Dix thèses sur la transdisciplinarité

Équilibres épistémologiques, méthodologies et conditions matérielles de la recherche scientifique

- Mouvement généralisé vers l'atténuation des barrières disciplinaires au sein d'universités traditionnellement très féodales (ex: Harvard, University College, etc.)
- Dans l'enseignement, pour diversifier l'offre
  - De 7000 à 30000 diplômes universitaires interdisciplinaires (de 1973-2005 aux EU)
- Dans la recherche, pour limiter les luttes intestines entre départements
- Nouveaux sujets « porteurs » (gouvernance de la santé, changement climatique, néurosciences, usages technologiques…)

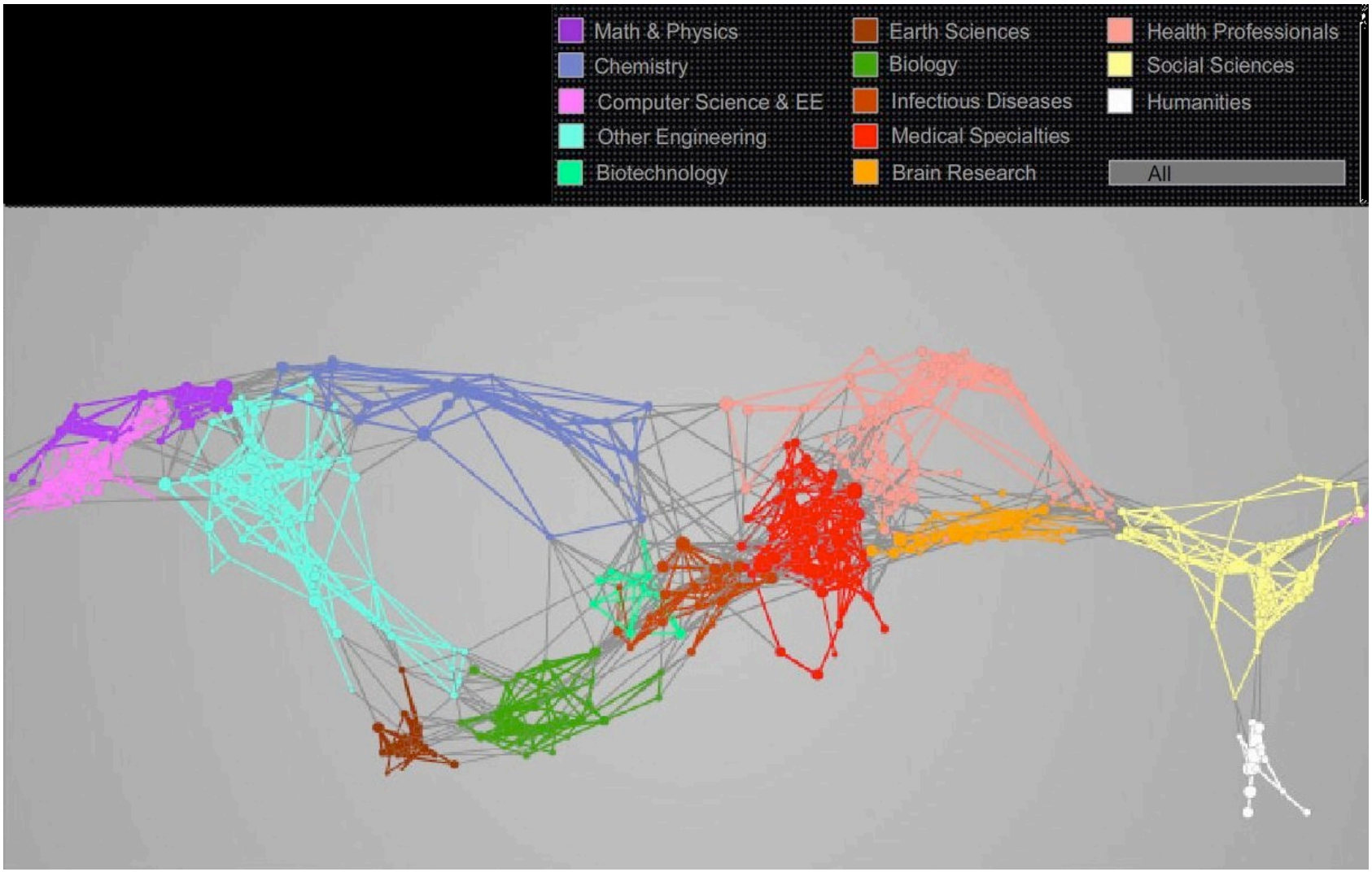
- Multi: chacun pour soi à parts égales
  - Professionnel: spécialiste d'une discipline
  - Pas de création d'un vocabulaire commun
- Inter: effort commun pour faire surgir un nouveau questionnement
  - Professionnel: expertise dans plusieurs domaines
  - Recherche de points de contact
- Trans: dépasser les barrières grâce à une théorie/méthode/paradigme
  - Le chercheur transdisciplinaire: une chimère
  - Intégration, interconnexion/sublimation des disciplines dans un savoir unique

1) La transdisciplinarité est une notion plurielle

- On peut parler de trois types de transdisciplinarités
  1) Sérielle (disciplines se donnant le relais sur un objet) (ex: rationalité)
  2) Synchronique (objet à multiples entrées) (ex: épidémiologie)
  3) Synthétique (réaménagement disciplinaire) (ex: système)

2) La transdisciplinarité est conditionnée par les équilibres épistémiques en jeu

- Mapsofscience.com
- Discipline = cluster de revues savantes
- 16000 revues => 554 domaines disciplinaires
- Cartographiées selon les références et mots-clés


Math & Physics
Chemistry
Computer Science & EE
Other Engineering
Biotechnology
Earth Sciences
Biology
Infectious Diseases
Medical Specialties
Brain Research
Health Professionals
Social Sciences
Humanities
All

3) La transdisciplinarité n'est pas une issue nécessaire de l'évolution des sciences

- J Withfield (2008) An Indifference to Boundaries. *Nature*, 451(21): 872-3
- Dénoncer le *buzz*
- « La logique du centre commercial appliquée à l'université »

nature Vol 451(21) February 2008

SPECIAL REPORT

An indifference to boundaries

As some of the world's largest universities undergo dramatic departmental restructuring to foster interdisciplinary research, **John Whitfield** asks whether they're making the right move.

Immunologists at Imperial College London have been tripping over a sticky problem: the structures of the molecules they are working on. The obvious go-to team is the institute's strong corps of structural biologists. But the immunologists are in the division for cellular and molecular biology, whereas the structural biologists are in the division of molecular bioscience. Splitting the funding — and the credit — causes turf wars. The solution? A department of life sciences that merges three biological divisions. "We decided we needed to break the incentive to be selfish," says ecologist Ian Owens, who heads the new interdisciplinary department.

Established three months ago, the department is part of a trend at traditionally structured universities towards initiatives that foster interdisciplinary research. Harvard University — which has a reputation as a place of powerful departmental fiefdoms — and University College London are also retigging their institutions to remove internal barriers and encourage researchers to come together in new combinations. Part of the trend springs from subject areas that have emerged over the past decade — such as global health, climate change, neuroscience and systems biology — that straddle the boundaries of older disciplines.

It is an idea pioneered by boutique institutes such as Santa Fe Institute in New Mexico, where complexity theory was developed; Bell Laboratories in New Jersey, where lasers and information theory were developed; and the UK Medical Research Council's Laboratory of Molecular Biology in Cambridge, where a group of physicists-turned-biologists pioneered molecular biology.

Social engineering

"Without any exceptions, over the past century the lead scientist on any major discovery has internalized a great deal of scientific diversity," says science historian Rogers Hollingsworth of the University of Wisconsin-Madison. He studies the types of research that lead to major breakthroughs in biomedical science — the kinds that win Nobel, Lasker or Crafoord prizes — and what gives the places that do that research their edge. Such internalization, Hollingsworth says, is most likely to happen in small institutes that have few internal barriers and flat hierarchies, where the bosses stay close to the labs. He points to Rockefeller University in New York and the California Institute of Technology in Pasadena as the exemplars of such an ethos.

Getting the right people together is important (see 'So, you want to be interdisciplinary ...'), as is the physical environment. While planning for the Janelia Farm research campus in Loudoun County, Virginia, director Gerald Rubin discovered that many of the most successful research institutes valued their canteen above all other facilities, owing to the contacts it helped people to create. So Janelia Farm serves three meals a day, seven days a week — but the cafeteria is open for just 90 minutes at lunchtime, encouraging people to bump into one another. Tables seat eight people, but research groups have a maximum size of six, so they must mingle, and you pay more for take-out than eating in. There's also an on-campus pub, serving free coffee all day to deter people from brewing up in their labs, and beer and meals in the evening. "We have done a huge amount of social engineering," says Rubin.

But while distinct departments still control rewards and credentials, not everyone believes that traditional universities will achieve the interdisciplinary success of specialist institutes such as Santa Fe — or even that it is a worthwhile exercise to attempt.

"Interdisciplinary is becoming the buzzword in science, but I'm extraordinarily sceptical about what's going to result in the next 10–15 years from this," says Hollingsworth. "Large research organizations have an enormous

Escape the intellectual blinkers

Researchers working in traditional departments have several places to go to escape the grind of teaching, applying for grants and running a lab. And the demand for such places is rising, says ecologist Marten Scheffer of Wageningen University in the Netherlands, who is helping to set up two interdisciplinary institutes.

Scheffer is a founding father of the institute Para Limes (PL), currently being installed in a fourteenth-century monastery in Doesburg in the Netherlands. The PL started running scientific meetings last year and plans to be fully operational by 2012, with an annual budget of €5.5 million. It will be staffed by cast of 'visitors' coming in for anything from a few days to a few months, and what they do is up for grabs, says Scheffer. "The most important thing is to bring the right mix of people together, and let it evolve."

He is also involved in setting up a similar but more focused institute in Uruguay, the South American Institute for Resilience and Sustainability Studies, which will look at issues such as fisheries, biodiversity and climate change from the broadest possible viewpoint. Like the PL, everyone will be just visiting. Meetings should start in 2009. "We're planning to get policymakers involved at an early phase," Scheffer says. He hopes that humanities researchers, politicians and artists will also visit the institute. J.W.

872

©2008 Nature Publishing Group

3) La transdisciplinarité n'est pas une issue nécessaire de l'évolution des sciences

- Au-delà des bornes disciplinaires:
  - Difficulté d'adaptation
  - Difficultés de financement
  - Difficultés de publication
  - (Avec des bémols: revues et cadres institutionnels pour la mise en place de recherches transdisciplinaires)

nature Vol 451|21 February 2008

SPECIAL REPORT

An indifference to boundaries

As some of the world's largest universities undergo dramatic departmental restructuring to foster interdisciplinary research, **John Whitfield** asks whether they're making the right move.

Immunologists at Imperial College London have been tripping over a sticky problem: the structures of the molecules they are working on. The obvious go-to team is the institute's strong corps of structural biologists. But the immunologists are in the division for cellular and molecular biology, whereas the structural biologists are in the division of molecular bioscience. Splitting the funding — and the credit — causes turf wars. The solution? A department of life sciences that merges three biological divisions. "We decided we needed to break the incentive to be selfish," says ecologist Ian Owens, who heads the new interdisciplinary department.

Established three months ago, the department is part of a trend at traditionally structured universities towards initiatives that foster interdisciplinary research. Harvard University — which has a reputation as a place of powerful departmental fiefdoms — and University College London are also rejigging their institutions to remove internal barriers and encourage researchers to come together in new combinations. Part of the trend springs from subject areas that have emerged over the past decade — such as global health, climate change, neuroscience and systems biology — that straddle the boundaries of older disciplines.

It is an idea pioneered by boutique institutes such as Santa Fe Institute in New Mexico, where complexity theory was developed; Bell Laboratories in New Jersey, where lasers and information theory were developed; and the UK Medical Research Council's Laboratory of Molecular Biology in Cambridge, where a group of physicists-turned-biologists pioneered molecular biology.

Social engineering

"Without any exceptions, over the past century the lead scientist on any major discovery has internalized a great deal of scientific diversity," says science historian Rogers Hollingsworth of the University of Wisconsin-Madison. He studies the types of research that lead to major breakthroughs in biomedical science — the kinds that win Nobel, Lasker or Crafoord prizes — and what gives the places that do that research their edge. Such internalization, Hollingsworth says, is most likely to happen in small institutes that have few internal barriers and flat hierarchies, where the bosses stay close to the labs. He points to Rockefeller University in New York and the California Institute of Technology in Pasadena as the exemplars of such an ethos.

Getting the right people together is important (see 'So, you want to be interdisciplinary ...'), as is the physical environment. While planning for the Janelia Farm research campus in Loudoun County, Virginia, director Gerald Rubin discovered that many of the most successful research institutes valued their canteen above all other facilities, owing to the contacts it helped people to create. So Janelia Farm serves three meals a day, seven days a week — but the cafeteria is open for just 90 minutes at lunchtime, encouraging people to bump into one another. Tables seat eight people, but research groups have a maximum size of six, so they must mingle, and you pay more for take-out than eating in. There's also an on-campus pub, serving free coffee all day to deter people from brewing up in their labs, and beer and meals in the evening. "We have done a huge amount of social engineering," says Rubin.

But while distinct departments still control rewards and credentials, not everyone believes that traditional universities will achieve the interdisciplinary success of specialist institutes such as Santa Fe — or even that it is a worthwhile exercise to attempt.

"Interdisciplinary is becoming the buzzword in science, but I'm extraordinarily sceptical about what's going to result in the next 10–15 years from this," says Hollingsworth. "Large research organizations have an enormous

Escape the intellectual blinkers

Researchers working in traditional departments have several places to go to escape the grind of teaching, applying for grants and running a lab. And the demand for such places is rising, says ecologist Marten Scheffer of Wageningen University in the Netherlands, who is helping to set up two interdisciplinary institutes.

Scheffer is a founding father of the institute Para Limes (PL), currently being installed in a fourteenth-century monastery in Doesburg in the Netherlands. The PL started running scientific meetings last year and plans to be fully operational by 2012, with an annual budget of €5.5 million. It will be staffed by cast of 'visitors' coming in for anything from a few days to a few months, and what they do is up for grabs, says Scheffer. "The most important thing is to bring the right mix of people together, and let it evolve."

He is also involved in setting up a similar but more focused institute in Uruguay, the South American Institute for Resilience and Sustainability Studies, which will look at issues such as fisheries, biodiversity and climate change from the broadest possible viewpoint. Like the PL, everyone will be just visiting. Meetings should start in 2009. "We're planning to get policymakers involved at an early phase," Scheffer says. He hopes that humanities researchers, politicians and artists will also visit the institute. J.W.

872

©2008 Nature Publishing Group

4) Il faut apprendre à gérer les allers-retours entre disciplinarité et transdisciplinarité

- Un cas intéressant : le phénomène des *joint appointments* pour enseignants ayant des compétences à la charnière entre deux ou plusieurs disciplines (es. chaire en sociologie et cyberculture)
- Laquelle va être coupée en cas de restrictions budgétaires?
- Militer pour le disciplinarité/transdisciplinarité?
- Deux pôles entre lesquels la recherche scientifique oscille

5) La transdisciplinarité est une dynamique de « fluidification » épistémologique

- Elle intervient à des moments précis et dans des contextes socio-économiques favorables
- Chaque fois qu'il y a une exigence de reconfiguration des équilibres scientifiques
- Emergence de nouveaux objets, questionnements et/ou enjeux politiques (ex: STS, women's studies)
- Mais après le *dissolve* il y a toujours le *coagula* (historiquement ceci a été le cas pour nombre de nouveaux domaines)

6) La transdisciplinarité est un adaptateur de la science aux usages sociaux

- Quand une innovation scientifique doit trouver une application (possiblement commerciale), la discipline de laquelle elle est issue doit s'articuler avec d'autres disciplines afin de pouvoir assurer un impact social
- Secteur privé et la logique du « anything goes »

7) La transdisciplinarité n'est pas insensible aux conditions matérielles des professions intellectuelles

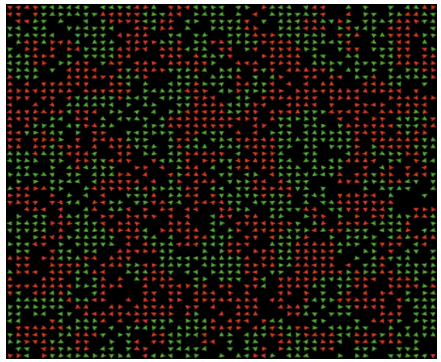
- Eléments pour une sociologie de la transdisciplinarité
  - Les carrières
  - Les évaluations
  - Les logiques internes à la production scientifique

7) La transdisciplinarité n'est pas insensible aux conditions matérielles des professions intellectuelles

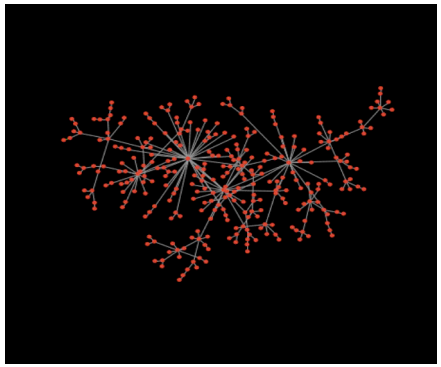
- Ex: Le phénomène des *impact factor whores*
  - Publier ou mourir
  - Auteurs multiples et *saucissonnage*
  - La course aux revues ayant un JIF élevé

8) Il ne faut pas crier à la transdisciplinarité à chaque fois qu'on lance une nouvelle méthode

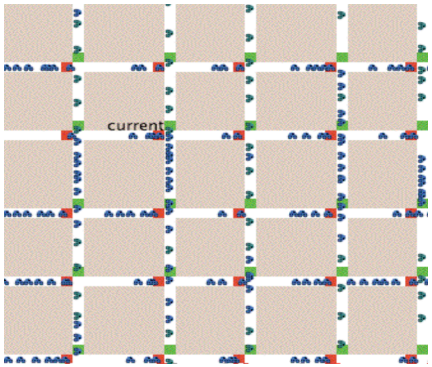
- Le cas de la simulation multi-agents
- Simulation assistée par ordinateurs de comportements sociaux
- Applicable aussi à la biologie, à l'économie, à la physique, à la médecine, etc.
- Équipes mixtes socio, informaticiens, mathématiciens, physiciens, etc.
- Excellent pour évaluer des phénomènes complexes



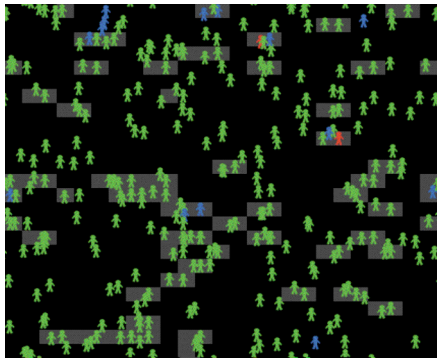
Ségrégation



Réputation

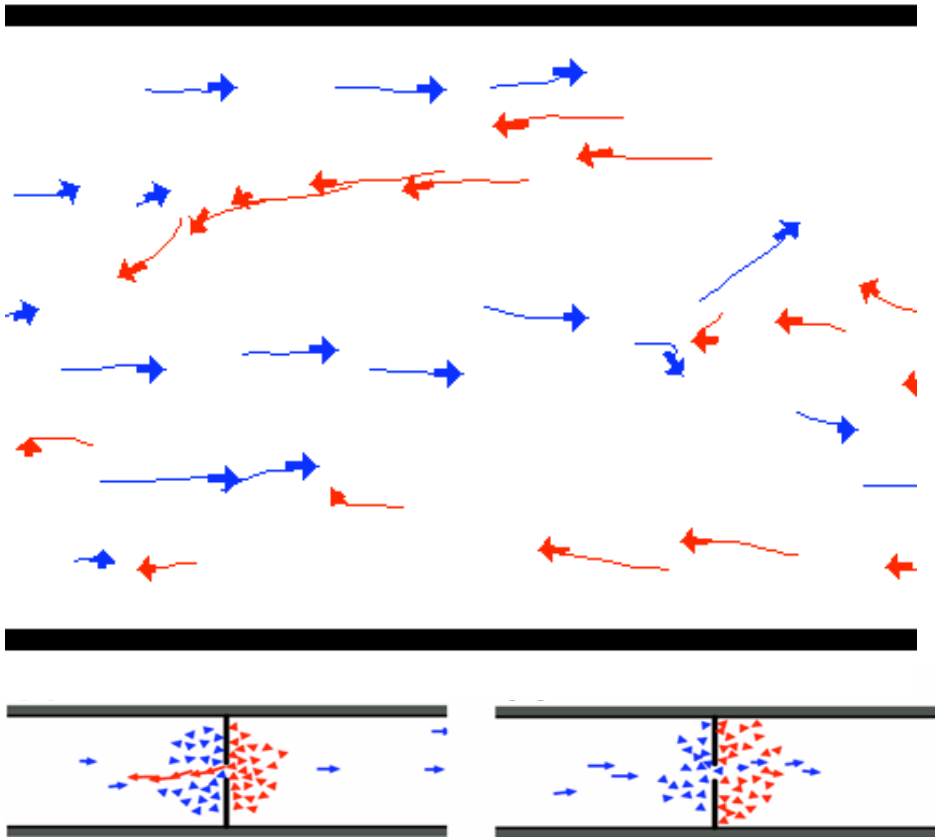


Trafic



Sida

- Herb Gintis « L'unification des sciences du comportement »
- Péril reductionniste: econophysics et sociophysics



9) La transdisciplinarité peut aider établir une grille d'évaluation des différentes contributions disciplinaires

- Pas de principe unitaire (nouvelle réduction ou impérialisme théorique)
- Le travail de l'« encyclopédant » (E. Morin)
- Mais cette grille se doit d'être toujours mobile et capable de s'adapter à la naissance de nouveaux objets/enjeux
- Mettre de la chair sur le squelette d'un paradigme

10) La transdisciplinarité peut aussi être un cache-misère pour toute forme de réductionnisme

- Déterminisme positiviste
  - Surdétermination biologique et génétique (de la molécule à la foule)
  - Synthèses néo-darwiniennes et évolutionnisme
  - La « petite cerise culturelle »

10) La transdisciplinarité peut aussi être un cache-misère pour toute forme de réductionnisme

- Culturalisme post-moderne
  - *Linguistic turn*
  - L'attraction pour les métaphores et pour le nomadisme conceptuel
  - L'affaire Sokal comme un exemple d'ouverture disciplinaire inconvenable

- Point de départ: Afin de pouvoir saisir l'unité de l'homme, les disciplines confluent dans un nouveau paradigme - en représente en même temps dépassement et sublimation.
- Mais la transdisciplinarité n'est ni inévitable ni unique.
- Elle accompagne l'émergence de nouveaux objets, de nouveaux aménagements épistémologiques, des nouvelles méthodologies.

- JIF, h-index, citations: ces mesures ont une distribution très asymétrique
  - La plupart des articles cite 30-100 autres articles
  - Certains en citent des milliers
  - 30% des articles publiés chaque année ne sont jamais cités
  - Le nombre médian de citations est 5
  - Les papiers les plus cités ont 200 citations
  - La majorité des chercheurs publie moins de 200 articles
  - Mais certains dépassent les 1000

- La valeur de ces index est strictement corrélée aux chercheurs et aux institutions auxquels ils sont rattachés
  - Cercles vertueux/vicieux selon les stades de la carrière des auteurs
  - Les chercheurs anglophones sont sur-représentés!
  - L'effet revue qui a des retombées sur l'évaluation scientifique et professionnelle des chercheurs

Journal	Stat. Period	JIF	Q2	μ
Phys Rev Lett	1966-2006	7.072	22	1.40
Ecology	1974-1994	4.782	52	1.75
Am Sociol Rev	1955-1996	3.205	36	1.60
Econometrica	1980-1996	2.402	35	1.58
Ann Math	1955-1995	2.406	25	1.45

Stringer, Sales-Pardo & Amaral, PLoS One **3**, e1683 (2008)