenet of promoting robust and creative research is to work hard and become an excellent scientist. But the actual importance of this core belief may easily be underestimated.

One center leader has made the point that creativity is, in essence, a kind of by-product of hard work; that is, one cannot be intentionally creative. Another reminds us that, **in the collective imagination, the value of sustained effort and repetition is probably under-valued, whereas the idea of "effortless and unexpected comprehension" is probably overvalued** as a way of promoting the generation of novel ideas.

Well-rehearsed stories present the generation of great new ideas as a fascinating result of serendipity, thus implying that anyone could stumble upon an act of genius. Perhaps most famously, Alexander Fleming 'accidentally' discovered penicillin; in more recent times, Morten Meldal discovered the 'click' reaction - a discovery that was ultimately rewarded with the Nobel Prize in 2022 - resulting from a failed experiment. But even here - perhaps especially so - skill and hard work are important ingredients (see below, "Be Sloppy").

## Nurture trust and motivation

Researchers are in a sense like inventors who collaborate while competing to make the same invention. On the one hand, they know that their ideas will improve with collaboration, to the benefit of everybody; on the other hand, too much openness might allow others to steal their ideas. How to balance this?

Senior staff members at the centers explain that the balance between competition and collaboration changes toward collaboration when a center starts up because of the common goal. The larger the center is, however, and the more unclear it is who is and isn't part of the center, the more uncertainty arises about the extent to which one can share research ideas in good faith.

Center leaders highlight trust and motivation as cornerstones in stimulating a collaborative and creative environment. In the words of one center staff member, **"Trust is the overlooked superpower."** Centers promote an atmosphere of inclusiveness and tolerance, e.g., in terms of tolerating "stupid questions" – and, more generally, creating a positive and relaxed atmosphere. Hence, the centers' investment of time in informal meetings and even get-togethers such as canoeing together or establishing cake clubs is not just about well-being; it is of direct significance to the quality of the research carried out.

## Push for new perspectives

*Center leaders are well aware of the importance of challenging their own and the center staff's perspectives and assumptions as a way of helping new ideas to emerge. Centers of Excellence use and explore a wide variety of ways to push each other to think out of the box.*

## Collaborate, crossing silos

Perhaps the most mentioned activity to stimulate new thinking and new ideas is that of working together across traditional scientific fields or subfields, such as when quantum physicists work together with molecular biologists to develop non-invasive measurements of biological systems.

It is well-known that interdisciplinary research, involving the combination of traditions, theories, methods, and objects from divergent fields, is fertile ground for making breakthroughs. Hence, it may seem surprising that some studies find that group diversity is inversely proportional to the novelty of ideas generated<sup>1</sup>. However, the centers provide nuance to this in the sense that they find interdisciplinary collaboration to be highly demanding; in fact, they report that **it often takes years to get to a point where the mutual understanding across scientific fields and languages is sufficiently advanced for the collaboration to pay off**. But ultimately, in the experience of centers of excellence, cross-disciplinary collaboration is highly valuable.

<sup>1</sup> Degn, L. and Alnor, E.D: Creativity in research – current perspectives on the nature of, the conditions for, and the role of creativity in research. Danish Center for Research and Research Policy, August 2024.

## Interact

Another form of scientific activity highlighted is the interactions among colleagues in closely related fields in or outside the center. **When two centers asked their staffs about promoters of creativity, collaboration was a clear first**. Peer-to-peer collaboration takes several forms and has important benefits:

- The most common ways of promoting interaction include organizing retreats, inviting guest researchers, engaging in international collaborations and conferences, consulting advisory boards, and holding pre-conference or pre-experiment meetings. There is significant variation, testifying to the effects of trying out new, fruitful formats and constellations, such as idea incubators and “think big” events, or cross-level and cross-discipline grouping. Some centers have decided that Ph. D. students must have two mentors to ensure they receive diverse feedback.
- Center leaders and senior staff are aware of the importance of informal meeting places, such as at coffee machines. Indeed, early-career researchers report that these often facilitate chance encounters with colleagues who happen to be able to help them with or guide them to further resources and networks.
- A common observation is that a flat hierarchy is essential; hierarchies where less experienced researchers are hesitant to share their ideas and ask questions are counterproductive to creativity.
- Some centers actively promote the acquaintance of colleagues to make sure that everybody knows what resources are available at the center, for instance, via systematic onboarding processes. Moreover, some centers actively promote a system involving common problem solving, for instance, inviting the entire center to help in solving particularly hard challenges.
- Most centers collaborate with private or public organizations and undertake ambitious outreach activities. Such activities may be highly time-consuming, especially in the case of starting up new companies. But generally, the centers find that such interaction, as well as a balance between theoretical and applied thinking, can be a benefit to the center.

## Be sloppy (in a controlled way)

Some centers emphasize the need to undertake research with a low level of control, for instance, in the sense that the data should be allowed, as much as possible, to speak for itself. **“Plans are useless, but planning is essential,” a researcher reminds us.**

Certainly, observers of science have pointed out that many great discoveries seem to be “chance” discoveries. This observation points to the importance of some element of “sloppiness” in the sense of, say, allowing an experiment to unfold without too much intervention. But at the same time, it reminds us that the value of uncontrolled experimentation is dependent on “a prepared mind” and a person with sufficiently high skills to see when something entirely new emerges<sup>1</sup>.

<sup>1</sup> Degn, L. and Alnor, E.D: Creativity in research – current perspectives on the nature of, the conditions for, and the role of creativity in research. Danish Center for Research and Research Policy, August 2024.

## Be theoretically open-minded

The recognition of the value of combining skills with low control also illustrates a point about theoretical openness. If something radically new is observed, it may require an ability to look beyond conventional interpretations to actually understand the observations as novel. This is not always a trivial matter, and for this reason, one center reports that it grappled with this problem by hiring a theoretician of science to stimulate theoretical openness among center staff.

## Take risks (responsibly)

The willingness to take risks was mentioned by several centers as important in the pursuit of novel ideas.

Centers of Excellence are given the ability and confidence to take risks and are encouraged to do so. However, risk-taking involves dilemmas. Unsuccessful research can be challenging to publish, and publication is key to a successful career. **Center leaders are especially hesitant to let early-career researchers pursue risky projects** because, at this stage, they are extremely dependent on building a publication portfolio for career advancement.

At Centers of Excellence, a very large part of the research is carried out by early-career researchers. By inference, this means that much of the research cannot be too risky. One center, however, has tried to solve this problem by offering extended funding to Ph.D.'s who take on a risky project in case the research fails.

## Promote diversity and plurality

The centers generally emphasize the importance of diversity in terms of age, gender, nationality, etc., but in some scientific areas, promoting, for example, gender balance is challenging. Many centers mention that Centers of Excellence have the benefit of encompassing many different colleagues who work within the same broad scientific area and may have new, relevant perspectives or may be able to demonstrate equipment. This essential dynamic is underpinned by having shared facilities, a key benefit of a physical center.

# Encourage independence and originality

Centers of Excellence are expected to deliver breakthroughs within their specific topic as described in their research plan. But what do center leaders do if they, or one of their early-career researchers, come up with a brilliant and bold idea for a project that does not obviously fit with the research plan? **What do center leaders do if one of their core researchers with essential skills gets their own grant, drawing them away from the center?**

In both cases, the centers' response is flexibility and encouragement. Center leaders are aware that the researchers will improve and be more motivated if they increasingly get to carve out their own niche, allowing for the evolution of the next generation of research leaders who pursue their own ideas. Center leaders often nudge post-docs to apply for grants to become research leaders in their own right while offering them continued guidance and supervision and keeping them close to continuously benefit from their expertise.

## **THEME REPORTS FROM THE DANISH NATIONAL RESEARCH FOUNDATION - RESEARCHERS' PERSPECTIVES ON CONDITIONS OF RESEARCH**

Close contact with its grant holders is part of the Danish National Research Foundation's DNA. Annual follow-up meetings at the sites of each grant holder are a way of supporting the ambitious research centers through continual dialogue. At the meetings, the DNRF takes the opportunity to interview the center staff about how they view the broader issues that are directly consequential to the continued well-being of research and researchers.

Themes emerging from these interviews are collected in the annual meeting publications. In this way, researchers' perspectives become available to other stakeholders in the Danish research landscape who share the ambition of promoting Danish research and innovation.

### **ABOUT THE DANISH NATIONAL RESEARCH FOUNDATION (DNRF)**

The DNRF funds Danish basic research in all academic fields with the potential of becoming world leading. This is achieved mainly through flexible, long-term funding in the form of Centers of Excellence led by top scientists.

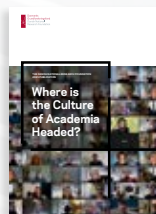
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*Editor: Morten Andreasen  
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*Danish National  
Research Foundation  
1057 Copenhagen K*

*T: +45 3318 1950  
E: [dg@dg.dk](mailto:dg@dg.dk)  
[www.dg.dk](http://www.dg.dk)*