INTERDISCIPLINARY RESEARCH

Why? How? When?

AGENDA

What is a scientific disciplin?

The Manhattan Project as an archtypical interdisicplinary project

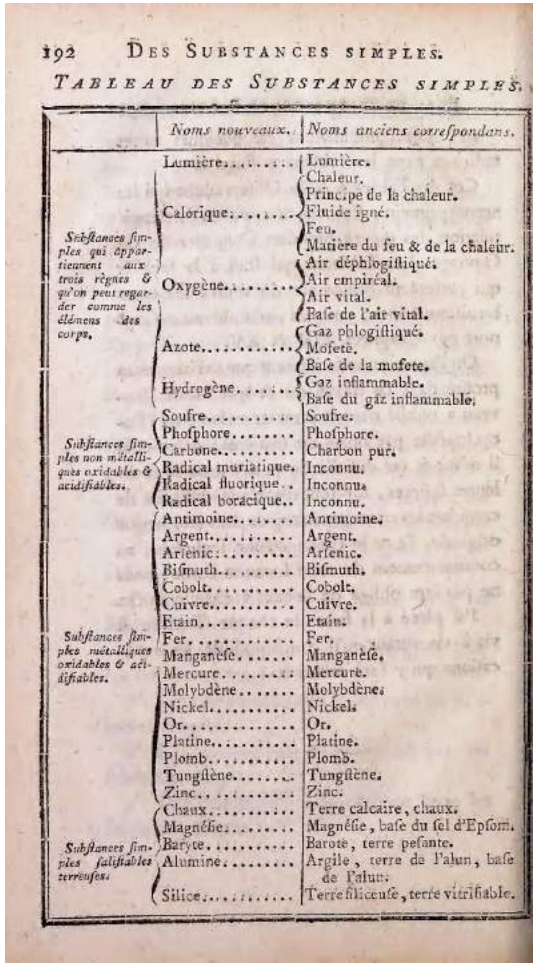
- Actors in the network; blending professionals
- Roles of partners in the project: who leads? Hierachy or democracy
- Professional standards: ours, yours or theirs?
- Complex organization, complex (unwanted?) results

Why do we need interdisicplinary: universal and local (AU) perspectives

How is interdisciplinary research made

"Occasions" for interdisciplinary research

WHAT IS A SCIENTIFIC DISCIPLIN?

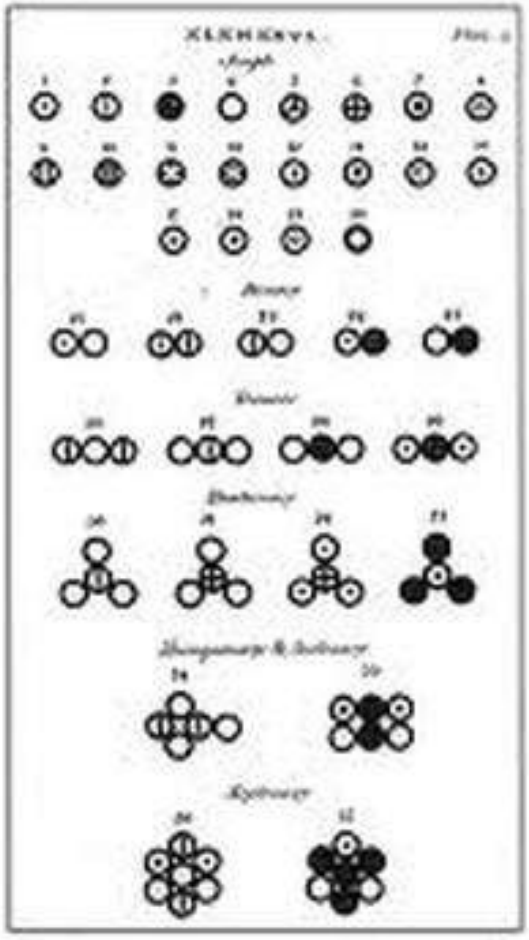


192 DES SUBSTANCES SIMPLES.

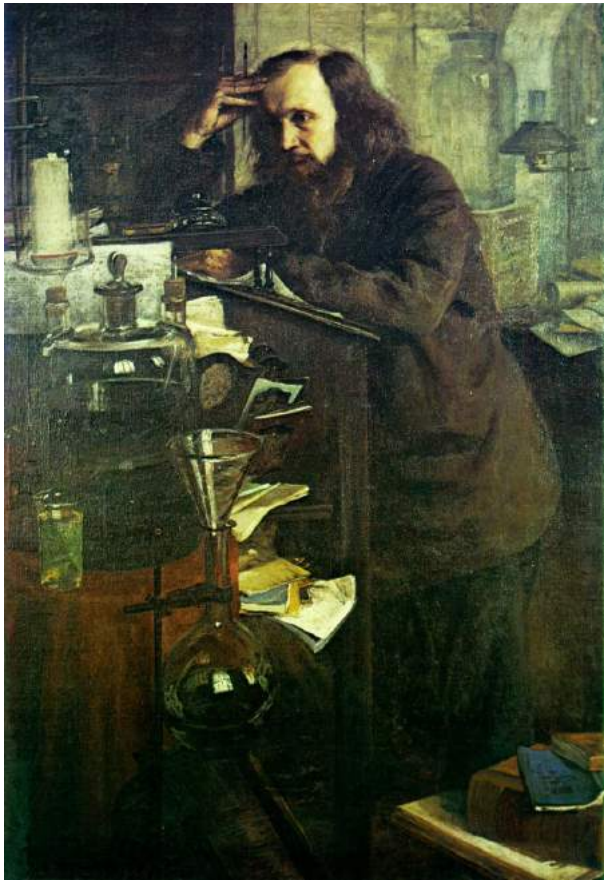
TABLEAU DES SUBSTANCES SIMPLES.

	Noms nouveaux.	*Noms anciens correſpondans.*
Subſtances ſimples qui appartiennent aux trois règnes & qu'on peut regarder comme les élémens des corps.	Lumière	Lumière.
	Calorique	Chaleur. Principe de la chaleur. Fluide igné. Feu. Matière du feu & de la chaleur.
	Oxygène	Air déphlogiſtiqué. Air empiréal. Air vital. Baſe de l'air vital.
	Azote	Gaz phlogiſtiqué. Moſete. Baſe de la moſete.
	Hydrogène	Gaz inflammable. Baſe du gaz inflammable.
Subſtances ſimples non métalliques oxidables & acidifiables.	Soufre	Soufre.
	Phoſphore	Phoſphore.
	Carbone	Charbon pur.
	Radical muriatique	Inconnu.
	Radical fluorique	Inconnu.
	Radical boracique	Inconnu.
Subſtances ſimples métalliques oxidables & acidifiables.	Antimoine	Antimoine.
	Argent	Argent.
	Arſenic	Arſenic.
	Biſmuth	Biſmuth.
	Cobolt	Cobolt.
	Cuivre	Cuivre.
	Etain	Etain.
	Fer	Fer.
	Manganèſe	Manganèſe.
	Mercure	Mercure.
	Molybdène	Molybdène.
	Nickel	Nickel.
	Or	Or.
	Platine	Platine.
	Plomb	Plomb.
	Tungſtène	Tungſtène.
	Zinc	Zinc.
Subſtances ſimples ſaliſiables terreuſes.	Chaux	Terre calcaire, chaux.
	Magnéſie	Magnéſie, baſe du ſel d'Epſom.
	Baryte	Barote, terre peſante.
	Alumine	Argile, terre de l'alun, baſe de l'alun.
	Silice	Terre ſiliceuſe, terre vitrifiable.

WHAT IS A SCIENTIFIC DISCIPLIN?



WHAT IS A SCIENTIFIC DISCIPLIN?



Reihen	Gruppo I. — R^1O	Gruppo II. — RO	Gruppo III. — R^2O^3	Gruppo IV. RH^4 RO^2	Gruppo V. RH^3 R^2O^5	Gruppo VI. RH^2 RO^3	Gruppo VII. RH R^2O^7	Gruppo VIII. — RO^4
1	H=1							
2	Li=7	Be=9,4	B=11	C=12	N=14	O=16	F=19	
3	Na=23	Mg=24	Al=27,3	Si=28	P=31	S=32	Cl=35,5	
4	K=39	Ca=40	—=44	Ti=48	V=51	Cr=52	Mn=55	Fe=56, Co=59, Ni=59, Cu=63.
5	(Cu=63)	Zn=65	—=68	—=72	As=75	Se=78	Br=80	
6	Rb=85	Sr=87	?Yt=88	Zr=90	Nb=94	Mo=96	—=100	Ru=104, Rh=104, Pd=106, Ag=108.
7	(Ag=108)	Cd=112	In=113	Sn=118	Sb=122	Te=125	J=127	
8	Cs=133	Ba=137	?Di=138	?Ce=140	—	—	—	— — — —
9	(—)	—	—	—	—	—	—	
10	—	—	?Er=178	?La=180	Ta=182	W=184	—	Os=195, Ir=197, Pt=198, Au=199.
11	(Au=199)	Hg=200	Tl=204	Pb=207	Bi=208	—	—	
12	—	—	—	Th=231	—	U=240	—	— — — —

WHAT IS A SCIENTIFIC DISCIPLIN?

Common language, specific for that disiplin

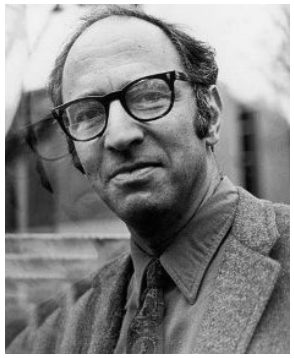
Common foci (e.g., elements, purification of elements)

Shared methodologies

Shared publication channels/venues for presentation (e.g., scientific journals, conferences)

"Social fabric": heroes (and villains!), professional insignia

CAN A SCIENTIFIC DISCIPLIN — DISINTEGRATE?



Anomalies

Findings not explained/explainable by paradigm

Example: Classic Newtonian physics versus Quantum Physics

Breakdown in central definitions/demarcations

Example: Synthesis of the transuranium "element" americum

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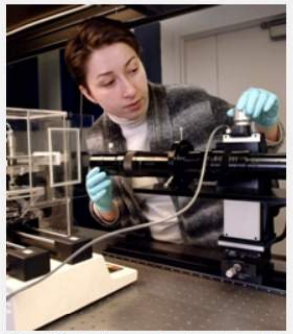
What is Interdisciplinary Research?

The definition of a "discipline" and discussions of the varieties of interdisciplinary, multidisciplinary, and trans-disciplinary research have occupied much scholarly debate. Although there is not always agreement on these definitions, it is clear that areas of research are dynamic -- continually emerging, melding, and transforming. What is considered interdisciplinary today might be considered disciplinary tomorrow.

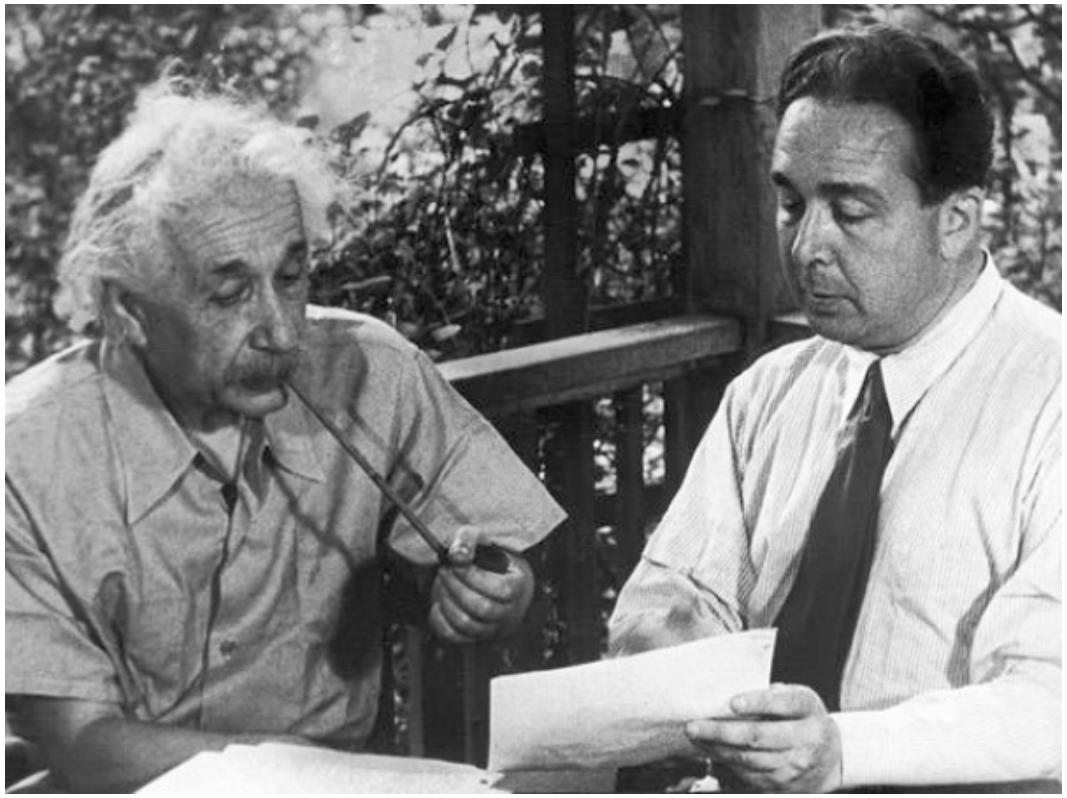
As a working definition of interdisciplinary research, we refer you to the definition set forth in a National Academies' report*:
"Interdisciplinary research is a mode of research by teams or individuals that integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or area of research practice."

*Committee on Facilitating Interdisciplinary Research, Committee on Science, Engineering, and Public Policy (2004). *Facilitating interdisciplinary research*. National Academies. Washington: National Academy Press, p. 2.



Sibel Korkut, a graduate student in chemical engineering at Princeton University, developed a technique for high-speed, low-cost printing of ultra-small lines for possible use in electronics. Her research was performed at the Princeton Center for Complex Materials (PCCM), a National Science Foundation Materials Research Science and Engineering Center.

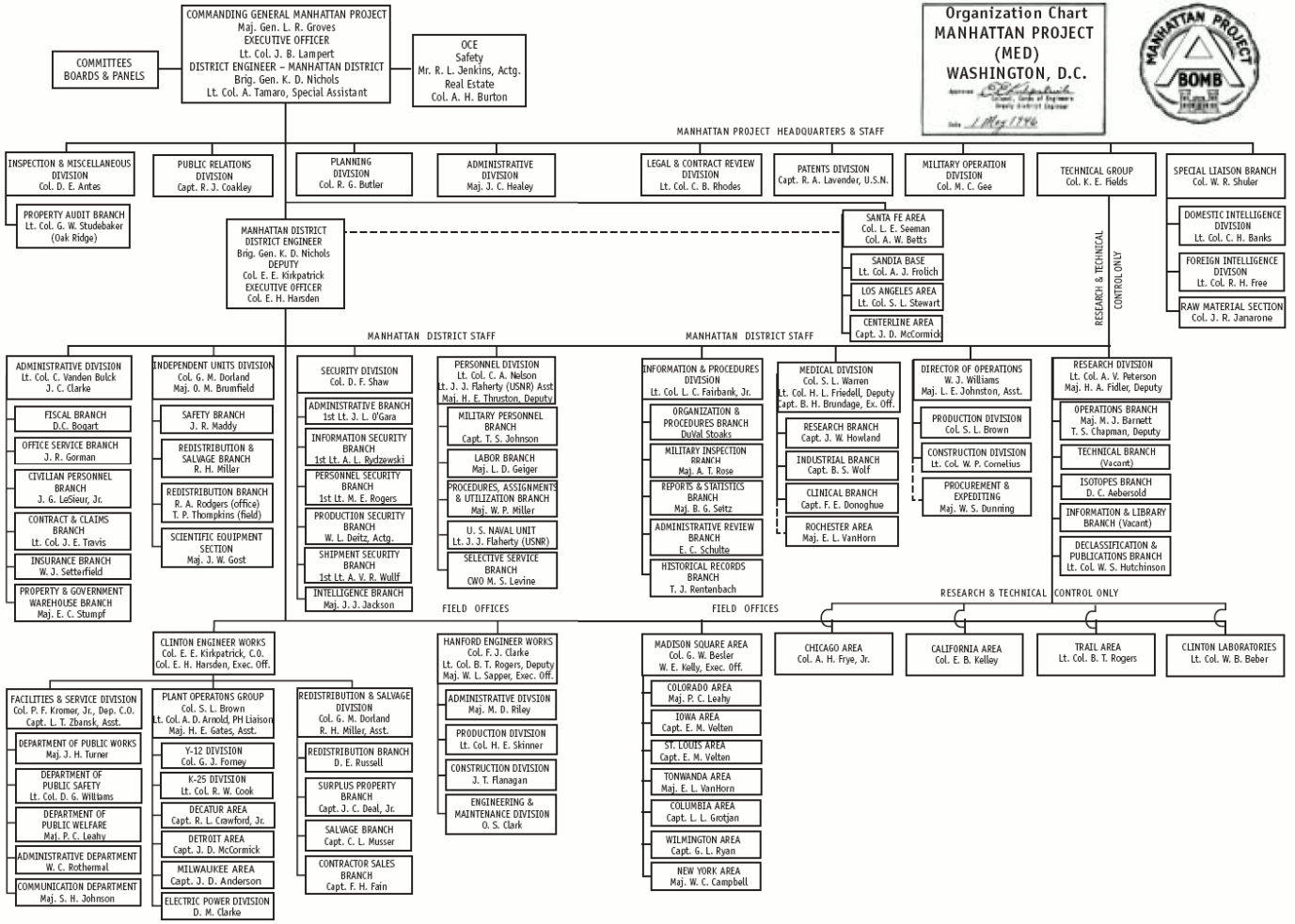
EXAMPLE OF A INTERDISCIPLINARY PROJECT



ACTORS IN THE MANHATTAN NETWORK

...an interdisciplinary network (?)

MANHATTAN PROJECT



ROLES OF PARTNERS IN THE PROJECT

https://www.youtube.com/watch?v=79D_rcWgO5Y

ROLES OF PARTNERS IN THE PROJECT

Simplistic representation of interdisciplinarity

Insignias:

- Uniforms: military staff
- Glassware: chemist/scientist

Functions

- Synthesis (!), scientist
- protecting valuable property, controlling it: the military

THE REAL THING.....

https://www.youtube.com/watch?v=89UNPdNtOoE

DO ACTORS UNDERSTAND EACH OTHER?

On one occasion an aggressive interrogation in congressional committe culminated in a rhetorical question from a bad-tempered Senator:

'What do you know about plutonium?'

Seaborg was able to answer that it was he who had discovered the element.

Gratzer (2002) "Eurekas and Euphorias"

MANHATTAN PROJECT

MANHATTAN PROJECT

Another basic question was the extent to which human beings could or should be studied to obtain the data needed to protect them. The radium dial painter data served as a baseline to determine how the effects of exposures in the body could be measured. But this left the question of whether plutonium, uranium, and polonium behaved more or less like radium. Research was needed to understand how these elements worked in the body and to establish safety levels. A large number of animal studies were conducted at laboratories in Chicago, Berkeley, Rochester, and elsewhere; but the relevance of the data to humans remained in doubt.

The Manhattan Project: A New and Secret World of Human Experimentation

MANHATTAN PROJECT

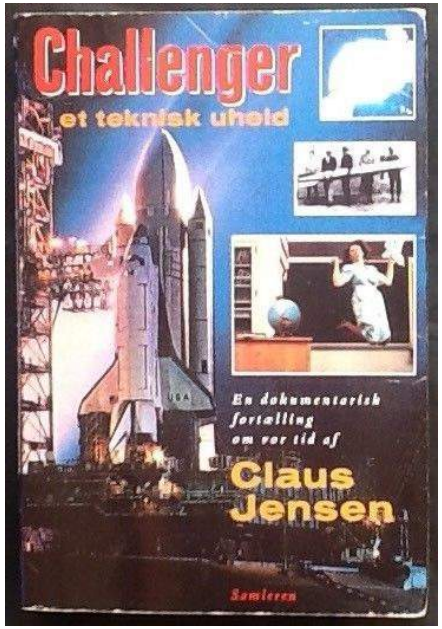
rpc1064a.jpg Rochester Public Library Local History Division

The university's metabolism ward, at what is now the Strong Memorial Hospital, became the central Manhattan District site for the administration of isotopes to human subjects. The two-bed ward, headed by Dr. Samuel Bassett, was part of the Manhattan District's **"Special Problems Division,"** which worked on the health monitoring of production plants, the development of monitoring instruments, and research on the metabolism and toxicology of long-lived radioactive elements.[51] An experimental plan called for fifty subjects altogether, in five groups of ten subjects each. Each group would receive plutonium, radium, polonium, uranium, or lead.[52] Although the exact number of subjects remains unknown, at least twenty-two patients were administered long-lived isotopes in experiments with plutonium (eleven subjects), polonium (five subjects), and uranium (six subjects).

The Manhattan Project: A New and Secret World of Human Experimentation

Complex organization, complex (unwanted?) results

https://www.youtube.com/watch?v=-mUCLHzWiJo



OBSERVATIONS FROM "MANHATTAN"

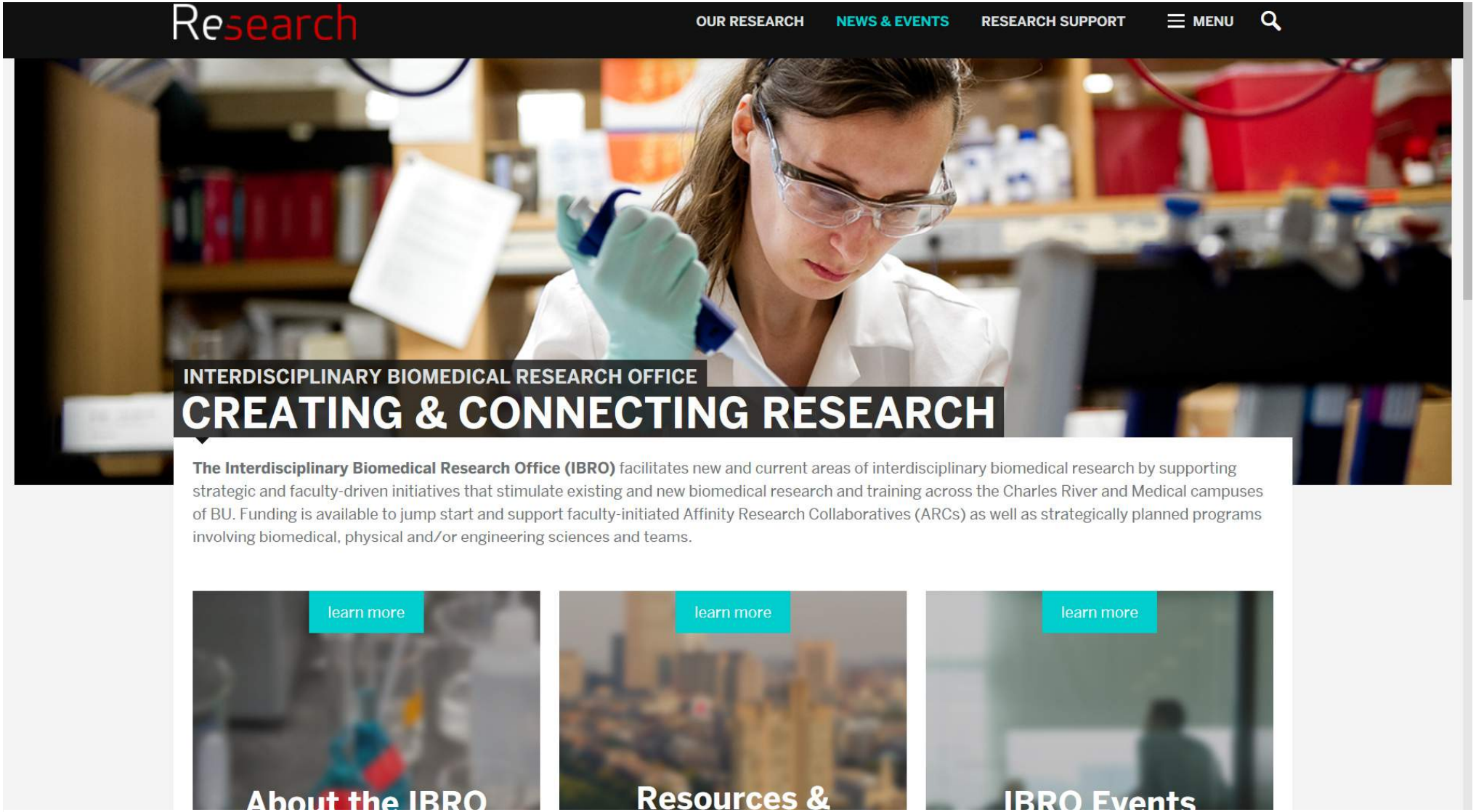
The Manhattan Project as an archtypical interdisicplinary project

- Actors in the network; blending professionals but keeping professions
  Workers, Scientists (several disciplines!), miltary, politicians

- Roles of partners in the project: who leads?
  Can be highly hierachical, **need of an organization**

- Professional standards: ours, yours or theirs?
  - Standards set from needs; complex decision

- Complex organization, complex (unwanted?) results
  - Outcome not up a single individual (not even the president)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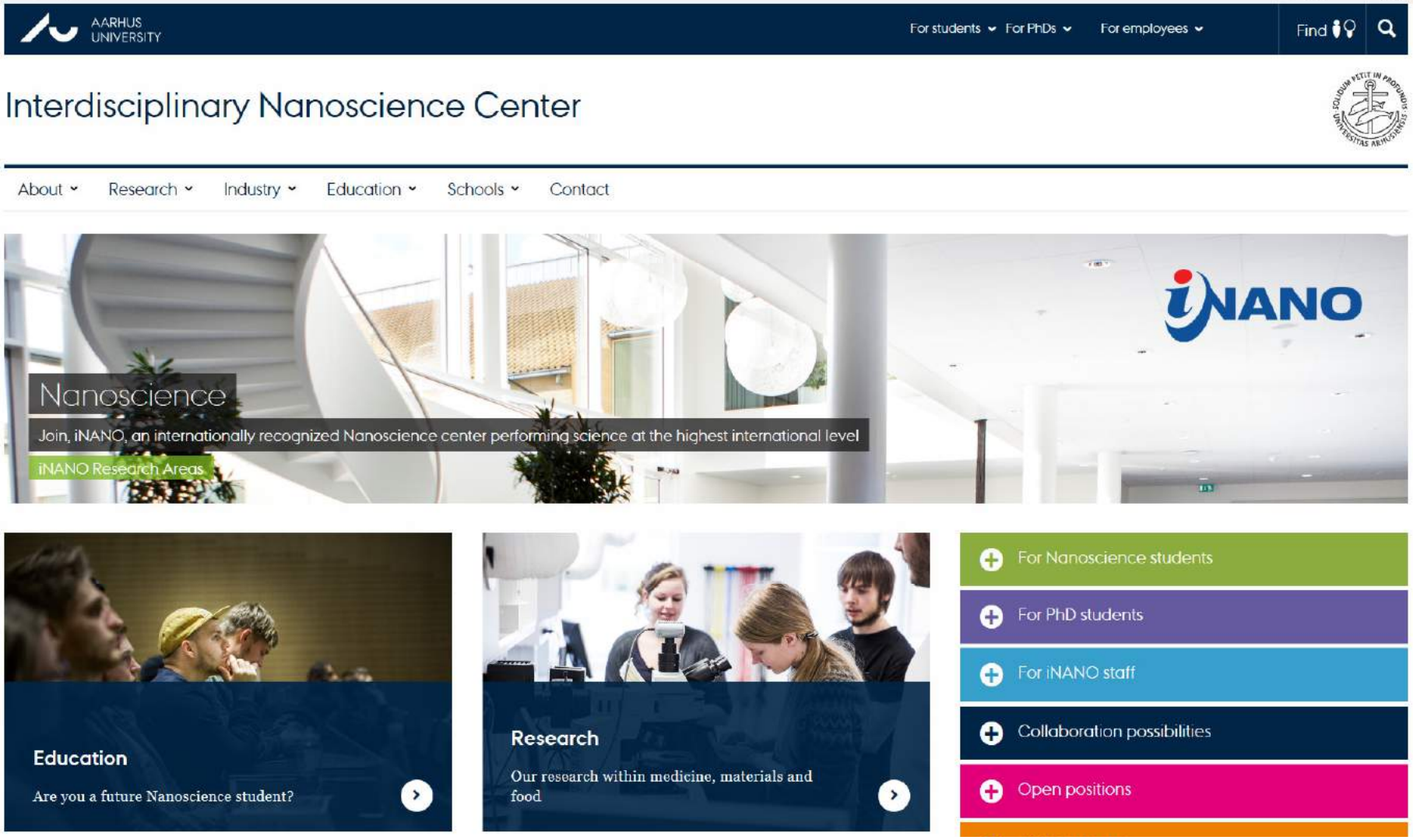
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WHY DO WE NEED INTERDIS. SCIENCE?

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

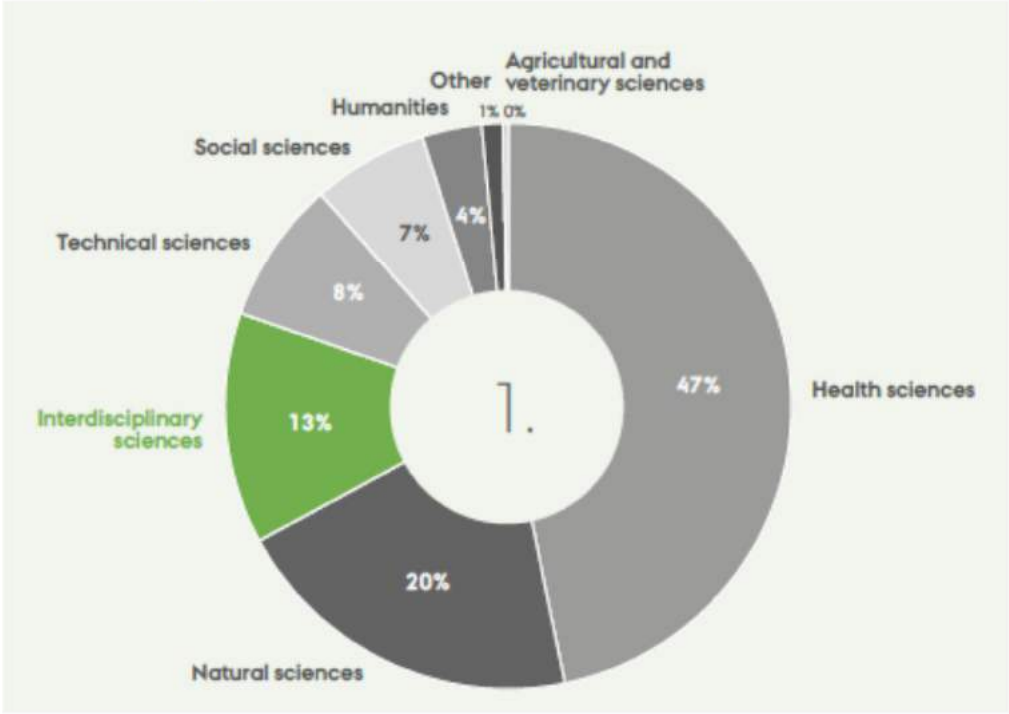
Can the battle be won from one discipline?

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.



STRATEGY

FOR THE MAIN ACADEMIC AREA

HEALTH

AT AARHUS UNIVERSITY

2013–2017

Health has three main strategic goals for the core activity Research:

1. Stimulating groundbreaking results through research excellence and interdisciplinary collaboration

Interdisciplinary research is one of the elements that is to propel AU forwards, given that many breakthroughs in research will take place on the borderlines between the traditional disciplines. It is, however, important to recognize that interdisciplinary research will only have the power to generate groundbreaking results if it rests upon a solid academic and professional foundation, which is why excellent research within the disciplines, which is crucial for successful interdisciplinary collaboration, must continue to be a hallmark of our university.

One criterion for success is the establishment of interdisciplinary centres that carry such professional weight that they have been able to put AU on the academic and scientific map in Denmark and abroad. The process of establishing and building up new interdisciplinary centres will be initiated as soon as possible. One of the challenges for these centres will be to encourage researchers to promote interdisciplinary collaboration and ensure the necessary dialogue across the academic fields.

For our students, these changes will materialize as new opportunities to participate in other types of research projects than previously in the context of BSc projects and MSc and PhD theses. Some interdisciplinary centres will also offer new degree programmes.

Health seeks to be a proactive and significant player in the interdisciplinary centres at AU – and as such we will actively help research to unfold between and across AU's four main academic areas.

Internally, our own main academic area will be alert to potential cross-departmental synergies. Also, the new University–Region agreement from 2011 between Health and the CDR provides a sturdy base for research initiatives, with responsibility for clinical and (in the longer term) public-health research resting solely with AU Health.

IMPLEMENTATION OF STRATEGY

Strategic criteria

If you apply for a fully financed PhD fellowship, you have to tick of the strategic criteria that your project falls within. You can choose more than one area. To do so, press the Ctrl+Alt (windows)/cmd ⌘ (Mac) button(s) and click on your desired options.

Your project has to fall within at least one of the Faculty of Health's strategic criteria in order to be considered for a fully financed PhD fellowship.

WHY DO WE NEED INTERDIS. SCIENCE?

ELEMENTS IN INTERDISICPLINARITY

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

Interdisciplinary projects requires:

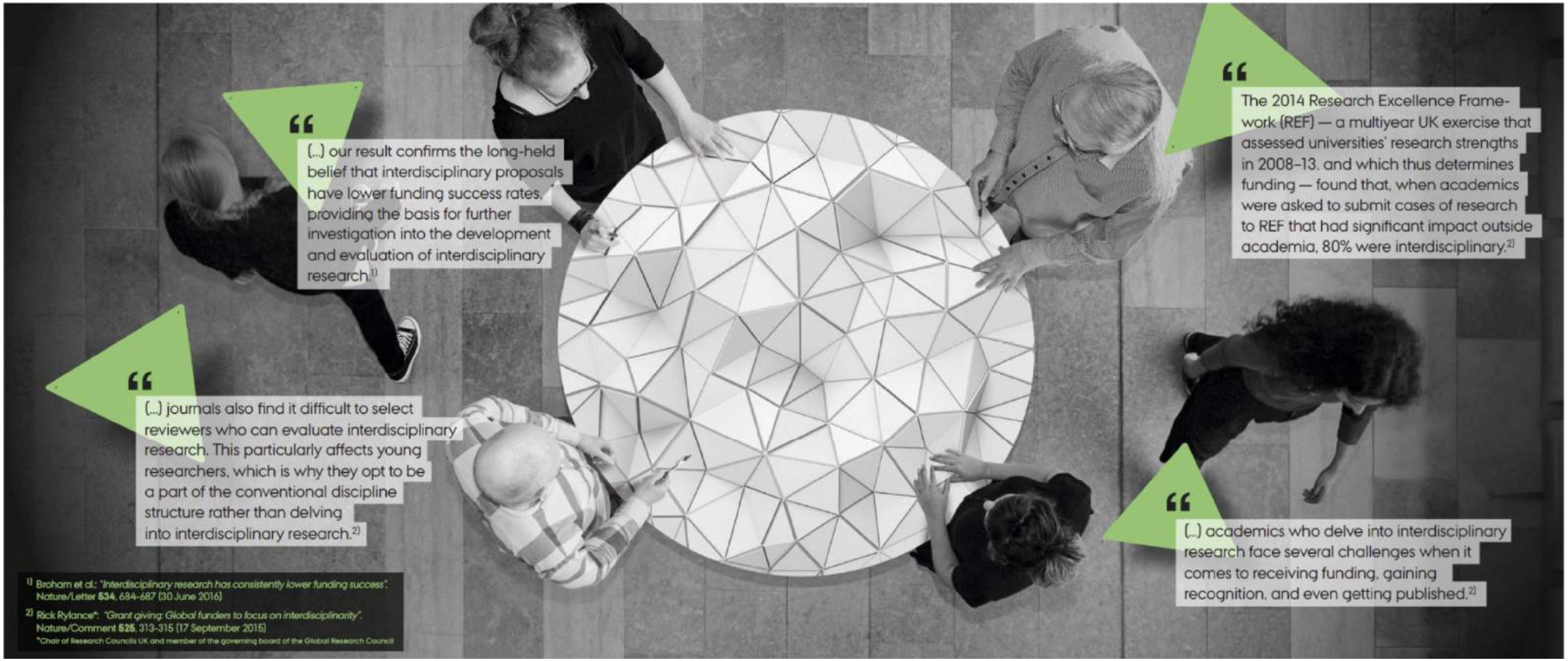
- Respect for the other participants
- Humility of personal achievements, combined with self-confidence of own contribution and competence
- Enthusiasm for learning and continuously updating knowledge

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

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


“
(...) 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.[1]
“
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.[2]
“
(...) 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.[2]
“
(...) academics who delve into interdisciplinary research face several challenges when it comes to receiving funding, gaining recognition, and even getting published.[2]
1) Braham et al.: "Interdisciplinary research has consistently lower funding success", Nature/Letter 534, 684-687 (30 June 2016)
2) 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

POINTS OF DISCUSSION

Challenges and Advantages for Students

Are Some Professions/Studies Intrinsically Interdisciplinary?

Examples of Monodisciplinary Research

(...)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