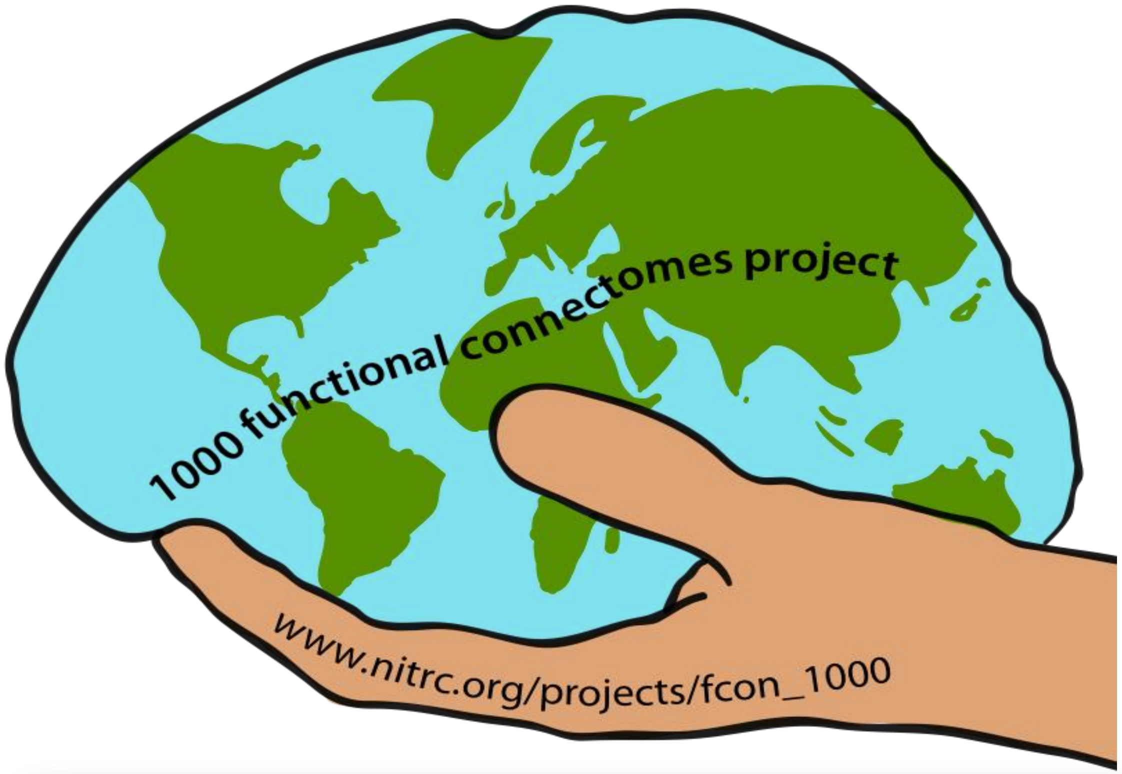

北京师範大學心理学部

Developmental Population Neuroscience

发展人口神经科学（开放脑科学范式）

左西年 (Xi-Nian Zuo)

Beijing Normal University

State Key Lab of Cognitive Neuroscience & Learning

National Basic Science Data Center

Chinese Data-sharing Warehouse for In-vivo Imaging Brain

DPN Course (Autumn 2022)

Lecture: Dr. Xi-Nian Zuo

Teaching assistant: Li-Zhen Chen (chenlz@mail.bnu.edu.cn)

Class 01 – *A Brief History of Developmental Population Neuroscience* (click the image to get materials)

http://deepneuro.bnu.edu.cn/?p=43&page=2

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科学研究的可重复性危机与应对

Behavioral and Brain Sciences

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The generalizability crisis

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tyarkoni@gmail.com

Target Article

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Generalization; inference; philosophy of science; psychology; random effects; statistics

Abstract

Most theories and hypotheses in psychology are verbal in nature, yet their evaluation overwhelmingly relies on inferential statistical procedures. The validity of the move from qualitative to quantitative analysis depends on the verbal and statistical expressions of a hypothesis being closely aligned – that is, that the two must refer to roughly the same set of hypothetical observations. Here, I argue that many applications of statistical inference in psychology fail to meet this basic condition. Focusing on the most widely used class of model in psychology – the linear mixed model – I explore the consequences of failing to statistically operationalize verbal hypotheses in a way that respects researchers' actual generalization intentions. I demonstrate that although the "random effect" formalism is used pervasively in psychology to model intersubject variability, few researchers accord the same treatment to other variables they clearly intend to generalize over (e.g., stimuli, tasks, or research

OPEN ACCESS

PLOS MEDICINE

Why Most Published Research Findings Are False

John P. A. Ioannidis

Published: August 30, 2005 • https://doi.org/10.1371/journal.pmed.0020124

Editor-in-Chief, Science Journals.
jberg@aaas.org

EDITORIAL

Progress on reproducibility

Marcia McNutt
Editor-in-Chief
Science Journals

EDITORIAL

Journals unite for reproducibility

Reproducibility

PSYCHOLOGY

Estimating the reproducibility of psychological science

Open Science Collaboration*

The hard road to reproducibility

Early in my Ph.D. studies, my supervisor assigned me the task of running computer code written by a previous student who was graduated and gone. It was hell. I had to sort through many different versions of the code, saved in folders with a mysterious numbering scheme. There was no documentation and scarcely an explanatory comment in the code itself. It took me at least a year to run the code reliably, and more to get results that reproduced those in my predecessor's thesis. Now that I run my own lab, I make sure that my students don't have to go through that.

In 2012, I wrote a manifesto in which I committed to best practices for reproducibility. Today, a new student arriving in my group finds all of our research code in tidy repositories, where every change is recorded automatically. Version control is our essential technology for record keeping and collaboration. Whenever we publish a paper, we create a "reproducibility package," deposited online, which includes the data sets and all the code that is needed to recreate the analyses and figures. These are the practices that work for us as computational scientists, but the principles behind them apply regardless of discipline.

It takes new students some time to learn how to work to these standards, but we have documentation

"My students and I continuously discuss and perfect our standards."

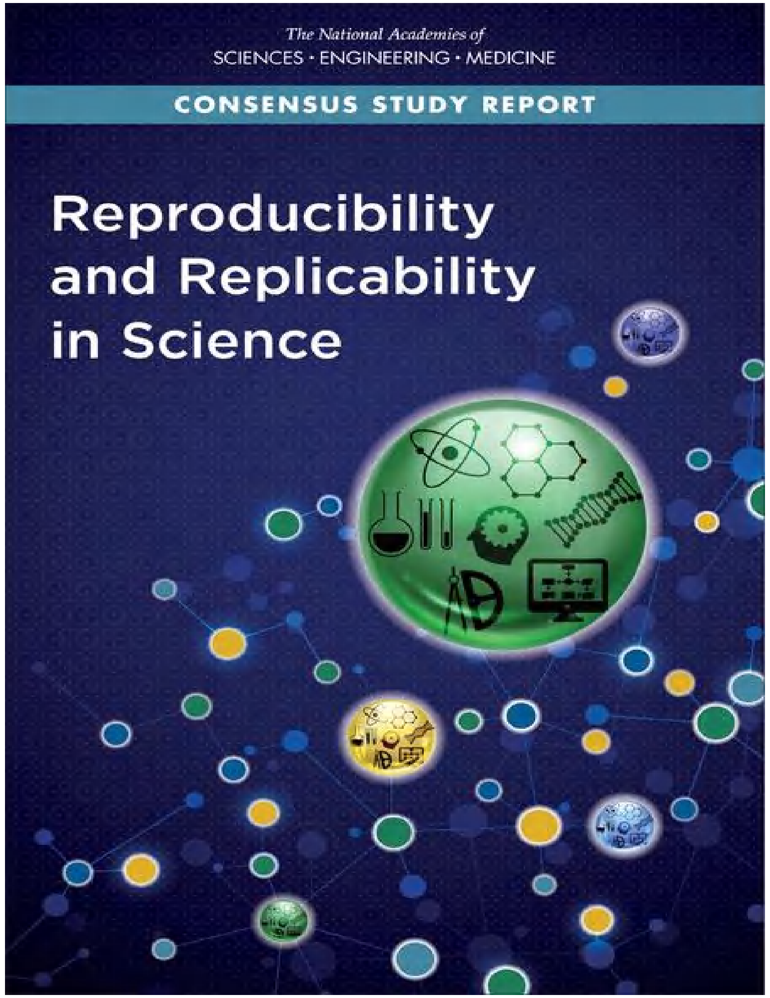
additional details were documented in the supplementary materials. It was the very definition of reproducible research.

Three years of work and hundreds of runs with four different codes taught us just how many ways there are to go wrong! Failing to record the version of any piece of software or hardware, overlooking a single parameter, or glossing over a restriction on how to use another researcher's code can lead you astray.

We've found that we can only achieve the necessary level of reliability and transparency by automating every step. Manual actions are replaced by scripts or logged into files. Plots are made only via code, not with a graphical user interface. Every result, including

新世纪的科学宣言：推进保障研究的可重复性和可持续

共识性研究报告



科学研究是船

研究
范式
生态
是锚

科学研究的可重复性是船

开放科学是锚

- 开放式科学**范式**
- 开放脑科学**概念**
- 开放脑科学**价值**
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- 开放脑科学**未来**


开放式科学范式

新世纪的科学研究范式：迈向团队化的开放科学研究和学术生态

Build up big-team science

Nicholas A. Coles, J. Kiley Hamlin, Lauren L. Sullivan, Timothy H. Parker & Drew Altschul

Researchers are creating grass-roots collaborative networks to tackle difficult questions in primate studies and more, but they need funding and other support.

"Leading the big-team-science movement can feel like climbing mountains without so much as a rope."

Are some of science's biggest questions simply unanswerable without redefining how research is done? This is the question that motivated the researchers who would later establish the ManyBabies Consortium: a grass-roots network of some 450 collaborators from more than 200 institutions who pool resources to complete massive studies on infant development (see, for example, ref. 1). Human infants are perhaps the most powerful learning machines on the planet – and understanding how that learning occurs could inform artificial intelligence, public policy, education and more. Yet a full understanding of infant learning seemed difficult (if not impossible) under the current research model.

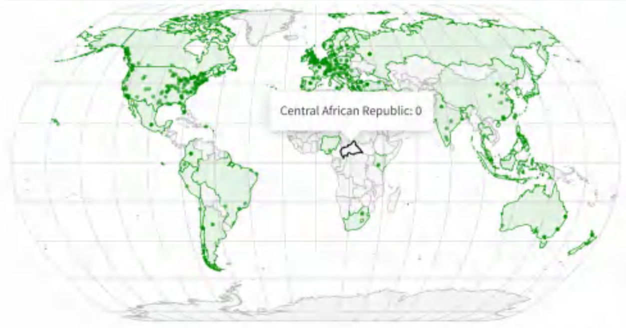
Consider the question of what captures infants' attention. Surely the probability that an infant will pay attention to, say, a rabbit, depends on presentation (for example, by a mother or a stranger), the child's previous experiences with mammals, what else is present alongside the rabbit, and much more. Unpacking this effectively would require dozens of experimental conditions and hundreds of infant participants. But most research projects are run by individual principal investigators and a shifting population of PhD students, meaning that data-collection efforts typically recruit fewer than 25 infants for each condition being tested[2].

But what if researchers worked interdependently and distributed work across many laboratories? Such consortia might be

Nature | Vol 601 | 27 January 2022 | 505

The Psychological Science Accelerator

760 researchers, 548 laboratories, 72 countries



Created by Nicholas A. Coles

心理科学加速器

Psychology looks to physics to solve replication crisis

What the CERN of psychology looks like.

Jon Brock

CellPress

Neuron
NeuroView

Big Science, Team Science, and Open Science for Neuroscience

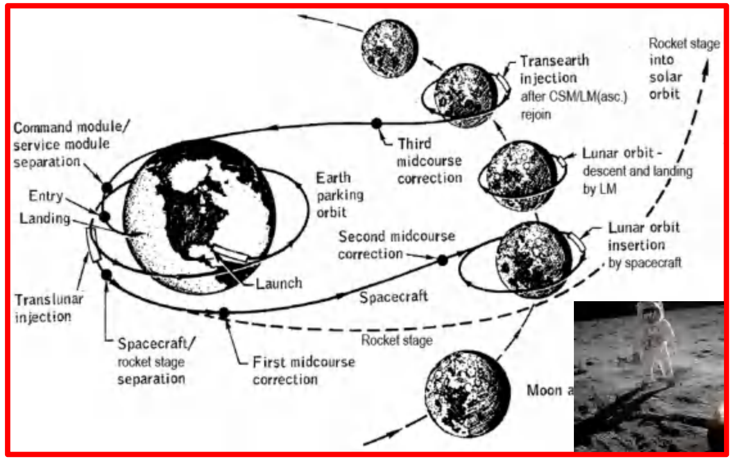
Christof Koch[1,*] and Allan Jones[1]
[1]Allen Institute for Brain Science, Seattle, WA 98109, USA
*Correspondence: christofk@alleninstitute.org

http://dx.doi.org/10.1016/j.neuron.2016.10.019

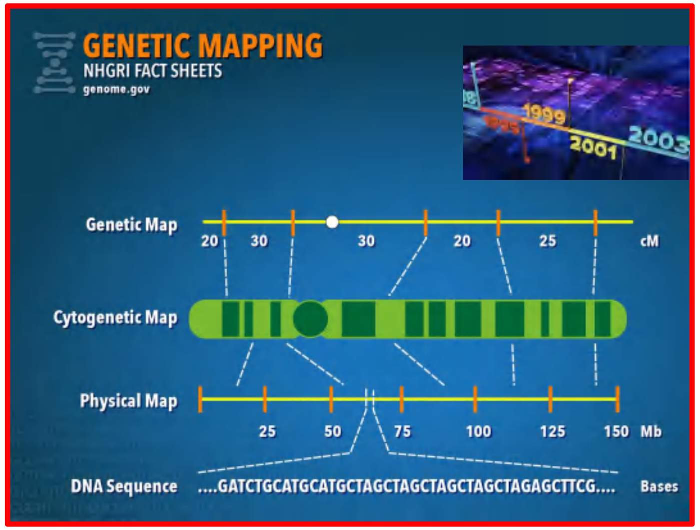
The Allen Institute for Brain Science is a non-profit private institution dedicated to basic brain science with an internal organization more commonly found in large physics projects—large teams generating complete, accurate and permanent resources for the mouse and human brain. It can also be viewed as an experiment in the sociology of neuroscience. We here describe some of the singular differences to more academic, PI-focused institutions.

团队化的大科学研究和实践：待解决问题的复杂性是核心特征

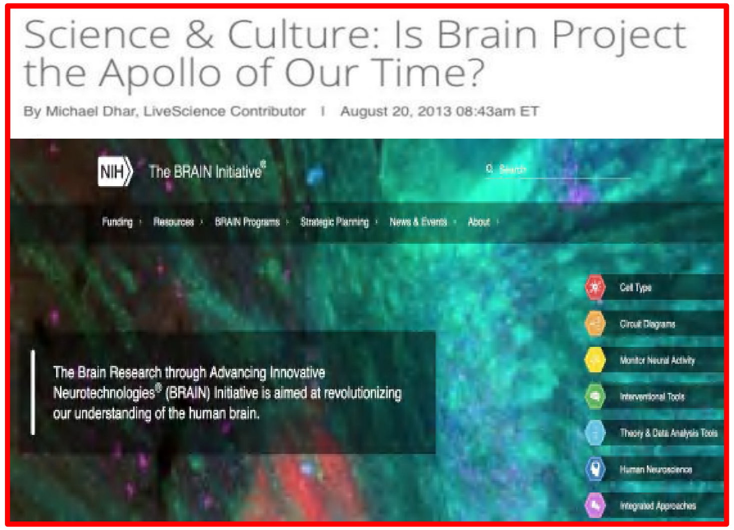
曼哈顿计划



阿波罗登月计划



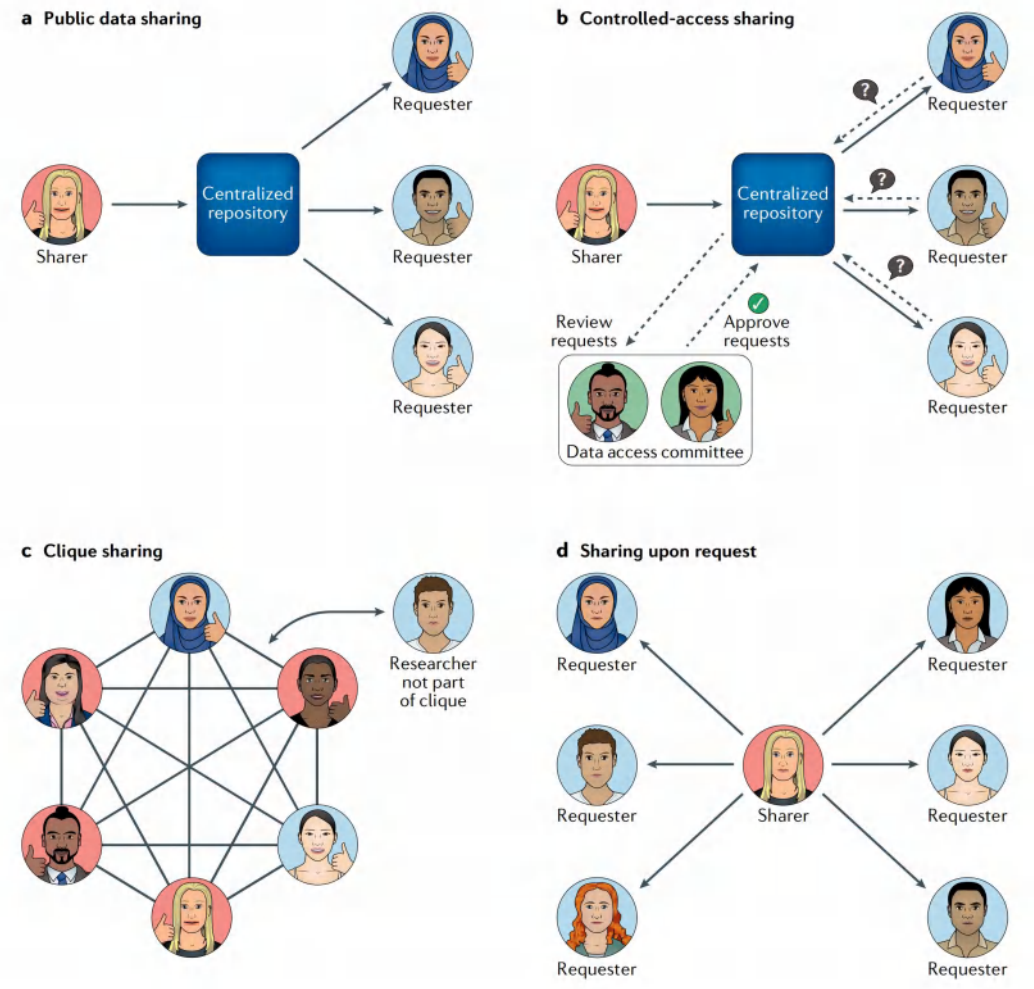
人类基因组计划



人类脑计划

开放式科学的学术与团体生态核心：数据共享与开放范式

Data是拉丁语单词Datum的复数形式，意指“a thing given”



Administration Priorities COVID Plan

BRIEFING ROOM

OSTP Issues Guidance to Make Federally Funded Research Freely Available Without Delay

AUGUST 25, 2022 • PRESS RELEASES

Today, the White House Office of Science and Technology Policy (OSTP) updated U.S. policy guidance to make the results of taxpayer-supported research immediately available to the American public at no cost. In a memorandum ↗ to federal departments and agencies, Dr. Alondra Nelson, the head of OSTP, delivered guidance for agencies to update their public access policies as soon as possible to make publications and research funded by taxpayers publicly accessible, without an embargo or cost. All agencies will fully implement updated policies, including ending the optional 12-month embargo, no later than December 31, 2025.

This policy will likely yield significant benefits on a number of key priorities for the American people, from environmental justice to cancer breakthroughs, and from game-changing clean energy technologies to protecting civil liberties in an automated world.

开放脑科学概念

神经影像数据共享推动开放式脑科学进程

Neuron
NeuroView

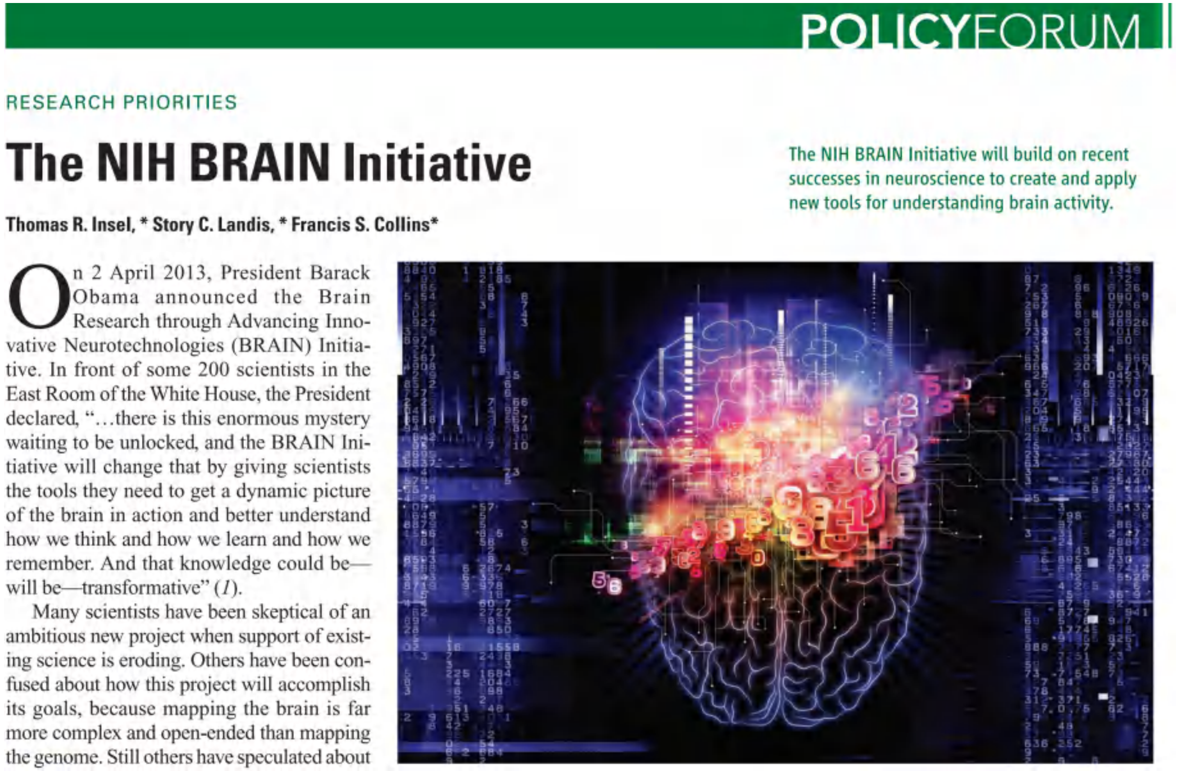
Open Neuroscience Solutions for the Connectome-wide Association Era

Michael Peter Milham[1,2,*]
[1]Center for the Developing Brain, Child Mind Institute, New York, NY 10022, USA
[2]Nathan S. Kline Institute for Psychiatric Research, Orangeburg, NY 10962, USA
*Correspondence: michael.milham@childmind.org
DOI 10.1016/j.neuron.2011.11.004

The neuroimaging community is at a crossroads. Long characterized by individualism, the data and computational and analytic needs of the connectome-wide association era necessitate cultural reform. Emerging initiatives have demonstrated the feasibility and utility of adopting an open neuroscience model to accelerate the pace and success of scientific discovery.

神经影像与大型脑科学计划

脑数据的量级



RESEARCH PRIORITIES

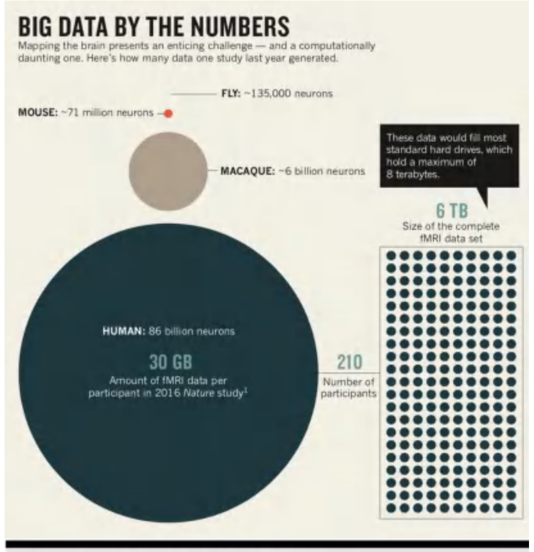
The NIH BRAIN Initiative

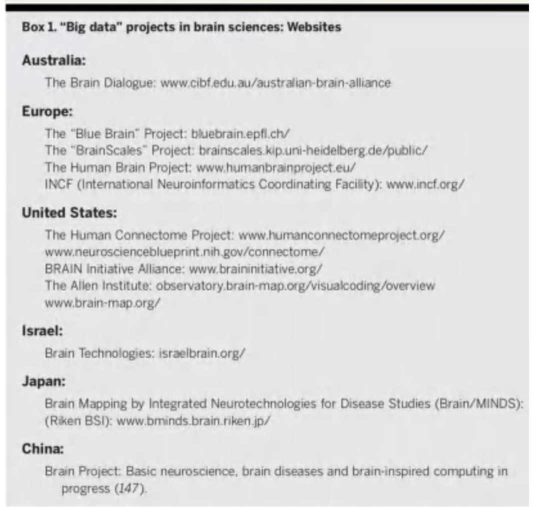
Thomas R. Insel,* Story C. Landis,* Francis S. Collins*

The NIH BRAIN Initiative will build on recent successes in neuroscience to create and apply new tools for understanding brain activity.

On 2 April 2013, President Barack Obama announced the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative. In front of some 200 scientists in the East Room of the White House, the President declared, "…there is this enormous mystery waiting to be unlocked, and the BRAIN Initiative will change that by giving scientists the tools they need to get a dynamic picture of the brain in action and better understand how we think and how we learn and how we remember. And that knowledge could be—will be—transformative" (*1*).

Many scientists have been skeptical of an ambitious new project when support of existing science is eroding. Others have been confused about how this project will accomplish its goals, because mapping the brain is far more complex and open-ended than mapping the genome. Still others have speculated about





Box 1. "Big data" projects in brain sciences: Websites

Australia:
The Brain Dialogue: www.cibf.edu.au/australian-brain-alliance

Europe:
The "Blue Brain" Project: bluebrain.epfl.ch/
The "BrainScales" Project: brainscales.kip.uni-heidelberg.de/public/
The Human Brain Project: www.humanbrainproject.eu/
INCF (International Neuroinformatics Coordinating Facility): www.incf.org/

United States:
The Human Connectome Project: www.humanconnectomeproject.org/
www.neuroscienceblueprint.nih.gov/connectome/
BRAIN Initiative Alliance: www.braininitiative.org/
The Allen Institute: observatory.brain-map.org/visualcoding/overview
www.brain-map.org/

Israel:
Brain Technologies: israelbrain.org/

Japan:
Brain Mapping by Integrated Neurotechnologies for Disease Studies (Brain/MINDS): (Riken BSI): www.bminds.brain.riken.jp/

China:
Brain Project: Basic neuroscience, brain diseases and brain-inspired computing in progress (*147*).

美国脑计划核心是神经影像技术研发

世界各国脑计划

《自然》系列社论：倡导开放式脑科学实践-促进认知神经科学揭示人类脑智奥秘

CAN BRAIN SCANS REVEAL BEHAVIOUR? BOMBSHELL STUDY SAYS NOT YET

Studies linking features in brain imaging to traits such as cognitive ability could be too small to be reliable.

By Ewen Callaway

"A lot of investigators have committed their careers to doing the kind of science that this paper says is junk."

Even larger studies

A scan using functional magnetic resonance imaging, or fMRI, shows areas of the brain that are active during speech.

nature

Time to recognize authorship of open data

The open-data revolution won't happen unless the research system values the sharing of data as much as authorship of papers.

"Crediting all those who contribute their knowledge to a research output is a cornerstone of science."

The international journal of science / 25 August 2022

nature

A crucial turning point for cognitive neuroscience

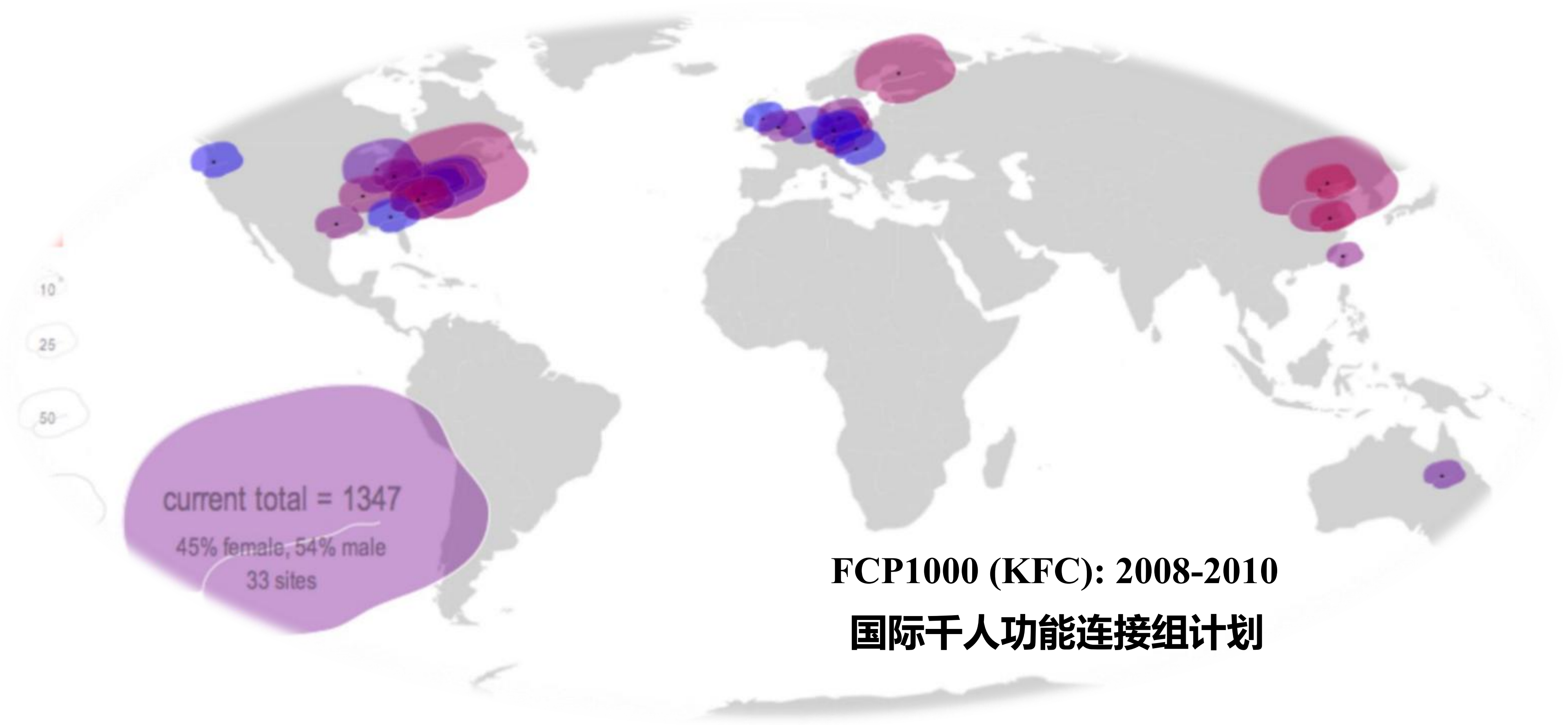
Researchers shouldn't fear papers that test and find flaws in methods. Such work contributes to better experimental designs and better science.

Predictive puzzles

"For a discipline to progress, we must not only appreciate its strengths, but also understand its weaknesses."


开放脑科学价值

国际案例分析：千人功能连接组计划



FCP1000 (KFC): 2008-2010

国际千人功能连接组计划

http://fcon_1000.projects.nitrc.org

促进领域研究理念和范式革新

NEUROSCIENCE

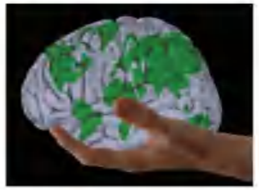
Collective brain maps

A new study, pooling brain-imaging data from 35 centers across the world, shows the power of data sharing and demonstrates a universal architecture of functional connections in the human brain.

Discovery-based scientific approaches, in which the analysis of large volumes of experimental data can lead to new hypotheses, are enabled by large-scale data sets aggregated through data sharing on a global scale. Although such data sharing has typically been the realm of fields such as genome analysis or protein structure, many other fields of biology can benefit from this. In neuroscience, for example, brain activity is monitored through techniques such as functional magnetic resonance imaging (fMRI). Access to large sets of fMRI data collected from many individuals would provide the neuroimaging community with the opportunity to explore the differences and commonalities of human brain function.

Given the myriad paradigms available for interrogating brain functional systems, many neuroscientists have remained skeptical about whether such a project would be feasible or whether it would produce meaningful results. New work from a large group of researchers now confirms that an approach capable of addressing this challenge is resting-state fMRI (R-fMRI). In this setting, researchers record approximately 5 minutes of brain activity while individuals rest quietly with their eyes open or closed. Paradoxically, imaging the brain at rest has proven an efficacious way of understanding our brains at work.

It has been known for some time that imaging the brain during rest reveals large-amplitude, low-frequency spontaneous fluctuations in the fMRI signal, which are temporally correlated across functionally related brain areas. "One thing that really captured my attention the first time I looked at fMRI images of the brain at rest was that the neural networks that you observe are highly similar to those seen in task based studies," says Michael Milham, a psychiatrist at New York University and coordinator of this work.



The resting-state imaging community has demonstrated the potential of carrying out discovery science in the human brain. Image courtesy of Marteen Mennes and Michael Milham.

These correlations yield detailed maps of functionally 'tuned' regions in the brain and together constitute an individual's 'functional connectome'. As Milham's group understood it, comprehensive mapping of the functional connectome of many individuals in a multicenter collaborative approach could be an invaluable resource for neuroscientists. Additionally, this work may lead to the development of approaches that allow researchers to discern genetic influences and brain-behavior relationships.

In an a priori uncoordinated fashion, Milham's group asked researchers across the world to share their R-fMRI scans. The purpose of the project, named the 1000 Functional Connectomes Project after its genomic sibling, "was to prove whether data gathered in different centers in a uncoordinated manner could generate meaningful results and whether there would be any strength to the data," explains Milham.

Milham's group and his many collaborators now provide an initial demonstration of the feasibility of pooling R-fMRI datasets across centers, in a project of unprecedented scale for the neuroimaging community. The 1000 Functional Connectomes project has gathered, in one year, R-fMRI data from 1,414 volunteers collected at 35 international centers. Those R-fMRI datasets have now been deposited in an open-access data repository (http://www.nitrc.org/projects/fcon_1000/). In the two months since it was launched, the site has had over 4,000 downloads.

Applying analytic methods to the aggregated data, Milham and co-workers demonstrate a universal architecture of functional connections in the resting human brain. They also demonstrate consistent loci of variability between individuals and centers, and interestingly, brain regions for which age and gender emerged as significant determinants of functional connectivity. But Milham is cautious about drawing too many conclusions from this study alone: "we must not forget that when we discover something through data mining then we have to do follow-up studies to validate it," he says.

For Milham, the value of resources such as this will be in their capacity to build normative maps of functional systems in the brain. In the future, these could be used for clinical applications in a similar way to how we use normal value ranges to interpret laboratory test results. Subsequent efforts will also tell whether this successful data sharing is a particularity of R-fMRI data or whether it will be reproduced with data from other functional imaging modalities or multimodal studies.

The 1000 Functional Connectomes project is alive and growing, and its creators are actively encouraging the broader community to contribute their R-fMRI data. Also, they are not alone in this endeavor, as other open-access resources for gathering and sharing of functional imaging data are available (fMRI Data Center, Function Biomedical Informatics Research Network, Open Access Series of Imaging Studies, BrainScape and BrainMap). These collaborative studies serve to show how data that are brought together can be much more than the sum of the parts.

Erika Pastrana

RESEARCH PAPERS

Biswal, B.B. *et al.* Toward discovery science of human brain function. *Proc. Natl. Acad. Sci. USA* **107**, 4734–4739 (2010).

Health officials warn of poor tuberculosis detection

Southeast Asia has a quarter of the world's poor and a third of its tuberculosis burden, with an estimated 4.9 million infected persons.

According to recent estimates from the World Health Organization (WHO), over 500,000 cases of multidrug-resistant tuberculosis (MDR-TB) occur annually worldwide—including 50,000 extensively drug-resistant tuberculosis (XDR-TB) cases. Southeast Asia has 28% of the world's MDR-TB cases, with India heading the list. But there are no national data for this and many developing countries on XDR-TB, and most cases are detected *ad hoc* among patients with MDR-TB not responding to treatment.

A March report from the WHO South-East Asia Regional Office cautions that despite marked improvement in detection and management of tuberculosis cases in national programs, an estimated one third of both regular and resistant cases in the region still go undetected or are treated outside national health programs with poor outcomes (*Bull. World. Health. Organ.* **88**, 164, 2010). These patients not only transmit the disease but also often develop drug resistance.

In most countries, national programs are not designed to track and treat individual cases to curb drug resistance. For example, India's revised national tuberculosis control program designed in the 1990s "addressed the clinical treatment of MDR-TB without developing a public health response to reduce its spread," says Jacob John, advisor at the department of virology and microbiology at Christian Medical College-Vellore in Tamil Nadu, India. "The same error should not be repeated with XDR-TB."

Laboratory diagnostic capacity for MDR-TB and XDR-TB is the main limitation, says Nani Nair, regional advisor at WHO South-East Asia Regional Office's department of communicable diseases. This needs tremendous scale-up of infrastructure, trained staff, lab equipment and supplies, Nair told *Nature Medicine*.

The report warned that with the current status quo the region will not achieve the UN millennium development goal of reducing tuberculosis prevalence and deaths to half the 1990 rate by 2015.

T V Padma, New Delhi

This is your brain online: the Functional Connectomes Project

Reference projects such as GenBank and the HapMap, which catalog gene sequences, have ushered in a new era of discovery in many avenues of biomedicine. But the burgeoning field of neuroimaging still lacks such scientific tools. This is in part because data from one of the most commonly used tools for studying human cognition—functional magnetic resonance imaging (fMRI) on subjects performing a specific task—cannot easily be compared across study sites. As a result, there's a growing need for a large database to serve as a reference of activity patterns within the human brain.

Last month, a team led by Michael Milham, a neuroscientist at New York University (NYU) Child Study Center, published the first analysis from the 1,000 Functional Connectomes Project, a collection of fMRI data sets donated by researchers from 35 centers around the world. This freely available resource includes data from more than 1,400 healthy subjects who underwent fMRI scans that assessed their brain activity when their minds were at rest (*Proc. Natl. Acad. Sci. USA* 107, 4734–4739, 2010). The study showed that resting-state fMRI data—long thought of as nothing more than random, background noise—can be reliably pooled across scanners to unveil a universal architecture of activity connections within the brain.

Unlike task-based fMRI, which can be highly specific to the study site, the 1,000 Functional Connectomes resource allows for systematic explorations of healthy and diseased brains to discover hitherto unknown underlying differences. "We're moving in the direction of being able to have objective measures of neurological and psychiatric illness," Milham says. "It's all stepping in the direction of being a clinical tool."

The effort takes its name from the Human Connectome Project, a $30 million initiative launched by the US National Institutes of Health last year to map the entire physical circuitry of the healthy adult human brain. But functional connectivity and structural connectivity are not the same thing. Functional connections, for example, can span more than one synapse and can be modulated by emotion or sleep, whereas anatomical circuits are more or less fixed over the short term.

"Having this much data in one place is a real treasure trove that is free to anybody who wants to play with it," says Marcus Raichle, a pioneer of resting-state fMRI at Washington University in St. Louis, Missouri who was not involved with the study.

"The connectomes project has the power to ask more questions," adds Craig Bennett, a cognitive neuroscientist at the University of California–Santa Barbara who published a review this month questioning the reliability and repeatability of fMRI scans in most typical neuroimaging studies (*Ann. N.Y. Acad. Sci.* 1191, 133–155, 2010). "You're not just looking across one study, you're drawing from such a large body of research that you really say things with authority."

Since having been posted online last December, the data set has been downloaded more than 4,500 times from researchers across 54 countries, according to Milham. One person who has explored the resource is Nora Volkow, director of the US National Institute on Drug Abuse in Bethesda, Maryland. Volkow is now developing quantitative methods to measure functional connectivity in her lab to follow up on preliminary observations of systemic differences between males and females.

"What's striking is how terribly consistent [the data] are—it's mindboggling," Volkow says. "I could use that data set to assess whether the connectivity patterns that I'm seeing in my patient actually differ in any significant way from this data set, which I can use as reference."

Elie Dolgin, New York

Correction

In 'State of Denial' (*Nat. Med.* **16**, 248 (2010)), we originally stated that David Rasnick denied the existence of AIDS while serving on an advisory panel. Contrary to a report produced by the panel, Rasnick says he did not question the existence of AIDS. Rather, he says that AIDS is not contagious and is not caused by HIV. The text should have read "Rasnick was also a member of South African president Thabo Mbeki's AIDS Advisory Panel; as part of the panel, Rasnick suggested that HIV testing be outlawed and antiretroviral drugs no longer used in the country." The error was corrected in the HTML and PDF versions of the article on 17 March 2010.

促进领域研究理念和范式革新

nature COMMUNICATIONS

ARTICLE

DOI: 10.1038/s41467-018-04976-1 OPEN

Assessment of the impact of shared brain imaging data on the scientific literature

Michael P. Milham[1,2], R. Cameron Craddock[1,2], Jake J. Son[1], Michael Fleischmann[1], Jon Clucas[1], Helen Xu[1], Bonhwang Koo[1], Anirudh Krishnakumar[1,3], Bharat B. Biswal[4], F. Xavier Castellanos[2,5], Stan Colcombe[2], Adriana Di Martino[5], Xi-Nian Zuo[6,7,8,9] & Arno Klein[1]

Data sharing is increasingly recommended as a means of accelerating science by facilitating collaboration, transparency, and reproducibility. While few oppose data sharing philosophically, a range of barriers deter most researchers from implementing it in practice. To justify the significant effort required for sharing data, funding agencies, institutions, and investigators need clear evidence of benefit. Here, using the International Neuroimaging Data-sharing Initiative, we present a case study that provides direct evidence of the impact of open sharing on brain imaging data use and resulting peer-reviewed publications. We demonstrate that openly shared data can increase the scale of scientific studies conducted by data contributors, and can recruit scientists from a broader range of disciplines. These findings dispel the myth that scientific findings using shared data cannot be published in high-impact journals, suggest the transformative power of data sharing for accelerating science, and underscore the need for implementing data sharing universally.

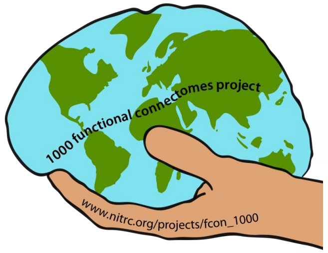


Table 2 Quantifying the money saved through the reuse of data

Database	Cost/subject	Phenotyping	Phenotyping	Clinical	Population	Difficulty	No. of publications	No. of scans/ subject	$ Saved
		Minimal	Comprehensive	Low	Moderate	High			
FCP	$1000	x					308	1	101,003,000
ADHD-200	$2000-5000			x	x		210	1	526,275,000
NKI-RS	$3000		x				188	1	70,065,000
ABIDE	$5000-10,000				x	x	190	1	995,560,000
CoRR	$2000	x					17	2	70,065,000

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Now more than ever, the potential and actual benefits of open data sharing are being debated in the pages of premier scientific journals, funding agency communications, scientific meetings, and workshops[1–3]. Throughout these discussions an array of potential benefits are acknowledged, ranging from increased transparency of research and reproducibility of findings to decreased redundancy of effort and the generation of large-scale data repositories that can be used to achieve more appropriate sample sizes for analyses. Equally important, data sharing is commonly described as a means of facilitating collaboration across the broader scientific community.

Despite its potential, for many, the benefits of data sharing are more theoretical than practical[2,4]. The reality is that data sharing is relatively limited in many disciplines and little information on its outcomes exists[5]. In the absence of clear demonstrations of data sharing's impact, debates on the topic are dominated by formidable—albeit hypothetical—downsides. Common concerns include loss of competitive advantage (especially for junior investigators)[6], fear of being scooped with one's own data, scientifically unsound uses of the data, and concerns that high-impact journals will not accept manuscripts that report findings generated by secondary analysis of open data sets.

To assess the tangible benefits of open data sharing, we provide a bibliometric analysis of a large brain image data-sharing initiative. The brain imaging community is a particularly valuable target for examination, as its challenges are representative of those commonly encountered in biomedical research. The high costs and workforce demands required to capture primary data limit the ability of individual labs to generate properly powered sample sizes. These obstacles are amplified when addressing more challenging (e.g., developing, aging, and clinical) populations or attempting biomarker discovery—both prerequisites for achieving clinically useful applications. Inspired by the momentum of molecular genetics,

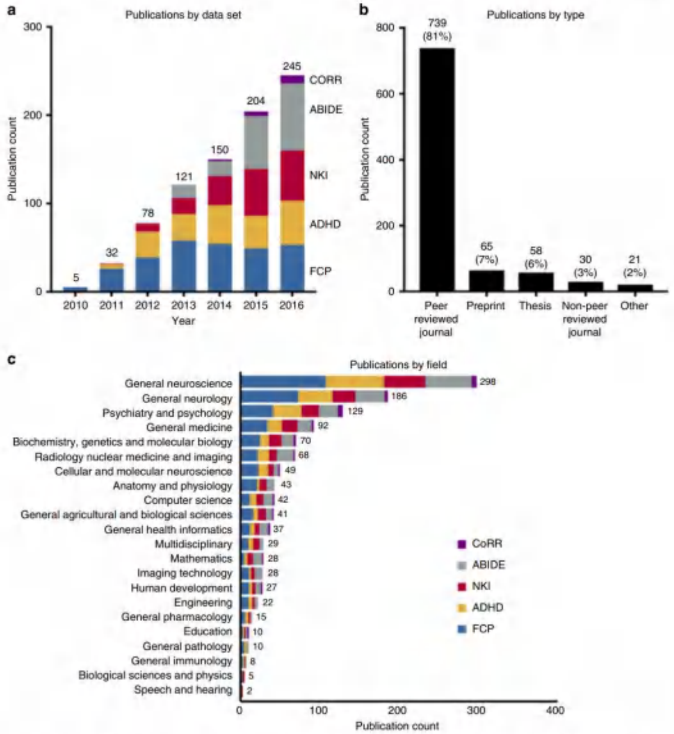

Fig. 1 Publications that used INDI shared data. Publications sorted (**a**) by INDI data set and year, for the period of 2010–2016 (2017 is not included since that year was in progress at the time this study was conducted), (**b**) by publication type, and (**c**) by journal discipline (limited to peer-reviewed publications and based on Web of Science classifications)

促进领域研究理念和范式革新

comment

The life-changing magic of sharing your data

The benefits of data sharing to the scientific community are widely agreed upon. But does data sharing also benefit individual scientists? I argue that data sharing may carry tangible benefits to one's own research that can outweigh any potential associated costs.

Laurence T. Hunt

It is increasingly expected that scientists not only publish results from their research but also freely share the raw data and analysis pipelines leading to those results. Data sharing is widely considered beneficial by other scientists, journals, funding agencies and by society as a whole.

It remains less certain whether similar benefits are conferred upon the scientists who share the data. Does the ambitious scientist really want to spend their time tidying data and scripts to freely share with their competitors? Mightn't their current findings be undermined or their future discoveries scooped? Couldn't this time be better spent advancing their own career, running new experiments and publishing yet more papers?

In this commentary, I argue that data sharing is in fact beneficial to even the most avaricious and self-interested scientists, as well as those who are more munificent and public-spirited in nature. Data sharing may actually lead to the advancement of one's own career, accelerate the pace of one's own scientific discoveries and increase the impact of one's own research output. Although there are legitimate concerns that must be carefully considered by the scientific community as data sharing is increasingly mandated, there are also concrete benefits among those who share data as well as growing enthusiasm for data sharing.

Lessons from the past

Imperatives to share data in psychology and cognitive neuroscience are not new. In 1999, for example, inspiration was drawn from efforts in genetics, proteomics and X-ray crystallography to launch a major new initiative to share human functional MRI (fMRI) data online: the fMRI Data Centre (fMRIDC). Despite substantial funding from the US National Science Foundation (NSF), the fMRIDC quickly suffered blowback from the scientific community upon launch. It was argued that fMRI was not mature enough for such efforts to be useful or that, unlike other fields, fMRI experimental design meant that each dataset was only optimised to address a single question. There were initial proposals that journals would demand fMRIDC data deposition at the time of publication, but these were mostly rescinded. While over a hundred studies were ultimately deposited, and several new discoveries were made via reuse of fMRIDC data, the withdrawal of NSF funding in 2006 ultimately led to the centre's closure. Worse, long-term storage was not planned for in the absence of funding: studies deposited on fMRIDC can no longer be readily accessed online.

Such tales provide both caution and instructive lessons for current repositories: to ensure that their long-term stability is secure and their scientific contributions well documented. Successor projects to fMRIDC, such as the International Neuroimaging Data Sharing Initiative (INDI) and OpenNeuro.org (formerly OpenfMRI.org) are now backed by more stable long-term infrastructure. Their scientific impact has also started to be quantified. It has been estimated that data reuse from OpenfMRI has saved US taxpayers $878,400, for example. A recent analysis identified 913 publications to date that had reused data from INDI, of which 295 had received 10 or more citations (i10-index) and 66 had received 66 or more citations (H-index). This demonstrates the increasing impact of shared data on the field.

This evidence points towards concrete benefits for scientific progress overall. But if data sharing mandates are to be well received by the community, it is important to consider the views and concerns of those asked to share their data, as well as the greater scientific good.

Benefits to individuals?

The intention to share data appears widespread these days, a notion borne out in a small, informal survey among faculty members of Psychology departments at eight UK universities (Fig. 1; see also ref.). A majority of colleagues at these universities now intend to share most of their data (Fig. 1a), but they do so for diverse reasons (Figs. 1b and 2). Some of the strongest motivations for data sharing (Fig. 2a) are 'other-regarding', in that the primary beneficiary is the scientific community rather than the individual. There is, for example, a prominent drive towards improving reproducibility, a particularly pressing issue in psychology research at present. Ensuring that data are archived for other researchers to reuse or reanalyse is also a salient concern (Fig. 2a). These other-regarding motivations are undeniably important, but they may lead to a perception that data sharing is biased towards being motivated by 'sticks' and not enough by 'carrots'. In fact, data sharing can also lead to a wide range of benefits to the individual scientist (Fig. 1c).

First, sharing data with others means that it is likely to be better documented, and it will have better long-term stability on a repository than stored locally on a hard disk. Crucially, this means that data will be stably archived for one's own future reuse. The time invested preparing data and documentation for repositories is a potential drawback and considered as such by survey respondents (Fig. 2b). But reuse becomes especially important once former students and postdocs have left the lab. The time invested preparing data and documentation for repositories is then quickly recouped as new lab members arrive. They can rapidly get up to speed on past studies and can try out new ideas simply by downloading the previously deposited data and analysis scripts. Even if all the key analyses have already been performed, well-documented datasets can provide an invaluable training opportunity for new students. These students will typically obtain a much deeper understanding of a lab's previous work by analysing the original raw data, rather than solely reading the resulting papers.

Second, sharing data means that your work can have a greater impact than that obtained from publication alone. By sharing the entire analysis code that takes you to a final conclusion from a given dataset, it becomes possible for other researchers to reverse-engineer your conclusions in a way that may not always be possible from examining the methods section of a paper, despite the authors' best intentions.

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EDITORIAL OPEN

Data sharing and the future of science

Who benefits from sharing data? The scientists of future do, as data sharing today enables new science tomorrow. Far from being mere rehashes of old datasets, evidence shows that studies based on analyses of previously published data can achieve just as much impact as original projects.

Data sharing has a long history in many areas of research. Although the push to encourage social and biological scientists to share and pool their results is a recent one[1], in other fields the use of shared data has been the norm for some time. For over a century, much of economics and meteorology have been based on publicly shared data, for example.

However, trepidation in relation to data-sharing is still prevalent in the scientific community, particularly in certain disciplines. The issues that make some researchers reluctant to share their own data have been much discussed[2], but researchers considering using shared data as a basis for their own research also have concerns: if I want to publish high-impact work, don't I need to collect new data? Is it the act of collecting original data that makes a study novel?

"There is a strong argument to be made that leaving data unshared is an impediment to the scientists of the future."

The benefits of data sharing may seem difficult to quantify. But the work of Michael P. Milham and colleagues[3] provides direct evidence that, in the field of neuroimaging, published papers based on shared data are just as likely to appear in high-impact journals, and are just as well-cited, compared with papers presenting original data. Although citations of a manuscript and the prestige of the journal in which it appears are not direct measures of the quality or novelty of scientific output, Milham et al.'s results are likely to be reassuring for cognitive neuroscientists concerned about whether the lack of original data collection would reduce the impact of their work.

Indeed, far from being an impediment to carrying out novel science, data sharing makes new types of research possible. Consider, for instance, research using the Human Connectome Project (HCP) dataset, one of the data sharing initiatives included in the Milham et al. study. The HCP currently contains extensive fMRI, structural MRI and behavioural data from 1200 healthy young adult volunteers (https://www.humanconnectome.org/study/hcp-young-adult), and is expanding to encompass child, adolescent and older adult brains. These data are made available to any interested researcher.

While data sharing had a somewhat rocky start in the world of cognitive neuroscience[4], the success of the HCP and the many influential studies based on it shows that its time has come. Without data sharing, it would be all but impossible for a single research group to scan 1200 people. MRI scans are expensive, and neuroimaging studies using original data typically consist of 20–50 participants. These sample sizes were sufficient to support the kinds of studies that were cutting-edge a decade ago, but today, more advanced methods require much more data.

It's not just in neuroscience that data sharing has already transformed the kinds of studies that researchers are able to carry out. In genetics, genomics and structural biology, large shared datasets are common (e.g., ref.[5]) and many researchers have used and re-used previously published datasets to enable new discovery in these areas[6].

In the physical sciences, data sharing is also increasingly practiced. In astronomy and astrophysics, for example, telescope data is typically open;[7] without such sharing, most research groups, lacking the funds to construct the kinds of large telescopes required for modern astronomy research, would be unable to reach the

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SCIENTIFIC DATA

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SUBJECT CATEGORIES
» Neuroinformatics
» Brain imaging
» Functional magnetic resonance imaging
» Cognitive neuroscience

An open science resource for establishing reliability and reproducibility in functional connectomics

Xi-Nian Zuo[1,2,*], Jeffrey S. Anderson[3], Pierre Bellec[4], Rasmus M. Birn[5], Bharat B. Biswal[6], Janusch Blautzik[7], John C.S. Breitner[8], Randy L. Buckner[9], Vince D. Calhoun[10], F. Xavier Castellanos[11,12], Antao Chen[2], Bing Chen[13], Jiangtao Chen[2], Xu Chen[2], Stanley J. Colcombe[11], William Courtney[10], R. Cameron Craddock[11,14], Adriana Di Martino[12], Hao-Ming Dong[1,15], Xiaolan Fu[1,16], Qiyong Gong[17], Krzysztof J. Gorgolewski[18], Ying Han[19], Ye He[1,15], Yong He[20], Erica Ho[11,14], Avram Holmes[21], Xiao-Hui Hou[1,15], Jeremy Huckins[22], Tianzi Jiang[23], Yi Jiang[1], William Kelley[22], Clare Kelly[12], Margaret King[10], Stephen M. LaConte[24], Janet E. Lainhart[5], Xu Lei[2], Hui-Jie Li[1], Kaiming Li[17], Kuncheng Li[25], Qixiang Lin[20], Dongqiang Liu[13], Jia Liu[20], Xun Liu[1], Yijun Liu[2], Guangming Lu[26], Jie Lu[25], Beatriz Luna[27], Jing Luo[28], Daniel Lurie[11,14], Ying Mao[29], Daniel S. Margulies[18], Andrew R. Mayer[10], Thomas Meindl[7], Mary E. Meyerand[30], Weizhi Nan[1,15], Jared A. Nielsen[3], David O'Connor[11,14], David Paulsen[27], Vivek Prabhakaran[31], Zhigang Qi[25], Jiang Qiu[2], Chunhong Shao[32], Zarrar Shehzad[11,14], Weijun Tang[33], Arno Villringer[34], Huiling Wang[35], Kai Wang[1,15], Dongtao Wei[2], Gao-Xia Wei[1], Xu-Chu Weng[13], Xuehai Wu[29], Ting Xu[1,11,14], Ning Yang[1,15], Zhi Yang[1], Yu-Feng Zang[13], Lei Zhang[1,15], Qinglin Zhang[2], Zhe Zhang[1,15], Zhiqiang Zhang[26], Ke Zhao[1], Zonglei Zhen[20], Yuan Zhou[1], Xing-Ting Zhu[1,15] & Michael P. Milham[11,14]

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Efforts to identify meaningful functional imaging-based biomarkers are limited by the ability to reliably characterize inter-individual differences in human brain function. Although a growing number of connectomics-based measures are reported to have moderate to high test-retest reliability, the variability in data acquisition, experimental designs, and analytic methods precludes the ability to generalize results. The Consortium for Reliability and Reproducibility (CoRR) is working to address this challenge and establish test-retest reliability as a minimum standard for methods development in functional connectomics. Specifically, CoRR has aggregated 1,629 typical individuals' resting state fMRI (rfMRI) data (5,093 rfMRI scans) from 18 international sites, and is openly sharing them via the International Data-sharing Neuroimaging Initiative (INDI). To allow researchers to generate various estimates of reliability and reproducibility, a variety of data acquisition procedures and experimental designs are included. Similarly, to enable users to assess the impact of commonly encountered artifacts (for example, motion) on characterizations of inter-individual variation, datasets of varying quality are included.

Design Type(s)	Test-retest Reliability
Measurement Type(s)	nuclear magnetic resonance assay
Technology Type(s)	functional MRI Scanner
Factor Type(s)	protocol
Sample Characteristic(s)	Homo sapiens • brain

*A full list of author affiliations appear at the end of the paper.
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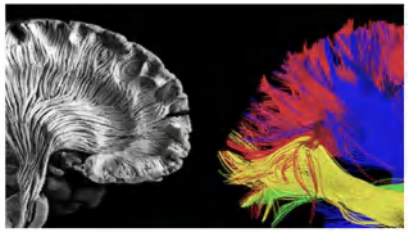
COLLECTION | 20 JANUARY 2015

Human brain MRI reproducibility

This collection presents a series of articles describing human brain scans – produced with a variety of magnetic resonation imaging (MRI) methods and modalities – which are designed to help researchers assess the reproducibility of brain imaging techniques and to develop new methods based on these data-types. Central to this collection are studies from the Consortium on Reliability and Reproducibility (CoRR), an initiative that has organized the release of data from thousands of individual brain scans collected at 18 international sites. show less



Comment

COMMENT
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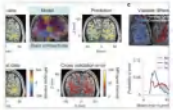
Scientific Data

Test-retest measurements and digital validation for *in vivo* neuroscience

Franco Pestilli



Organization for Human Brain Mapping
Advancing Understanding of the Human Brain

Best practices in data analysis and sharing in neuroimaging using MRI

Thomas E Nichols[1], Samir Das[2,3], Simon B Eickhoff[4,5], Alan C Evans[2,3], Tristan Glatard[2,6], Michael Hanke[7,8], Nikolaus Kriegeskorte[9], Michael P Milham[10,11], Russell A Poldrack[12], Jean-Baptiste Poline[13], Erika Proal[14], Bertrand Thirion[15], David C Van Essen[16], Tonya White[17] & B T Thomas Yeo[18]

Given concerns about the reproducibility of scientific findings, neuroimaging must define best practices for data analysis, results reporting, and algorithm and data sharing to promote transparency, reliability and collaboration. We describe insights from developing a set of recommendations on behalf of the Organization for Human Brain Mapping and identify barriers that impede these practices, including how the discipline must change to fully exploit the potential of the world's neuroimaging data.

The advancement of science requires continuous examination of the principles and practices by which the research community operates. In attempted to replicate 100 psychology studies and succeeded in only 39 cases[2], there is mounting evidence that scientific results are surement and analytical stability to broader notions of generalizability (**Table 1**). A very narrow notion of generalizability would be

代表性案例分享：描绘人类生命周期脑图表

Article

Charting brain growth in tandem with brain templates at school age

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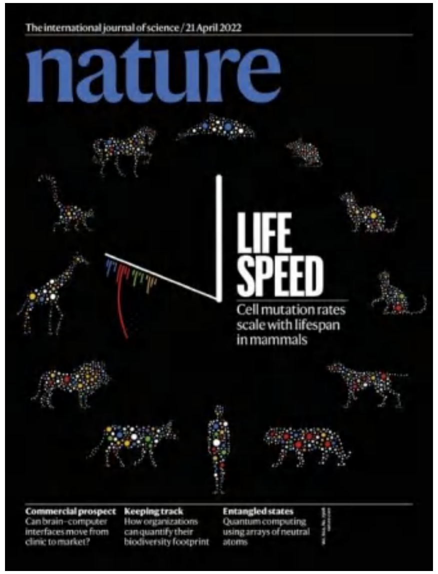
代表性案例分享：人类生命周期脑图表

- > 100 datasets
- > 100k participants
- > 120k samples
- Ages: 115 days - 100 years
- Team work
- Open science
- Reproducibility



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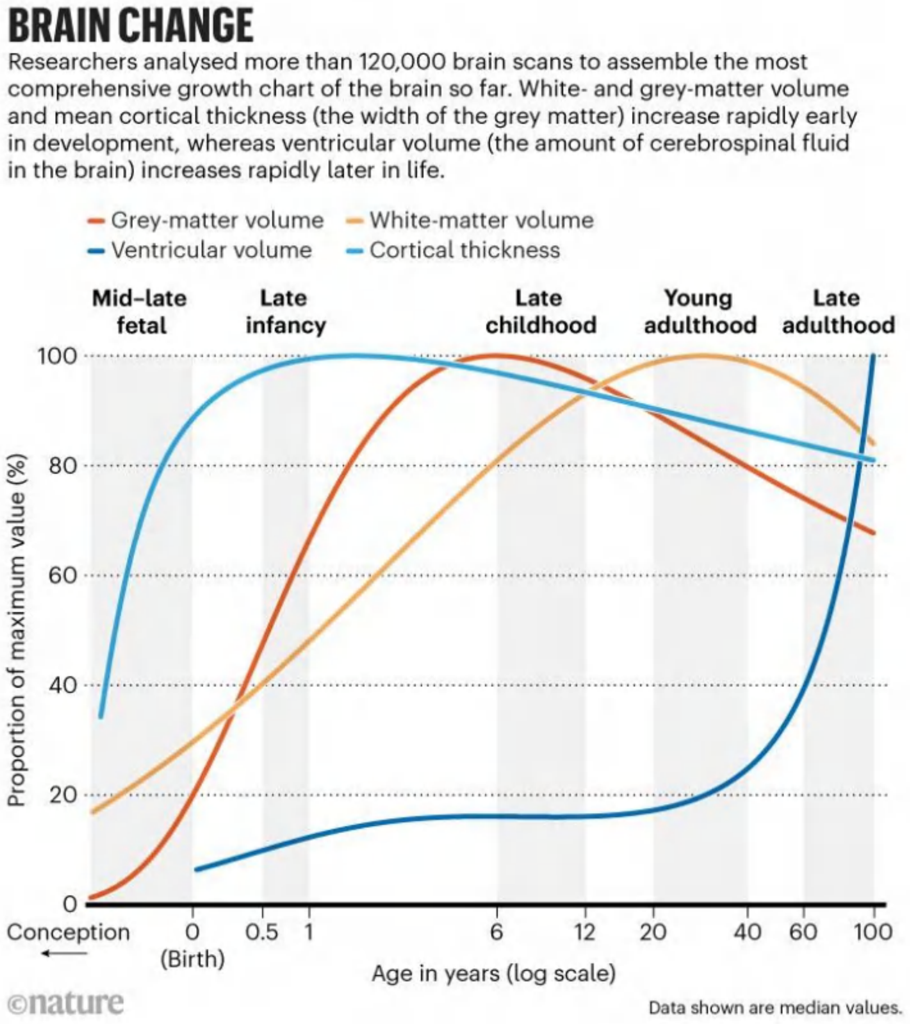

Article | Open Access | Published: 06 April 2022

Brain charts for the human lifespan

R. A. I. Bethlehem, J. Seidlitz, S. R. White, J. W. Vogel, K. M. Anderson, C. Adamson, S. Adler, G. S. Alexopoulos, E. Anagnostou, A. Areces-Gonzalez, D. E. Astle, B. Auyeung, M. Ayub, J. Bae, G. Ball, S. Baron-Cohen, R. Beare, S. A. Bedford, V. Benegal, F. Beyer, J. Blangero, M. Blesa Cábez, J. P. Boardman, M. Borzage, J. F. Bosch-Bayard, N. Bourke, V. D. Calhoun, M. M. Chakravarty, C. Chen, C. Chertavian, G. Chetelat, Y. S. Chong, J. H. Cole, A. Corvin, M. Costantino, E. Courchesne, F. Crivello, V. L. Cropley, J. Crosbie, N. Crossley, M. Delarue, R. Delorme, S. Desrivieres, G. A. Devenyi, M. A. Di Biase, R. Dolan, K. A. Donald, G. Donohoe, K. Dunlop, A. D. Edwards, J. T. Elison, C. T. Ellis, J. A. Elman, L. Eyler, D. A. Fair, E. Feczko, P. C. Fletcher, P. Fonagy, C. E. Franz, L. Galan-Garcia, A. Gholipour, J. Giedd, J. H. Gilmore, D. C. Glahn, I. M. Goodyer, P. E. Grant, N. A. Groenewold, F. M. Gunning, R. E. Gur, R. C. Gur, C. F. Hammill, O. Hansson, T. Hedden, A. Heinz, R. N. Henson, K. Heuer, J. Hoare, B. Holla, A. J. Holmes, R. Holt, H. Huang, K. Im, J. Ipser, C. R. Jack Jr, A. P. Jackowski, T. Jia, K. A. Johnson, P. B. Jones, D. T. Jones, R. S. Kahn, H. Karlsson, L. Karlsson, R. Kawashima, E. A. Kelley, S. Kern, K. W. Kim, M. G. Kitzbichler, W. S. Kremen, F. Lalonde, B. Landeau, S. Lee, J. Lerch, J. D. Lewis, J. Li, W. Liao, C. Liston, M. V. Lombardo, J. Lv, C. Lynch, T. T. Mallard, M. Marcelis, R. D. Markello, S. R. Mathias, B. Mazoyer, P. McGuire, M. J. Meaney, A. Mechelli, N. Medic, B. Misic, S. E. Morgan, D. Mothersill, J. Nigg, M. Q. W. Ong, C. Ortinau, R. Ossenkoppele, M. Ouyang, L. Palaniyappan, L. Paly, P. M. Pan, C. Pantelis, M. M. Park, T. Paus, Z. Pausova, D. Paz-Linares, A. Pichet Binette, K. Pierce, X. Qian, J. Qiu, A. Qiu, A. Raznahan, T. Rittman, A. Rodrigue, C. K. Rollins, R. Romero-Garcia, L. Ronan, M. D. Rosenberg, D. H. Rowitch, G. A. Salum, T. D. Satterthwaite, H. L. Schaare, R. J. Schachar, A. P. Schultz, G. Schumann, M. Schöll, D. Sharp, R. T. Shinohara, I. Skoog, C. D. Smyser, R. A. Sperling, D. J. Stein, A. Stolicyn, J. Suckling, G. Sullivan, Y. Taki, B. Thyreau, R. Toro, N. Traut, K. A. Tsvetanov, N. B. Turk-Browne, J. J. Tuulari, C. Tzourio, É. Vachon-Presseau, M. J. Valdes-Sosa, P. A. Valdes-Sosa, S. L. Valk, T. van Amelsvoort, S. N. Vandekar, L. Vasung, L. W. Victoria, S. Villeneuve, A. Villringer, P. E. Vértes, K. Wagstyl, Y. S. Wang, S. K. Warfield, V. Warrier, E. Westman, M. L. Westwater, H. C. Whalley, A. V. Witte, N. Yang, B. Yeo, H. Yun, A. Zalesky, H. J. Zar, A. Zettergren, J. H. Zhou, H. Ziauddeen, A. Zugman, X. N. Zuo, 3R-BRAIN, AIBL, Alzheimer's Disease Neuroimaging Initiative, Alzheimer's Disease Repository Without Borders Investigators, CALM Team, Cam-CAN, CCNP, COBRE, cVEDA, ENIGMA Developmental Brain Age Working Group, Developing Human Connectome Project, FinnBrain, Harvard Aging Brain Study, IMAGEN, KNE96, The Mayo Clinic Study of Aging, NSPN, POND, The PREVENT-AD Research Group, VETSA, E. T. Bullmore & A. F. Alexander-Bloch

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代表性案例分享：人类生命周期脑图表

EDITORIAL | 06 April 2022

Time to recognize authorship of open data

The open data revolution won't happen unless the research system values the sharing of data as much as authorship on papers.

Editorials

nature

Time to recognize authorship of open data

The open-data revolution won't happen unless the research system values the sharing of data as much as authorship of papers.

"Crediting all those who contribute their knowledge to a research output is a cornerstone of science."

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International Brain Chart Consortium (https://www.brainchart.io); *Nature* (2022) **Headline**

人类生命周期脑图表揭示脑智发展里程碑

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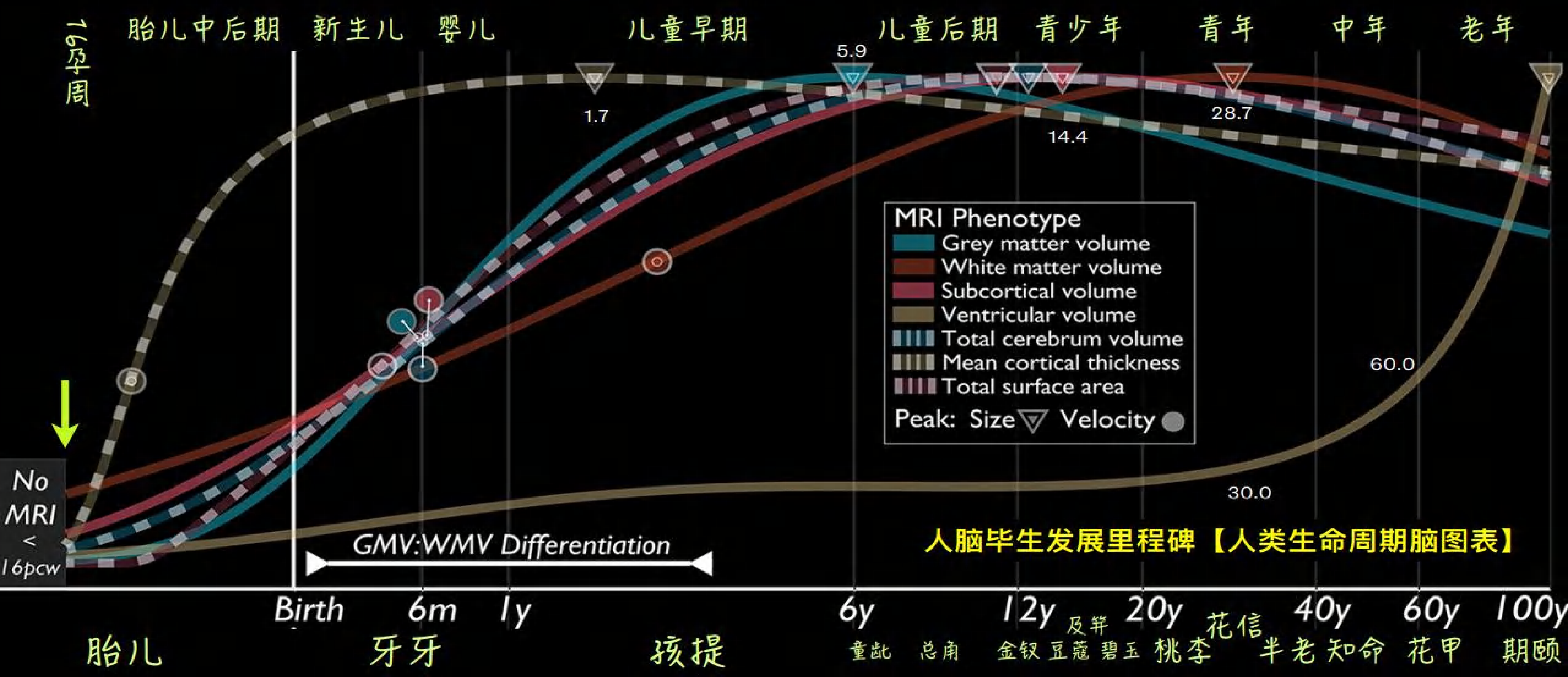
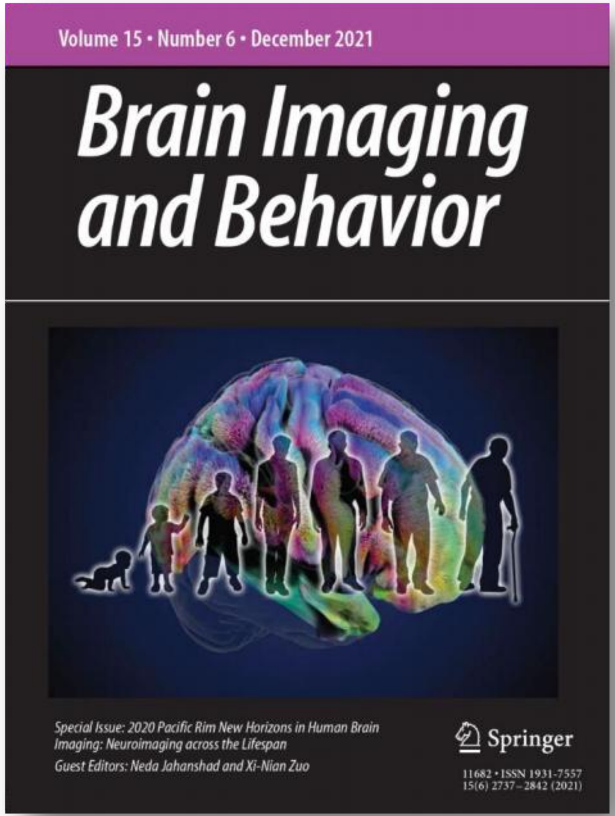
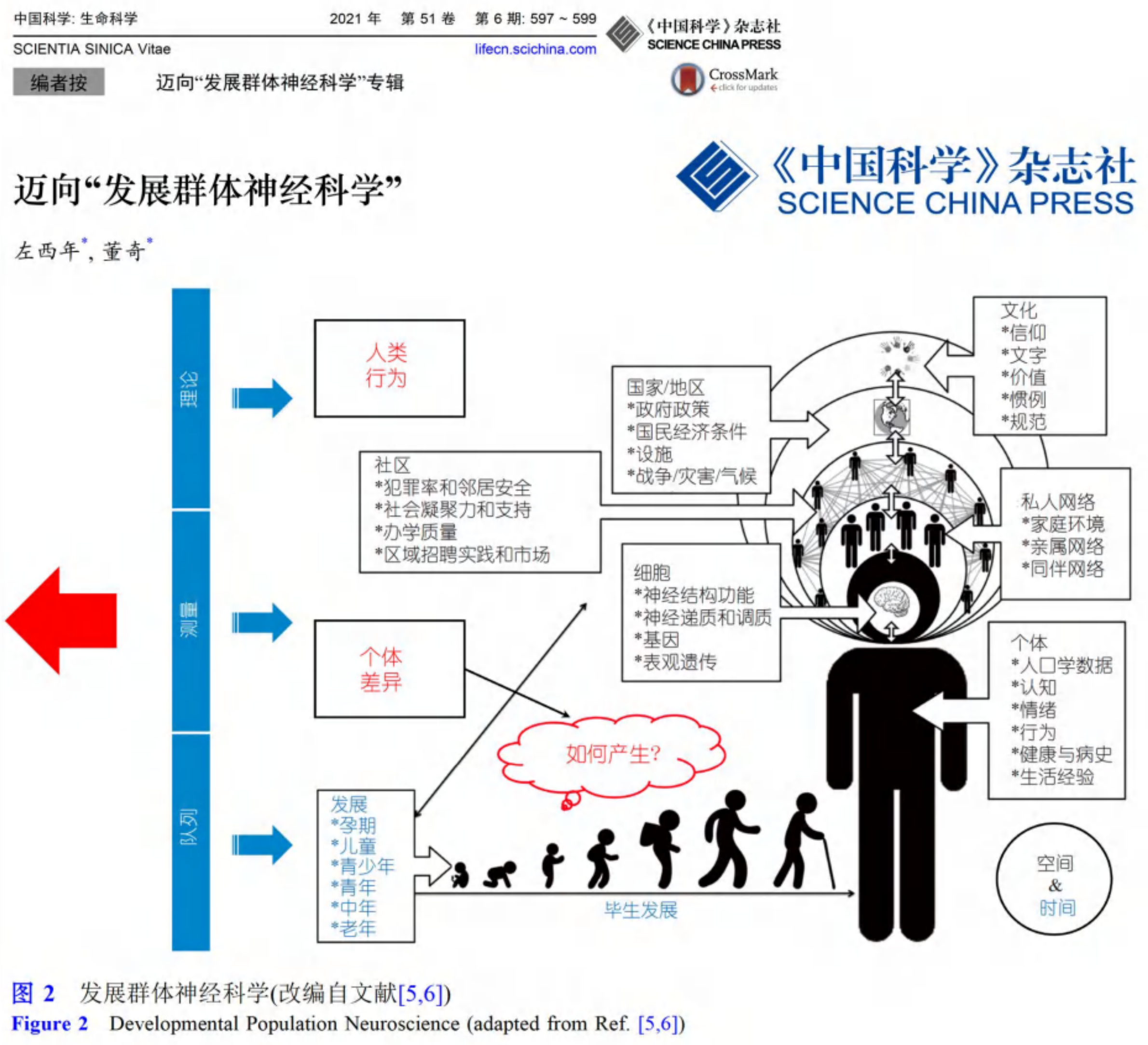


催生认知神经科学的新方向：发展人口神经科学

Developmental Population Neuroscience





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迈向“发展群体神经科学”

左西年*，董奇*

图 2 发展群体神经科学(改编自文献[5,6])

Figure 2 Developmental Population Neuroscience (adapted from Ref. [5,6])

促进科学普及与实践：现代科学健康生态保障与体现

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“工欲效其事，必先信其器”——个体差异的科学靠谱吗？

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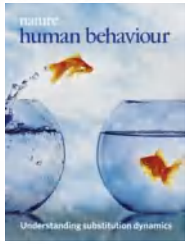

“To do a valid job, must make tools reliable first” —A decent science of individual differences?

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作为人类特有的行为，科学研究是社会文明的重要推动力量之一．近年来，研究的可重复性问题成为科学关注的焦点，从心理科学到临床医学等领域，研究的可重复性成为巨大挑战．生命科学研究的共同特点之一是对于测量工具的需求，先进的技术会促进更为精准的测量，提升研究可信度．测量理论中的信(可信)效(有效)度概念在不同学科都有涉及，特别是在心理科学和医学中有明确的统计学界定，但在其他学科未被充分认识，尤其是交叉学科．

人与人之间为何表现出如此巨大的差别？这是个体差异的科学问题，一直以来是生命科学领域备受关注的焦点．*Nat Hum Behav* 于 2019 年 6 月 28 日在线发表题为“Harnessing reliability for neuroscience research”的评论文章[1]，以神经科学为例，聚焦神经影像技术，提出了个体差异测量信效度统计学框架．在此框架下，个体差异的总测量由三部分组成(图 1(a))：研究对象特异的变化(疾病或特质测量)、研究对象非特异的变化(干扰和污染测量)、随机错误(随机噪声测量)．个体差异的测量采用重复测量设计(图 1(b))，图中相同颜色表示同一个人，不同颜色表示不同的人，个体间差异测量包含“疾病或特质测量”与“干扰与污染测量”的总和，而随机噪声测量则是个体内差异测量．个体差异测量的信度是个体间差异测量在总测量中所占比例，而疾病或特质特异变化所占比例则是个体差异测量的效度．由此，测量的信度就像一个瓶子的盖子一样，牢牢地限制住了测量的效度，不可信的测量永远不可能有效；与此同时，测量的个体间差异越大，其信度越高，测量个体内差异越小，其信度越高；最后，测量信度越高，其检测统计效应所需样本量越小．

那么，到底什么原因使得个体测量的信度如此重要呢？从理论上讲，结合上述 3 条测量信效度的统计定律，加上在实际应用和实践中，对于测量的效度是无法直接进行测量的(否则就没必要进行研究了，因为疾病或特质有效性已经解决的话，就意味着相应科学问题已经回答)．从实际应用上讲，教育实践中的“因材施教”和临床实践中的“精准医疗”都体现出个体差异测量研究的价值，高信度测量意味更易于区别不同的学生或病人，而在不同场合的测量稳定性也更好．综合来看，高信度测量对个体差异研究和应用转化至关重要．

近 10 年来，神经影像因为其安全性和高时空精度的优势，已经积累了大量数据，成千上万的人脑影像已经上线并公开，涵盖了人类在不同发展阶段和各类脑疾病障碍上的影像[2]．由此而催生了开放式神经科学的出现，推动了大型化脑科学(比如人工智能和脑疾病生物标记物)研究．个体差异研究的基础是统计力度，其决定了检测实验效应的能力．大样本量是提高统计力度的因素之一，然而如果测量信度不够，就会产生对大样本量的不必要需求．在此评论文章中，研究团队采用蒙特卡洛方法对信度、样本量和效应量之间的关系进行了数值模拟．结果揭示：在神经影像领域，潜在效应量较小，测量的信度局限将会极大地增加研究对样本量的需求．神经影像测量的信度研究表明：现有数据中极少有足够的个体数据能获得高度可信的脑连接测量．各国推出的各类大型脑计划中，个体差异的基础和转化研究(教育和临床)是中国脑计划的核心和特色，

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“一生最好是少年”：发育神经影像学

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The best thing in life is to be a teenager: Developmental neuroimaging

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生长发育图表(growth chart)是公共卫生与健康领域的重要工具，不仅可用于揭示儿童发育(如身高、体重)的一般规律，为生长发育(如营养摄入)评估提供健康参考，而且也可以为各类发育障碍发出预警信号，用于辅助诊断相关疾病，在家庭养育和临床实践中被广泛应用[1]．生长发育是遗传、环境和文化综合作用的过程，学龄期(6~18岁)儿童青少年不仅在身高体重上迎来发育高峰，通过来自校园的系统化教育，认知与学习能力得以快速提升，而且进一步加强了自我独立意识，通过历经青春期而体验愈加丰富的情感，开始徜徉在文化和历史的熏陶中，正为未来成年期的发展做好准备[2]．构建脑发育图表，可以为研究学龄期发展提供综合测量和评估工具，推进脑科学在家庭、教育和临床的个体化应用转化．

高精度脑成像技术的发展，正在逐步揭开人类心理与行为的脑影像，其中磁共振成像安全易用，已成为研究脑发育的核心成像技术，促进了发育神经影像学发展，为打通从微观水平(如神经黏和功能柱)到宏观水平(皮层厚度和面积)的全链条脑发育研究提供了顶端(宏观尺度)的证据(图1上)，为脑发育图表研究与应用奠定了基础[3–5]．脑发育图表研究的核心挑战是建设生长发育队列和研发可信而有效的测量，进而揭示遗传、环境和文化对脑发育的影响．来自中国科学院心理研究所、北京师范大学、西南大学、华南师范大学、浙江大学、滨州医学院的研究团队，联合美国纽约大学(New York University)和耶鲁大学(Yale University)、荷兰唐德斯研究所(Donders Institute)和伊拉斯姆斯大学(Erasmus University Rotterdam)、新加坡国立大学(National University of Singapore)的研究人员，历经8年，建立了学龄脑智发育研究队列，推进了脑发育图表测量的信效度方法学，研发了学龄脑发育图表的绘制规范，绘制并比较了中美脑发育图表．*Sci Bull*以封面文章形式发布这一学龄脑发育图表研究[6]．

上述学龄脑发育图表研究，基于中国科学院心理研究所领衔建设的脑智发育队列——“彩巢计划-成长在中国”[7]，在中国重庆地区和美国纽约地区，采用相同的加速纵向队列实验设计，建设了6~18岁脑智发育队列，绘制了全年龄段学龄期脑发育模板和图表，检验了中美脑发育曲线的差异．研究发现，脑模板在各年级之间有差别、在中美之间有差别，这些差异会影响脑发育图表的形状(图1中)．脑网络形态发育曲线的数学建模揭示，中美学龄期脑发育差异的脑区分布遵循特定规律，基础功能(如视觉和体感运动)区域在中美学龄儿童中具有简单而平行的发育轨迹，联合功能区域，在中美学龄儿童中则表现出复杂而不同的发育轨迹，特别是在青春期触发的前后(黑色箭头所示)；中美学龄脑发育差异化的区域，在左半球主要分布于默认模式网络(语言以及自我参照等功能，红色)，在右半球主要分布于额顶控制网络(认知控制等功能，橘色)．这些民族化差异是两国在遗传、环境和文化上的综合差异体现[8]，提示构建各自脑发育图表的必要性．*Sci Bull*

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青春期的“脑中乾坤”

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The brain’s Qian and Kun for puberty

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青春期是人类毕生发展的重要阶段．21世纪初，《科学》(*Science*)杂志曾发布125个科学问题，“什么引发了青春期?”位列第73．十余年间，对这一科学问题的研究使我们深入了解到与之有关的微观机制与“下丘脑-垂体-性腺轴”这一触发器有关[1]．这也开启了围绕青春期的发展认知神经科学研究的热潮，探索青春期与大脑发育的规律[2]．以磁共振成像为核心的发育神经影像学，为研究青春期的脑发育规律和机制提供了无创技术方法学体系[3,4]．尽管已有研究描绘了成人大脑功能组织特性及其空间分布模式[5]，但我们对大脑连接的功能组织如何生长发育的宏观规律与机制仍知之甚少，特别是从儿童到青少年的过渡时期，暨青春期．为了回答这一问题，来自北京师范大学、中国科学院、耶鲁大学和法国国家科学研究中心的合作团队[6]，在《美国科学院院报》(*Proc Natl Acad Sci USA*)发表研究论文指出，人脑皮层功能组织的梯度更替标志着从儿童到青少年的转变，为理解青春期的神经发育和进化机制提供了影像学证据．

该团队依托“彩巢计划-成长在中国”的5年加速纵向发育队列[7]，考察了190名学龄期健康儿童和青少年(6~18岁)的大脑功能发育情况．借助静息态功能磁共振成像技术，他们详细描绘了大脑功能连接的组织模式，以及如何在儿童到青少年的过渡中发展变化．研究发现，在儿童期大脑网络功能组织的主梯度(图1左列)，体现为从体感运动到视觉的功能连接特征分布模式．而在进入青少年时期后(图1中间一列)，主梯度则过渡至从基础感知觉到联合功能的连接特征分布模式．这已经与成年人的大脑功能连接主梯度模式接近(图1右列)，其空间一极的分布集中于默认网络，负责人类高阶而抽象的认知功能．上述梯度翻转更替过程是随年龄增加而逐渐变化完成的(图1(b))，大约在12~13岁出现拐点，这恰好是儿童步入青春期的年龄．12岁之前，大脑功能连接组织的主梯度为单一模态脑区的空间分布模式，表现为从体感运动(天蓝色)区域到视觉(紫色)区域．而12岁之后，主梯度则逐渐转变为多功能模态联合的关联模式，表现为从基础感知觉/视觉(天蓝色/紫色)区域到默认网络(红色)区域．次梯度也在12~14岁区间出现拐点，在此阶段表现出单功能模态脑区和多功能模态脑区的混叠成分，随后在青少年后期逐渐分离，最终成熟收敛到成年期的脑功能组织梯度．通过进一步量化默认网络内部功能梯度的变化发现，功能梯度随年龄增长而呈现明显的发育趋势，其各成分表现出年龄特异性．

众多研究已明确了青春期的过渡与儿童和青少年冲动行为、感觉寻求以及药物依赖和成瘾之间存在关联．相比于其他年龄人群，青少年群体更容易参与危险行为，并且易受到心理障碍和精神疾病的困扰[8]．同时，此年龄段的青少年开始逐渐摆脱对父母的依赖，寻求自我的独立．他们对外界认可、威胁和社会关系的关注不断增强，渴望以成年人的身份了解和接触外部的世界．上述发现揭示了人脑大尺度功能组织的随龄变化模式，并且认为，这种特定的成熟模式对理解上述认知和行为能力在发育过程中的成熟变化至关重要．

“乾坤”是中华文明对世界万物运行机制的哲学思辨，数学物理方法是自然科学的原始驱动力．大脑是极其复杂的数学物理系统，如果将其比喻成海洋(脑海)，那如何揭秘各种洋


开放脑科学挑战

科学管理与政策导向：科学团体的核心力与职业发展内驱力

开放科学团体角色

Towards wide-scale adoption of open science practices: The role of open science communities

Kristijan Armeni[1,2], Loek Brinkman[3,4], Rickard Carlsson[5,6], Anita Eerland[4,7,*], Rianne Fijten[8,9], Robin Fondberg[6,10], Vera E. Heininga[11,12,13], Stephan Heunis[14,15], Wei Qi Koh[16,17], Maurits Masselink[12,18,19,20], Niall Moran[16,17], Andrew Ó Baoill[16,17], Alexandra Sarafoglou[21,22], Antonio Schettino[23,24,25], Hardy Schwamm[16,17], Zsuzsika Sjoerds[26,27,28], Marta Teperek[29,30], Olmo R. van den Akker[31,32], Anna van't Veer[27,28,33] and Raul Zurita-Milla[34,35]

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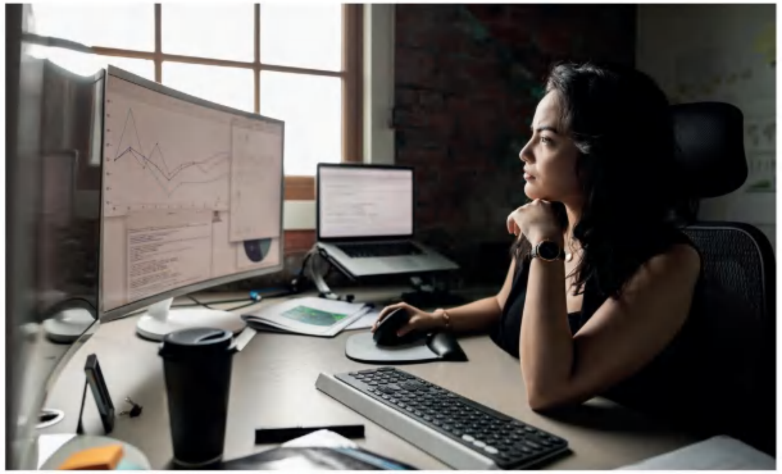
Perspective



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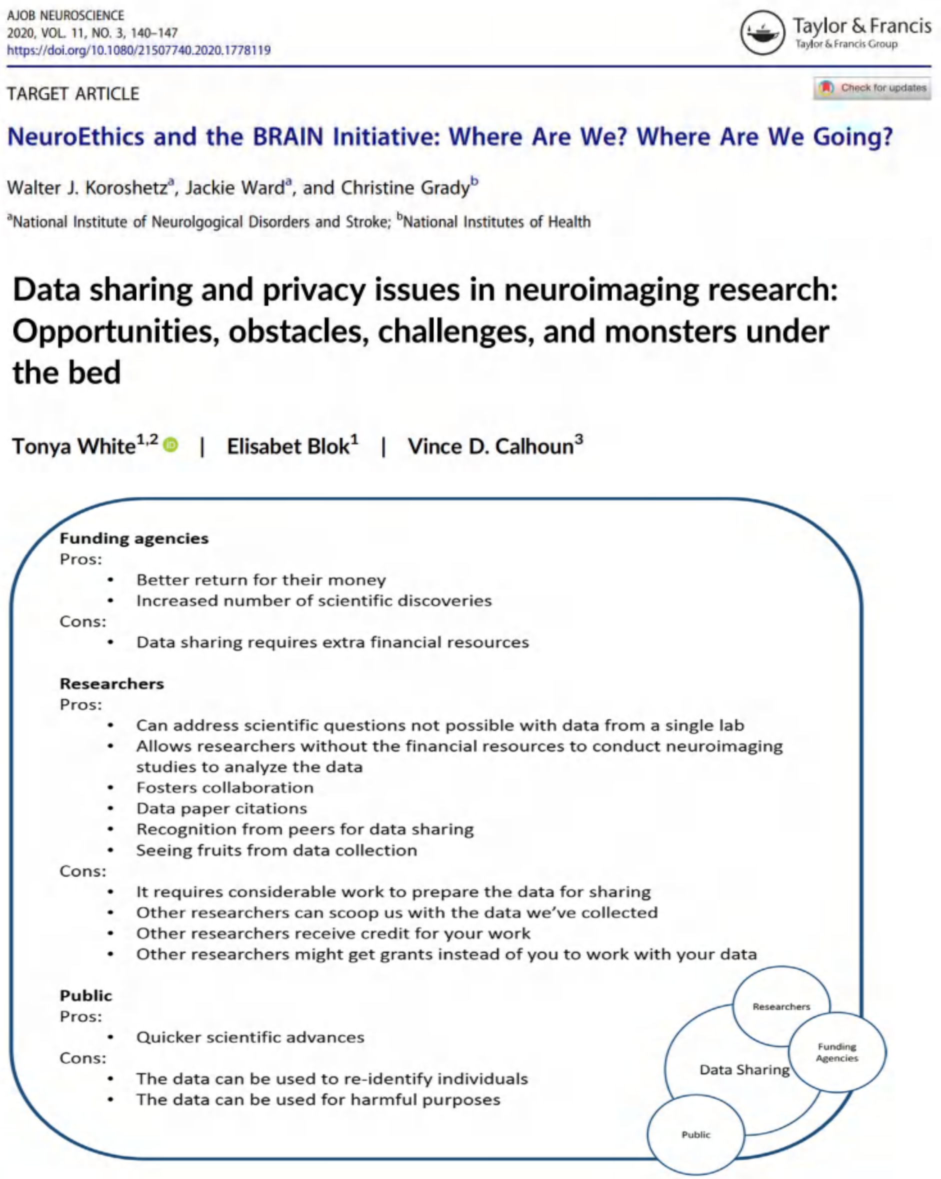

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NeuroEthics and the BRAIN Initiative: Where Are We? Where Are We Going?

Walter J. Koroshetz[a], Jackie Ward[a], and Christine Grady[b]

[a]National Institute of Neurolgogical Disorders and Stroke; [b]National Institutes of Health

Data sharing and privacy issues in neuroimaging research: Opportunities, obstacles, challenges, and monsters under the bed

Tonya White[1,2] | Elisabet Blok[1] | Vince D. Calhoun[3]

Funding agencies

Pros:

- Better return for their money
- Increased number of scientific discoveries

Cons:

- Data sharing requires extra financial resources

Researchers

Pros:

- Can address scientific questions not possible with data from a single lab
- Allows researchers without the financial resources to conduct neuroimaging studies to analyze the data
- Fosters collaboration
- Data paper citations
- Recognition from peers for data sharing
- Seeing fruits from data collection

Cons:

- It requires considerable work to prepare the data for sharing
- Other researchers can scoop us with the data we've collected
- Other researchers receive credit for your work
- Other researchers might get grants instead of you to work with your data

Public

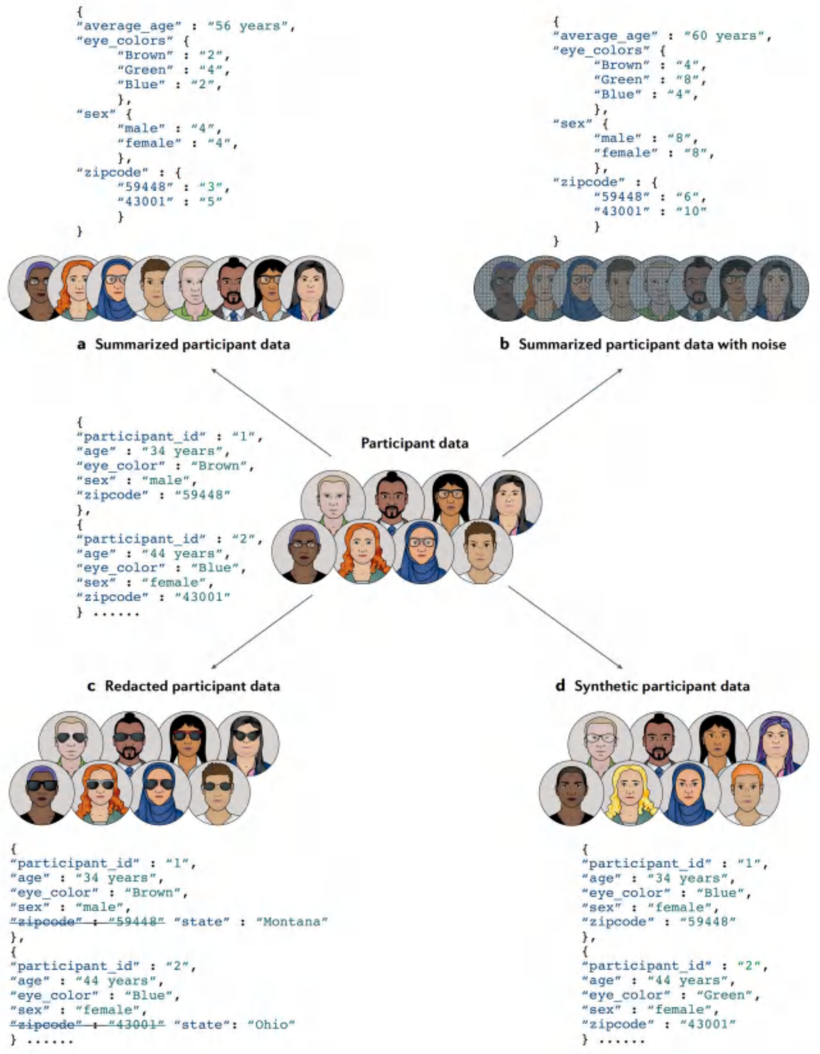
Pros:

- Quicker scientific advances

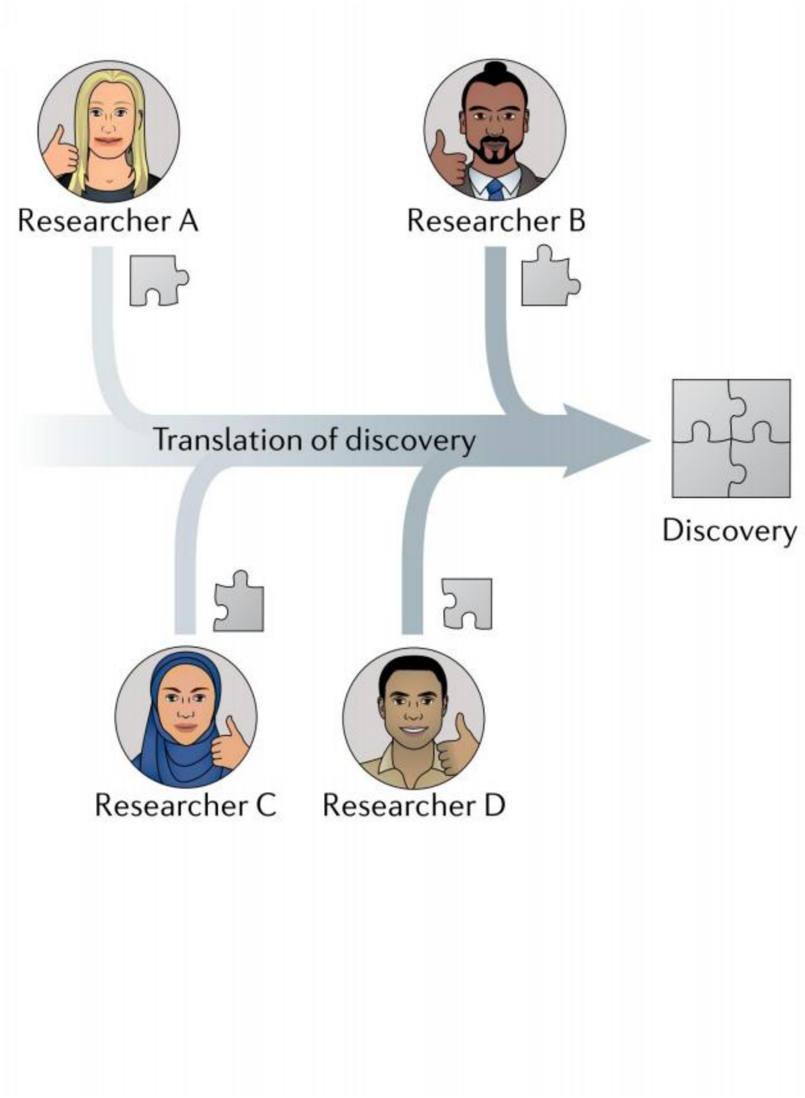
Cons:

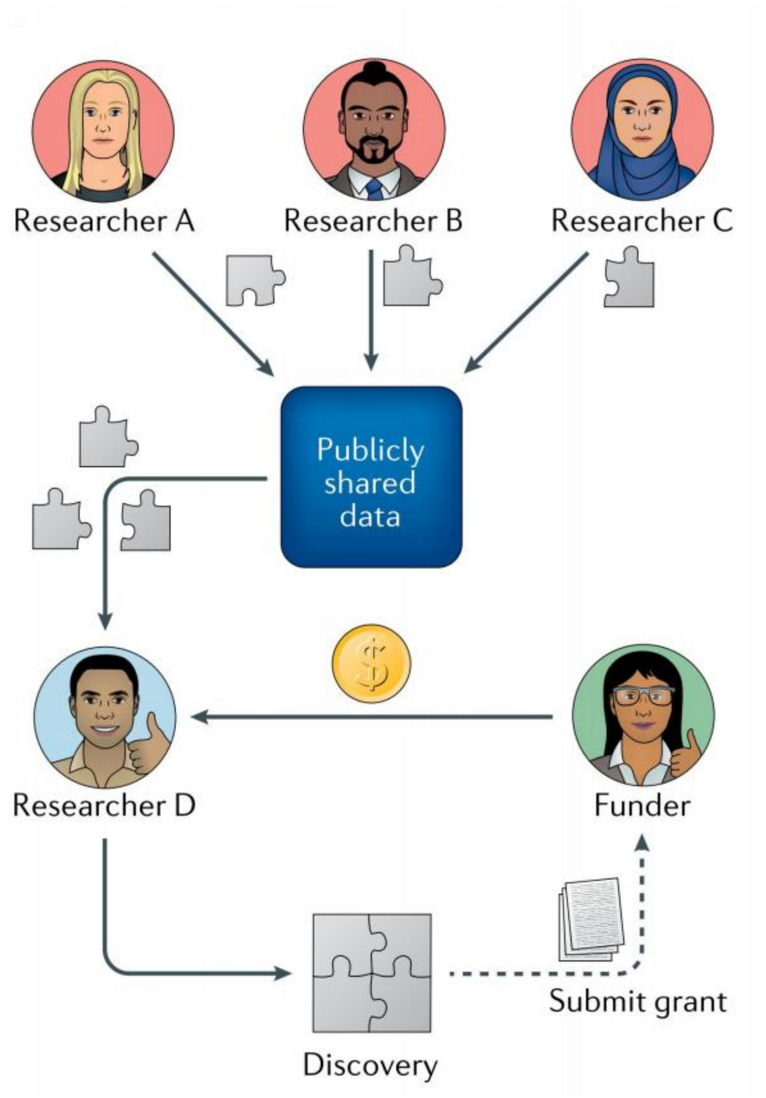
- The data can be used to re-identify individuals
- The data can be used for harmful purposes

Researchers
Funding Agencies
Data Sharing
Public

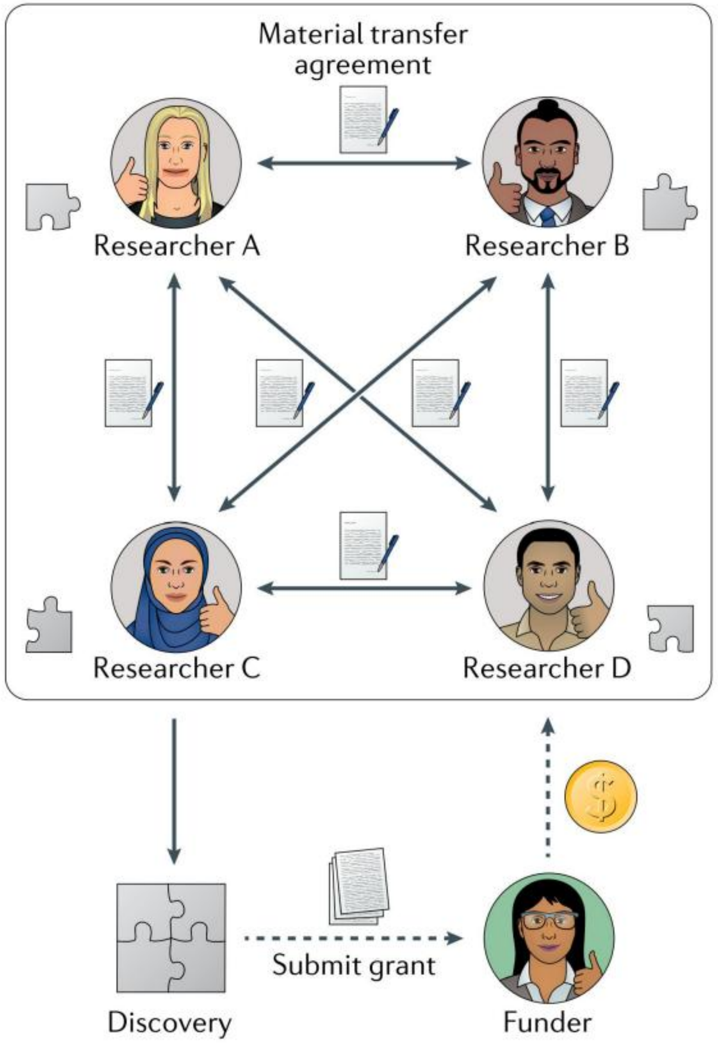


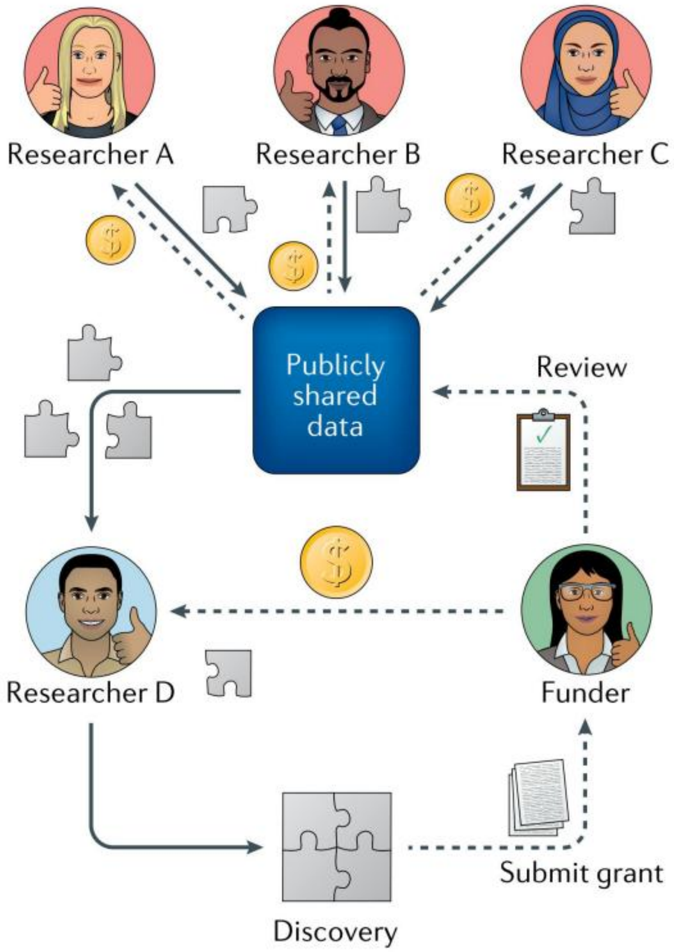
科学管理与政策导向：基金资助与学术合作的挑战





科学管理与政策导向：基金资助与学术合作的挑战






开放脑科学在中国

神经影像数据开放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鄂尔多斯盆地东缘临兴区块上古生界致密砂岩显微图像数据集
A photomicrograph dataset of Upper Paleozoic tight sandstone from Linxing block, eastern margin of Ordos Basin
推荐阅读
《岩石显微图像专题》卷首语
English


中国活体人脑成像共享数据库
支撑成效
3项
4578个
40篇
2项
1万+
数万名
CCS+DPABI
典型案例
一、学龄儿童青少年脑与心智发育研究
二、中国重度抑郁症功能磁共振数据集


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核物理 / 核应用
化学
光谱 / 质谱 / 色谱 /
热化学 / 状态物相 / 放射
生物化学 / 医药化工
天文
天文史 / 天体测量
高能天体物理 / 宇宙线
太阳系 / 银河系 / 宇宙
推荐数据库
—— 化学主题数据库
资源积累统计
数据集: 718 个
数据资源总量: 727.29TB
服务情况统计
累计在线访问人次: 14549.83万次
累计下载量: 2018.54TB

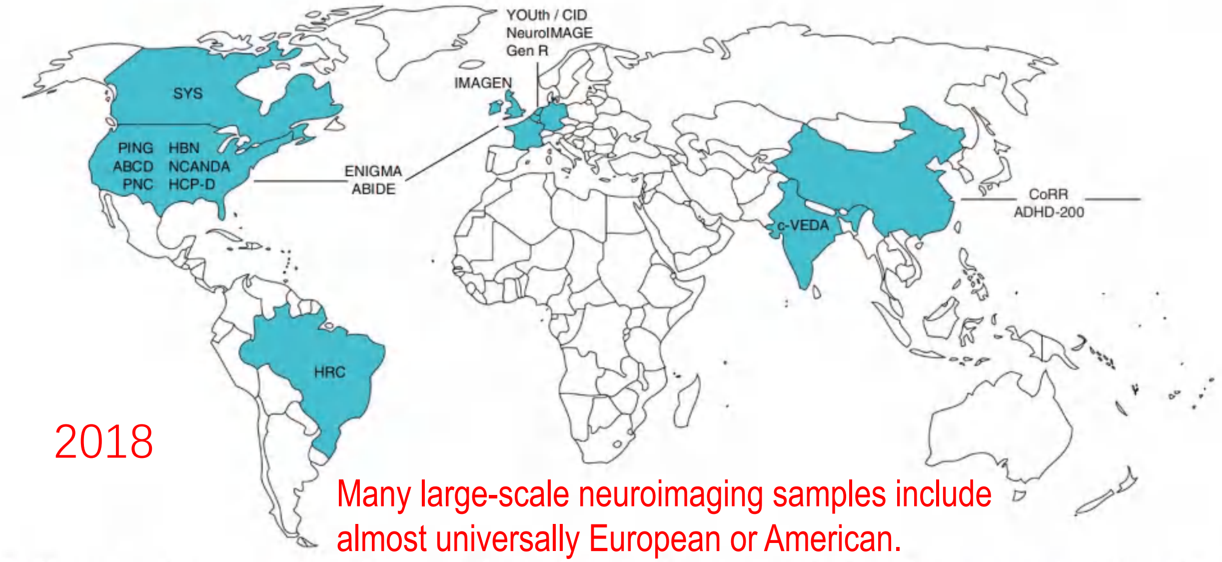
MRI Together

Call for Increasing Diversity

Diversity, Equity and Inclusivity within Data Science

NATURE COMMUNICATIONS | DOI: 10.1038/s41467-018-02887-9

REVIEW ARTICLE



2018

Many large-scale neuroimaging samples include almost universally European or American.

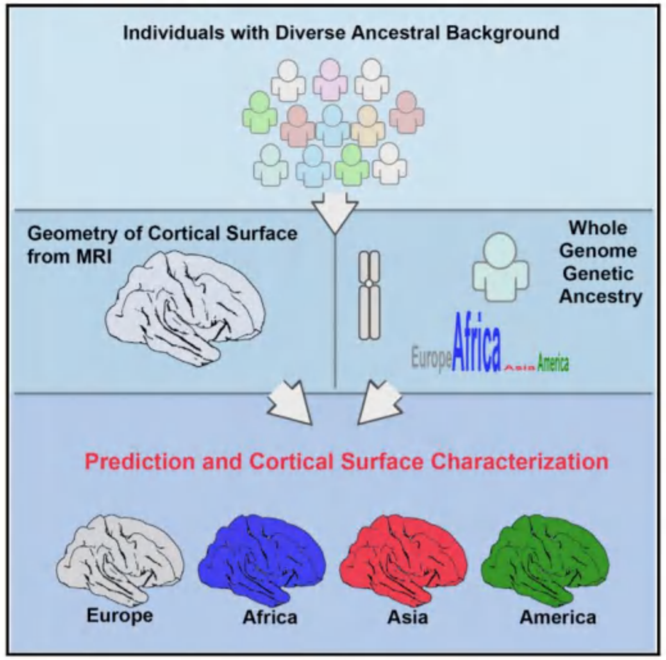
Fig. 1 Existing, ongoing, or planned data sets including structural and/or functional neuroimaging data from ~500 or more children or adolescents. These data sets, which represent both prospective and retrospective samples, include the Adolescent Brain Cognitive Development study[83] (ABCD; USA), Healthy Brain Network[82] (HBN; USA), Lifespan Human Connectome Project Development[80] (HCP-D; USA), National Consortium on Alcohol and NeuroDevelopment in Adolescence[149] (NCANDA; USA), Pediatric Imaging, Neurocognition, and Genetics study[150] (PING; USA), Philadelphia Neurodevelopmental Cohort[151] (PNC; USA), Saguenay Youth Study[152] (SYS; Canada), High Risk Cohort Study for the Development of Childhood Psychiatric Disorders[153] (HRC; Brazil), Autism Brain Imaging Data Exchange[81] (ABIDE; USA, Germany, Ireland, Belgium, Netherlands), Enhancing NeuroImaging Genetics through Meta-Analysis[154] (ENIGMA; worldwide), IMAGEN[79] (England, Ireland, France, Germany), Dutch YOUth cohort (part of the Consortium on Individual Development, or CID; Netherlands), Generation R Study[155] (Gen R; Netherlands), NeuroIMAGE[156] (follow-up of the Dutch arm of the International Multicenter ADHD Genetics, or IMAGE, project; Netherlands), Consortium on Vulnerability to Externalizing Disorders and Addictions (c-VEDA; UK, India), Consortium for Reliability and Reproducibility[157] (CoRR; China, USA, Canada, Germany), and ADHD-200[108] (USA, China). Although samples are distributed across the globe, African, Middle Eastern, South Asian, Oceanian, and Central and South American populations are underrepresented. Data collection efforts in these regions and others will be important for ensuring diverse, representative samples that will allow researchers to uncover general principles of the developing brain. (Map outline courtesy of Wikimedia user 'Loadfile' and is licensed under a CC BY SA 3.0

Current Biology

Report

Modeling the 3D Geometry of the Cortical Surface with Genetic Ancestry

Graphical Abstract



Authors

Chun Chieh Fan, Hauke Bartsch, Andrew J. Schork, ..., Nicholas J. Schork, Terry L. Jernigan, Anders M. Dale

Correspondence

amdale@ucsd.edu

In Brief

Fan et al. show that human cortical surface robustly predicts an individual's genetic ancestry despite that populations have been shaped by waves of migrations and admixture events. For each continental ancestry, the regional patterns of cortical folding and gyrification are unique and complex.

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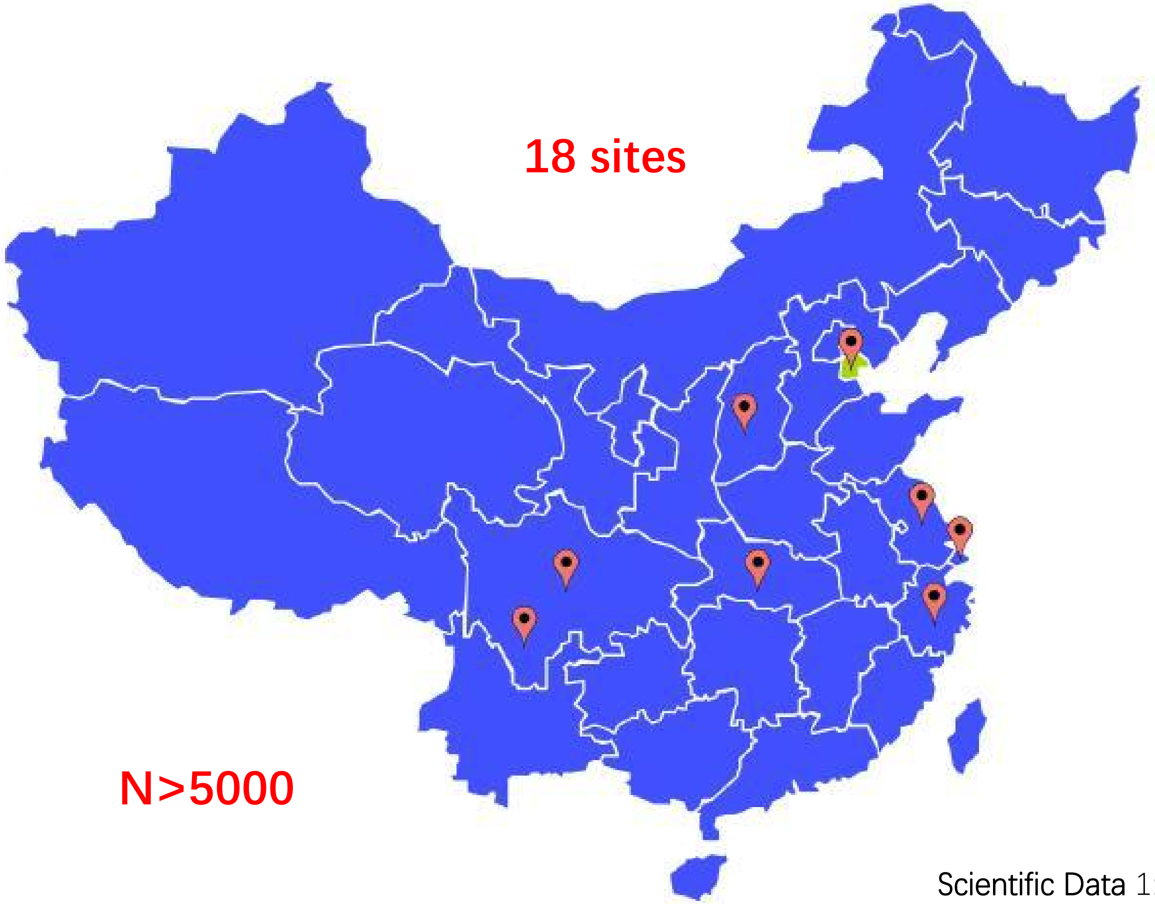
Consortium for Reliability and Reproducibility

https://www.nature.com/collections/yglmshrkbg



WISCONSIN UNIVERSITY OF WISCONSIN-MADISON

Xuanwu Hospital Capital Medical University

UNM

THE UNIVERSITY OF UTAH

南京军区南京总医院 Nanjing General Hospital of Nanjing Military Command

EU-AIMS Autism Research in Europe

NYU

UCSF University of California San Francisco

MAX-PLANCK-GESELLSCHAFT

BEIJING NORMAL UNIVERSITY 1902

中国科学院 CHINESE ACADEMY OF SCIENCES

HARVARD UNIVERSITY

SOUTHWEST UNIVERSITY

杭州师范大学 认知与脑疾病研究中心 Center for Cognition and Brain Disorders

CHILD MIND INSTITUTE

Scientific Data 1:140049 (2014) – CoRR (http://fcon_1000.projects.nitrc.org/indi/CoRR)

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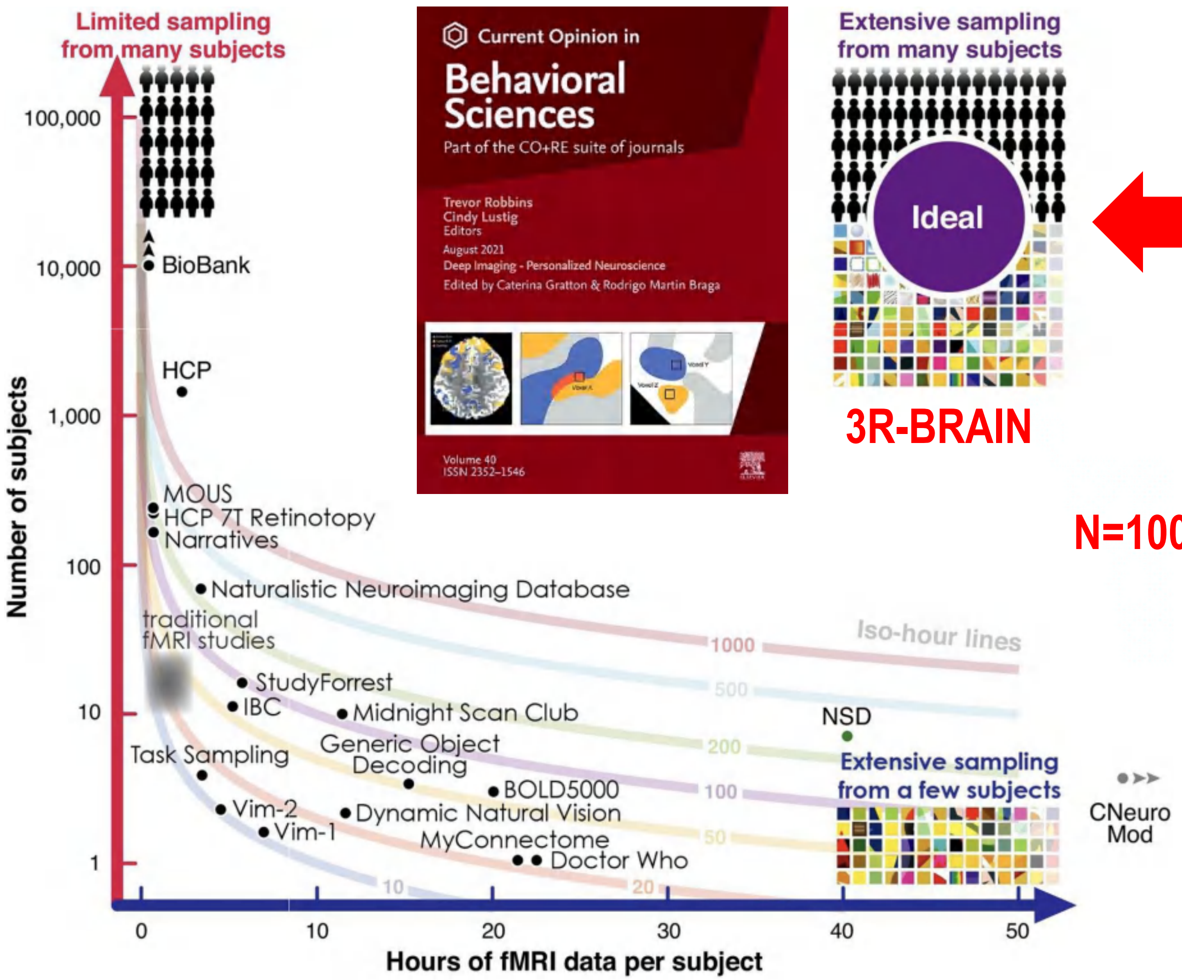
3R Brain Consortium

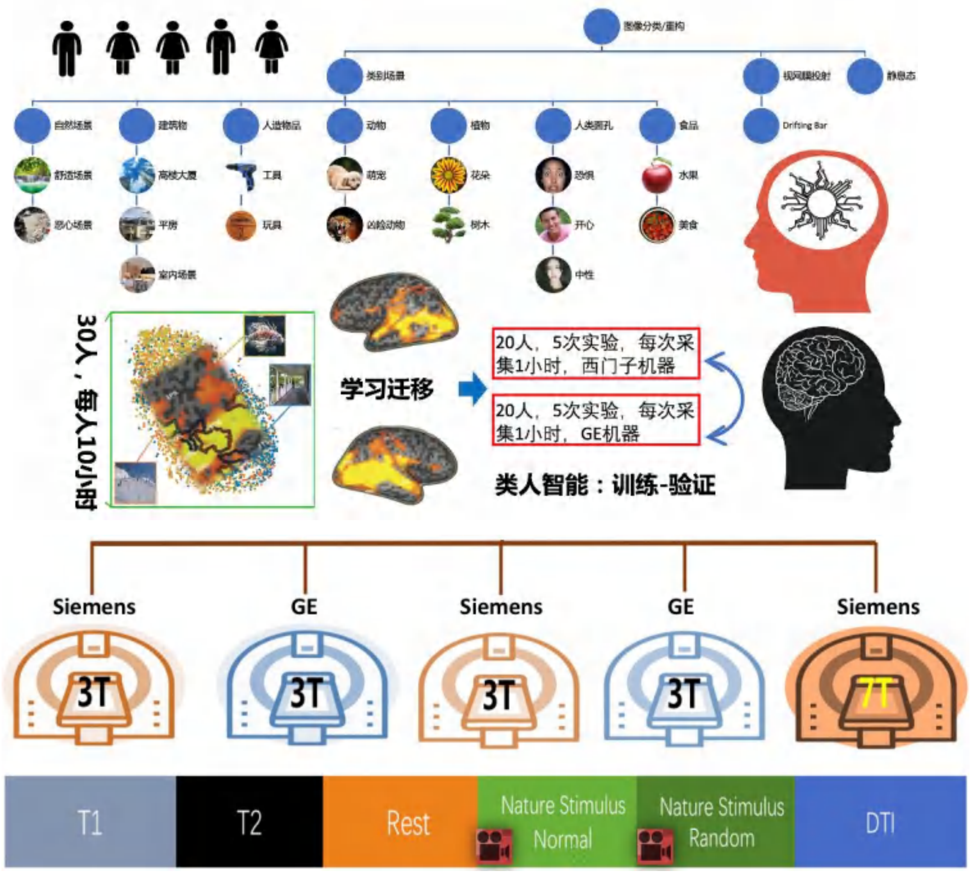
http://deepneuro.bnu.edu.cn/?p=163



3R-BRAIN

N=1000

A Brain Consortium for Reproducibility, Reliability and Replicability



	M	F	Age (years)	Total
Healthy Adults	165	201	34.2 ± 18.2	366

Large-Sample Data Platform

- **Genetic Measures**
- **Behavioral Measures**
- **MEG Data**
- **Multimodal MRI Data**
  - ✓ T1/T2 Structural
  - ✓ DTI
  - ✓ Resting-State fMRI
  - ✓ Task fMRI (7 Tasks)

	CHCP	HCP
Structural:	T1/T2 DTI	T1/T2 DTI
Functional:	Resting-state fMRI	Resting-state fMRI
	Task fMRI: 1. Language 2. Working Memory 3. Motor 4. Emotion 5. Relational 6. Social 7. Decision/Gambling	**Task fMRI:** 1. Language 2. Working Memory 3. Motor 4. Emotion 5. Relational 6. Social 7. Decision/Gambling

Behavior & Genetics

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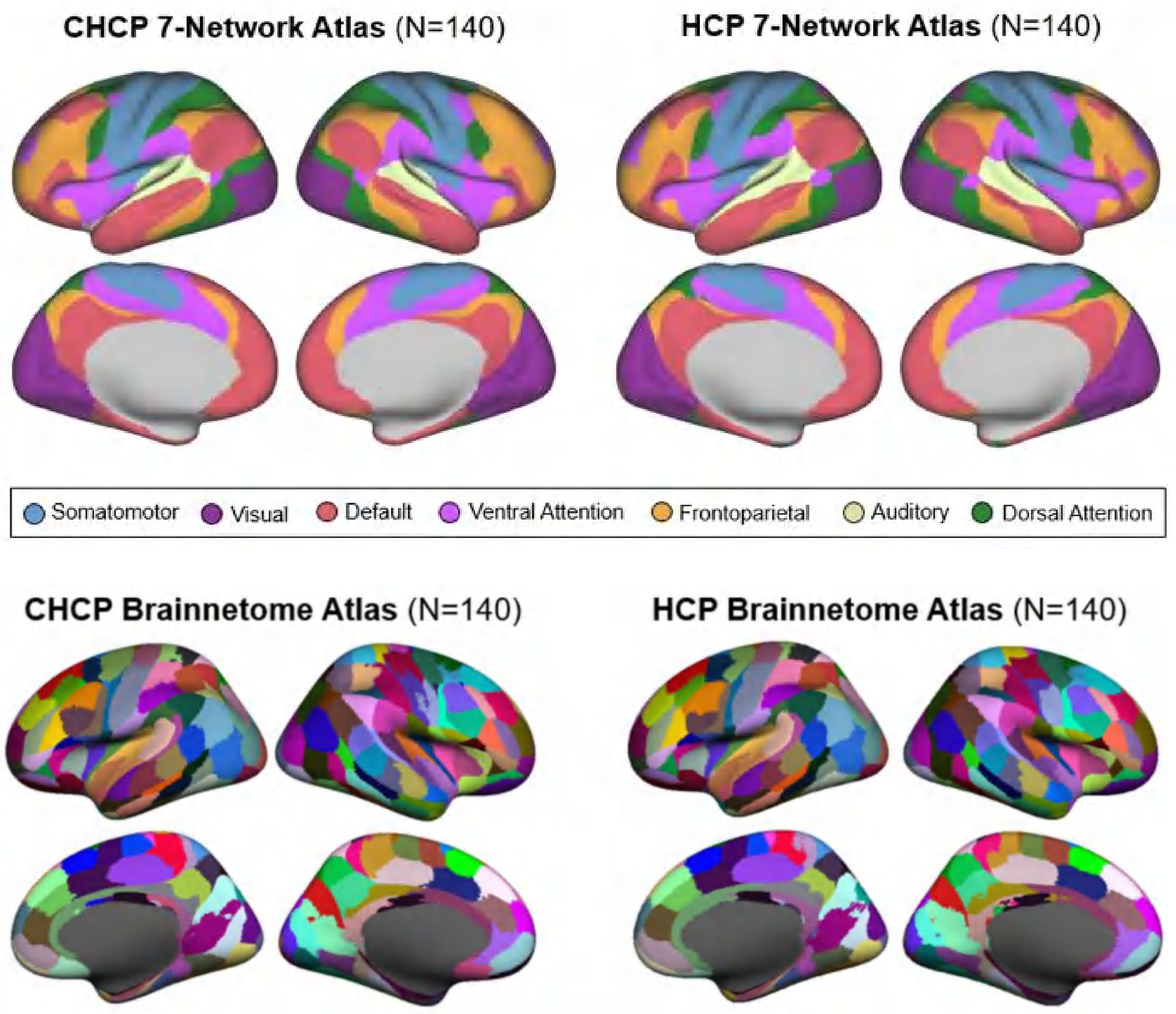
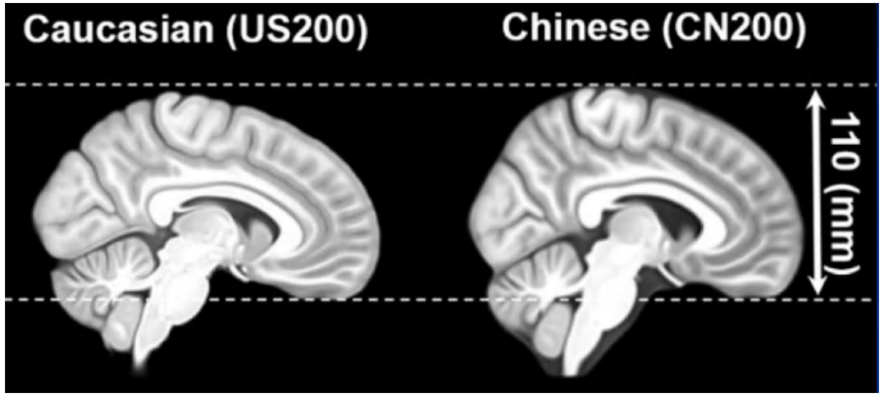
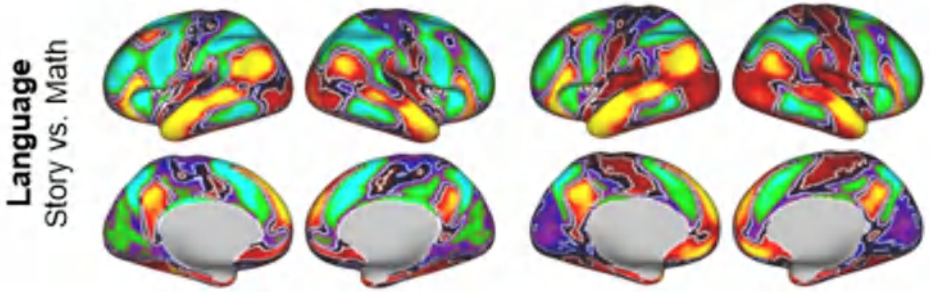
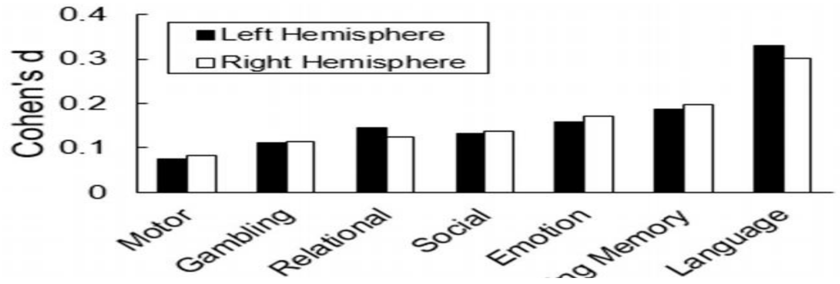
Chinese Human Connectome Project

https://chinese-hcp.cn









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Chinese Imaging Genetics Consortium

http://chimgen.tmu.edu.cn/en

N=10,000

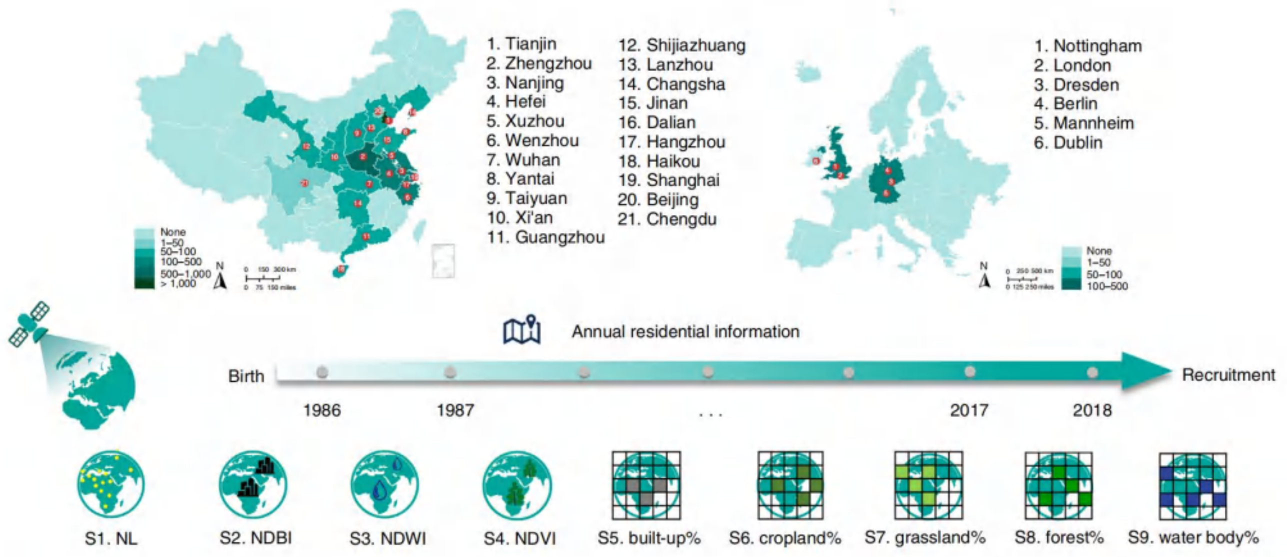
nature human behaviour

ARTICLES

https://doi.org/10.1038/s41562-021-01204-7

Check for updates

Global urbanicity is associated with brain and behaviour in young people



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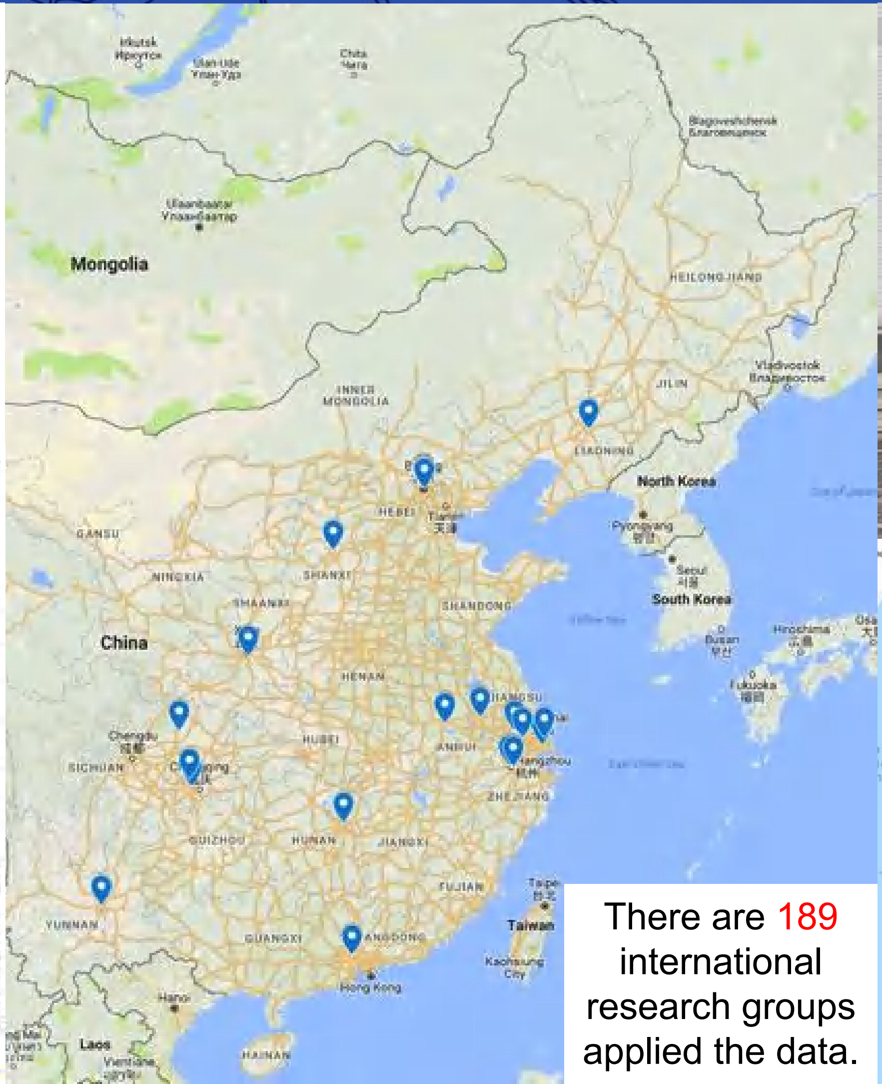
REST-meta-PD

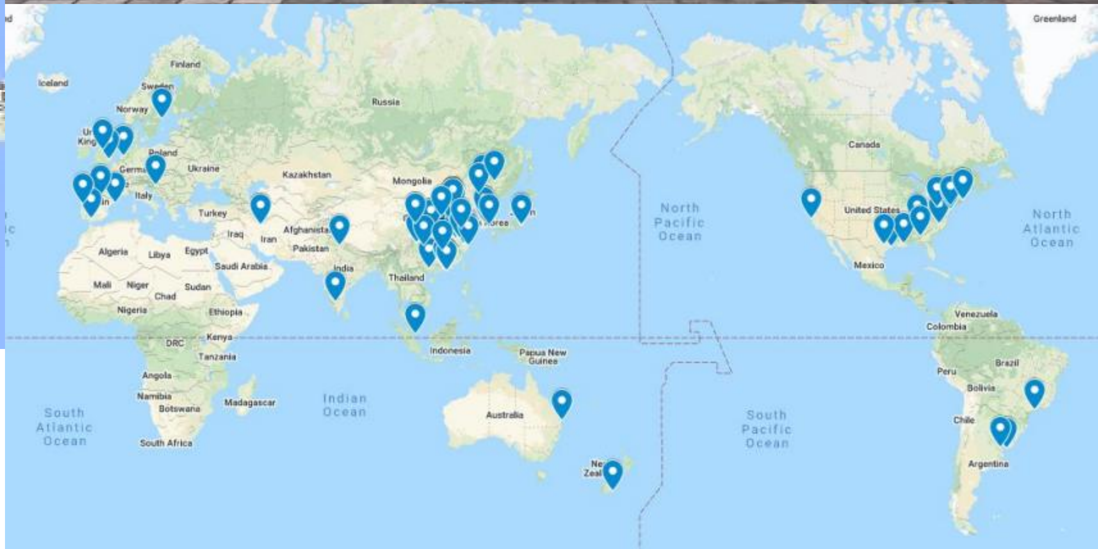
http://rfmri.org/REST-meta-MDD

REST-meta-MDD consortium contains neuroimaging data of 1,300 depressed patients and 1,128 normal controls from 25 research groups in China, forming the largest MDD rsfMRI dataset in the world.

Reduced default mode network functional connectivity in patients with recurrent major depressive disorder



There are 189 international research groups applied the data.



ELSEVIER
Science Bulletin
Volume 66, Issue 21, 15 November 2021, Pages 2148-2152
News & Views

Small *P* values may not yield robust findings: an example using REST-meta-PD

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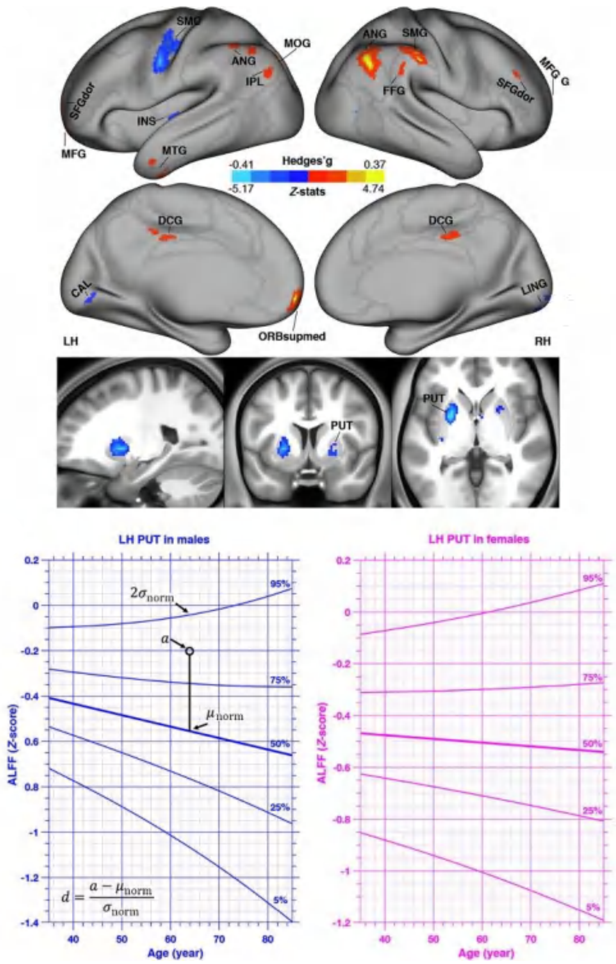
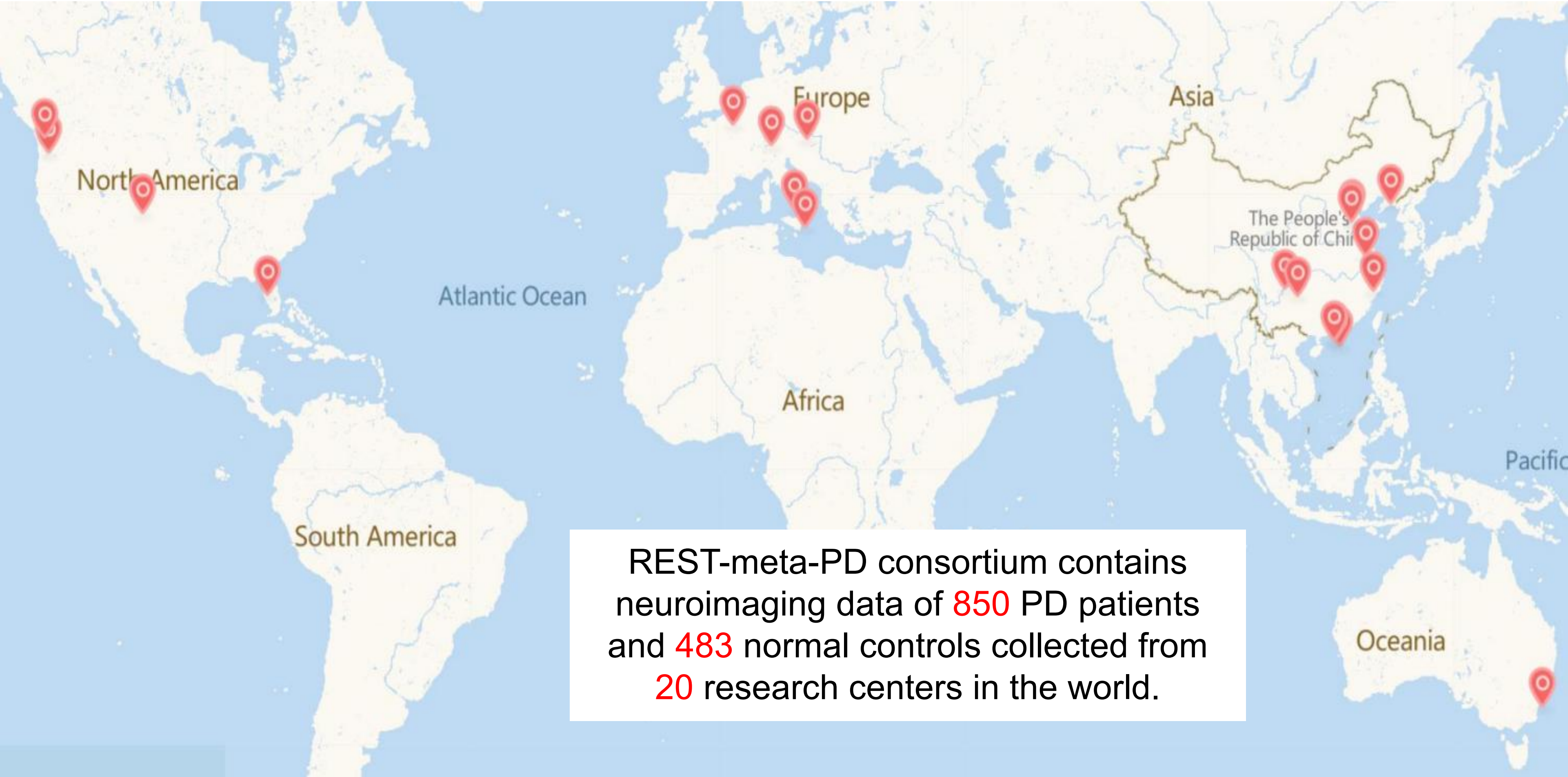
REST-meta-PD

Data Coming Soon to Public





REST-meta-PD consortium contains neuroimaging data of 850 PD patients and 483 normal controls collected from 20 research centers in the world.

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CBD – Beijing Cohort

Data-Sharing upon Requested

Children School Function and Brain Development: Beijing cohort study

北京师大-北大-回龙观医院
儿童脑发育与学校适应：基因-环境交互作用

Support

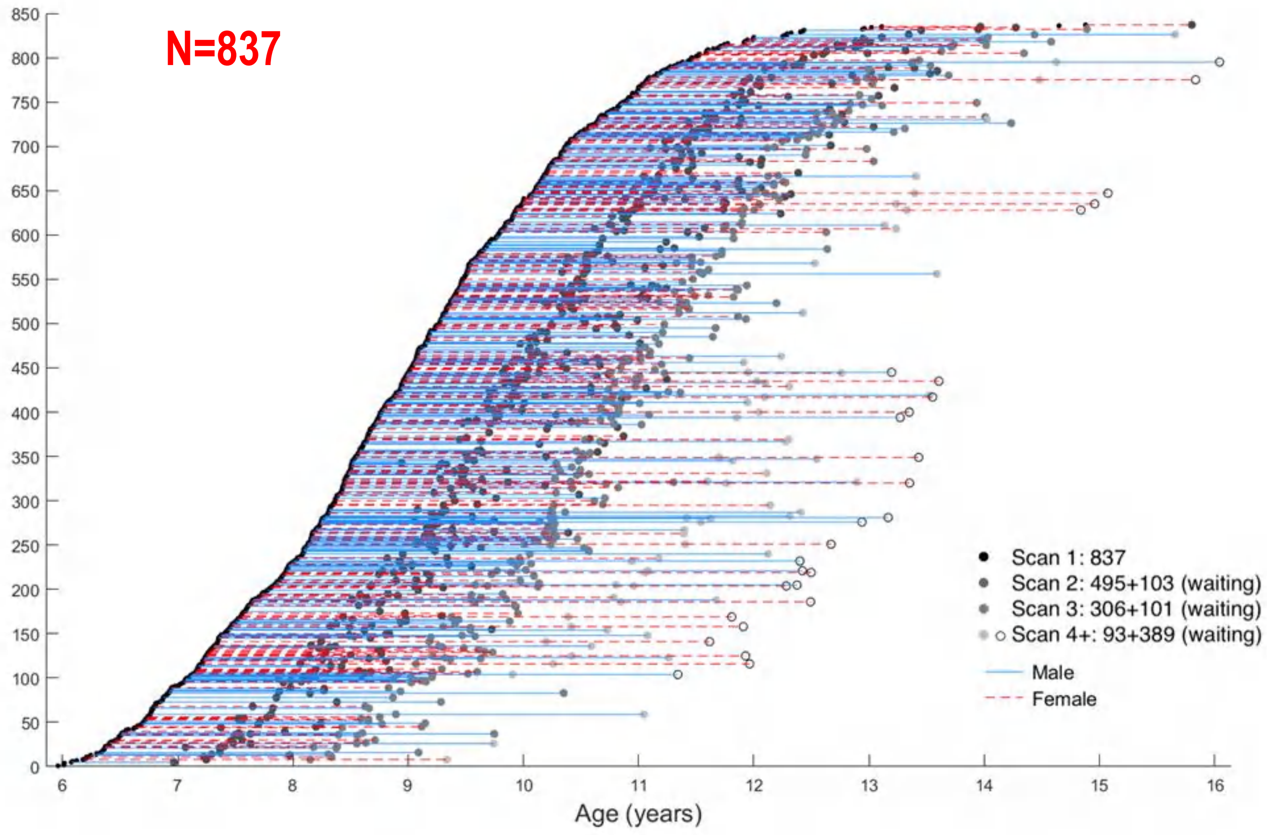
- 2016-2018: NSFC innovative team project (Chair： Qi Dong, Professor)
- 2018-2021: Beijing Brain Initiative Project (PI: Sha Tao)

Team

- Coordination: Sha Tao, Professor
- MRI: Yong He , Professor, with Drs. Jiahong Gao, Weiwei Men from PKU
- Task fMRI: Shaozheng Qin, Professor
- Behavioral assessments: Sha Tao, Professor
- Cohort running: Sha Tao, Professor
- Blood sample taking, preprocessing and storage: Shuping Tan, Professor, Huilongguan Hospital

International collaborator

- Gunter Schuman, Chair professor, KCL, Cohort Study. Now in Fudan U.
- Sylvan Desrivieres, Reader, KCL, Genomics



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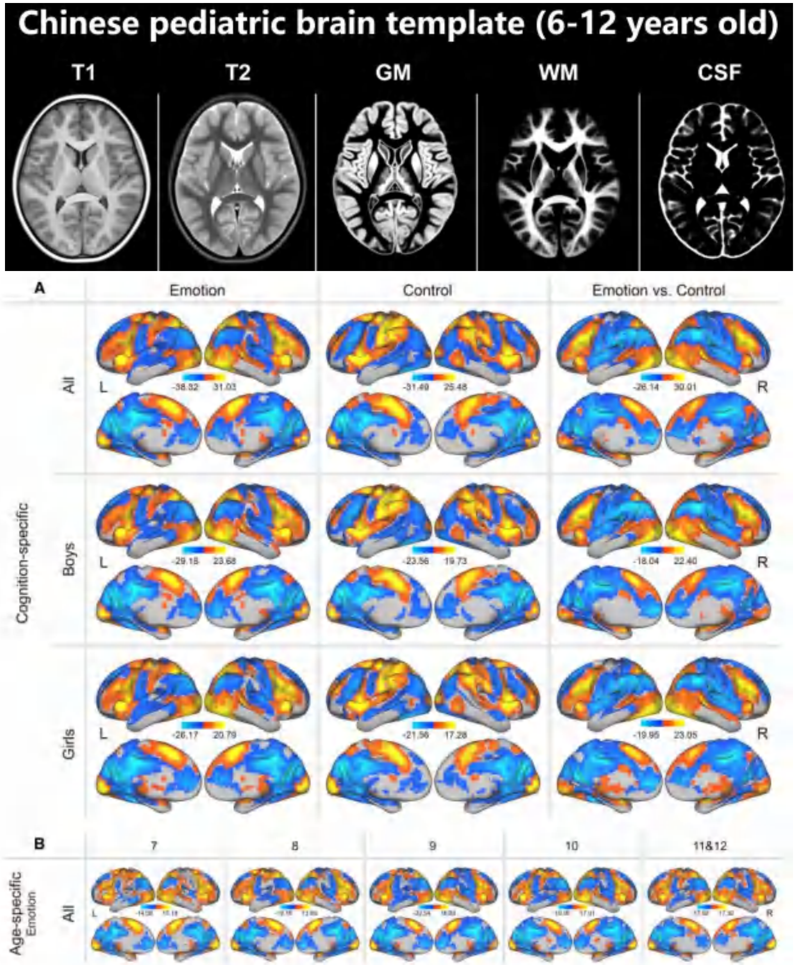
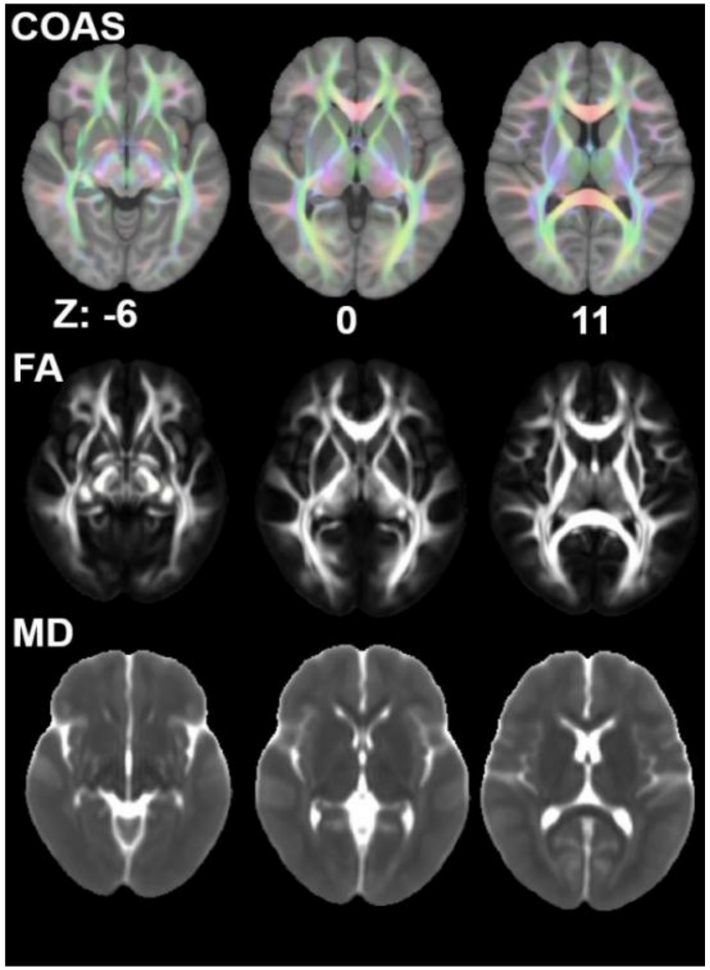
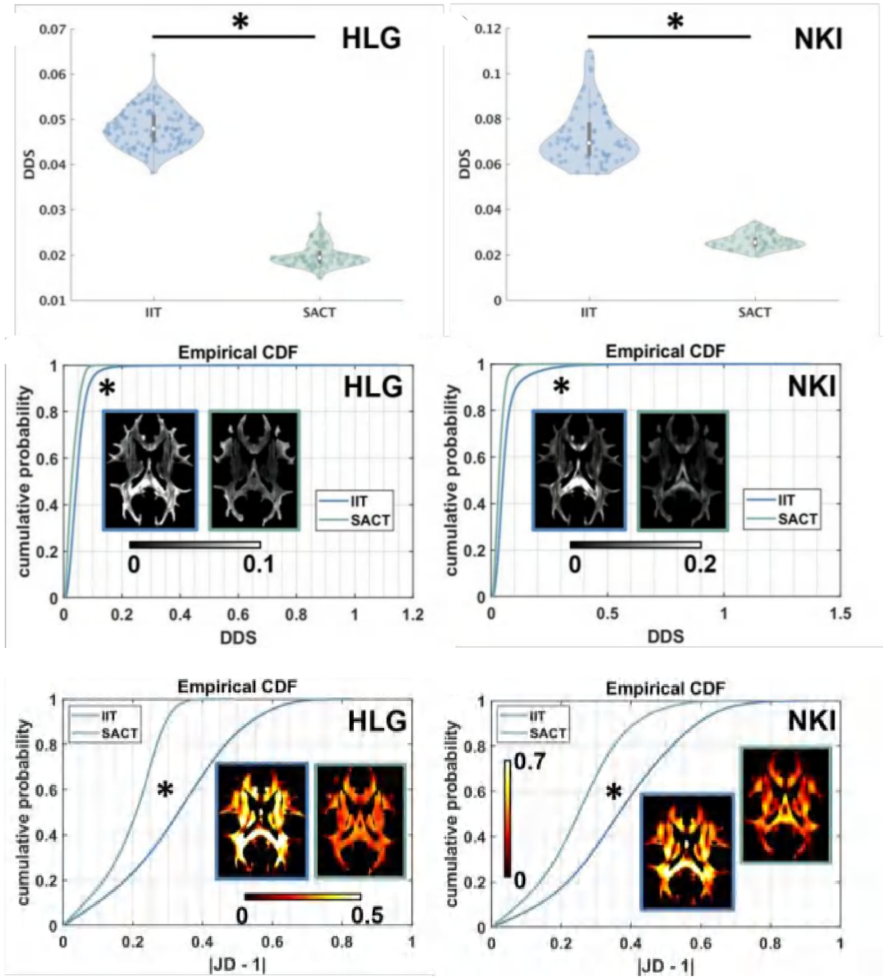
CBD – Beijing Cohort

Data-Sharing upon Requested



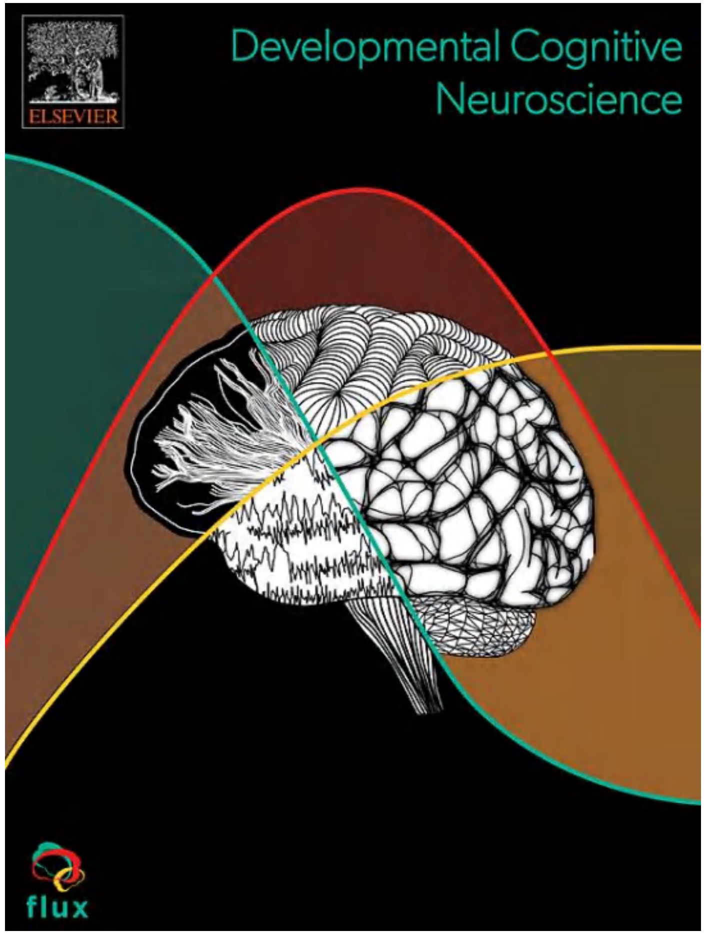




MRI Together

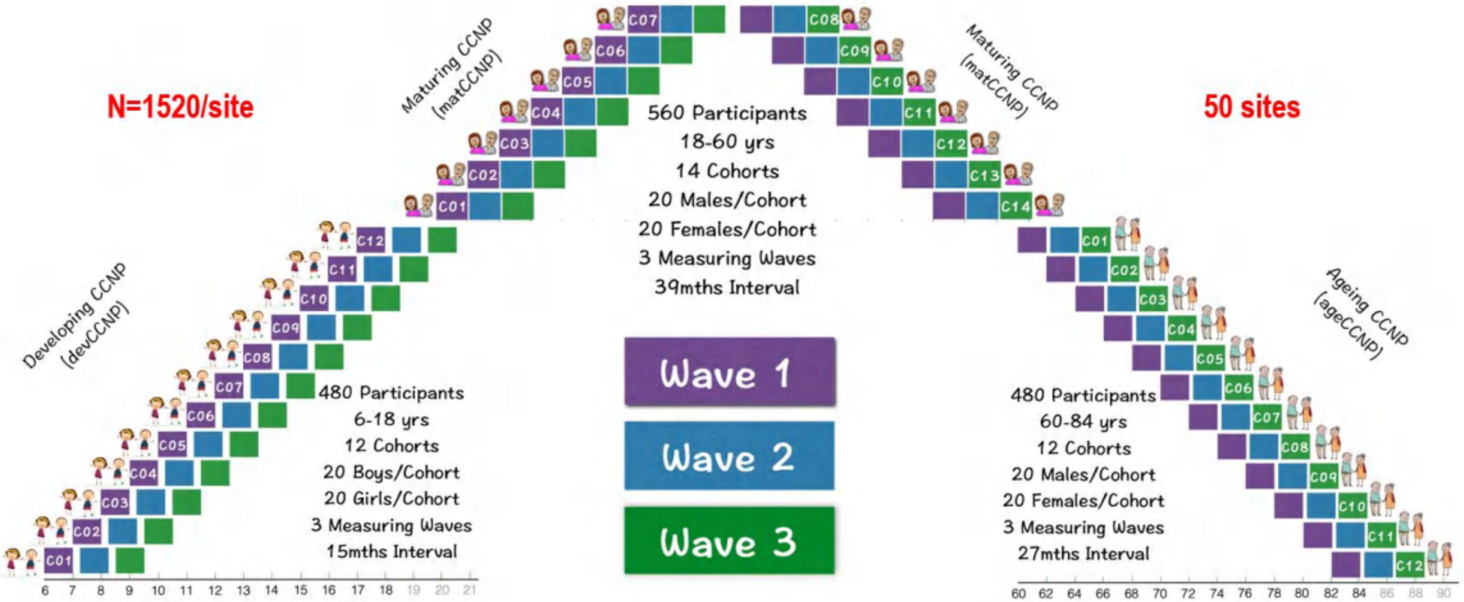
Chinese Color Nest Consortium

http://deepneuro.bnu.edu.cn/?p=163



Chinese Color Nest Project : An accelerated longitudinal brain-mind cohort

Siman Liu [a,b], Yin-Shan Wang [c,d], Qing Zhang [a,b], Quan Zhou [a,b], Li-Zhi Cao [a,b], Chao Jiang [e], Zhe Zhang [f], Ning Yang [c,d], Qi Dong [c], Xi-Nian Zuo [c,d,a,b,*,1], The Chinese Color Nest Consortium



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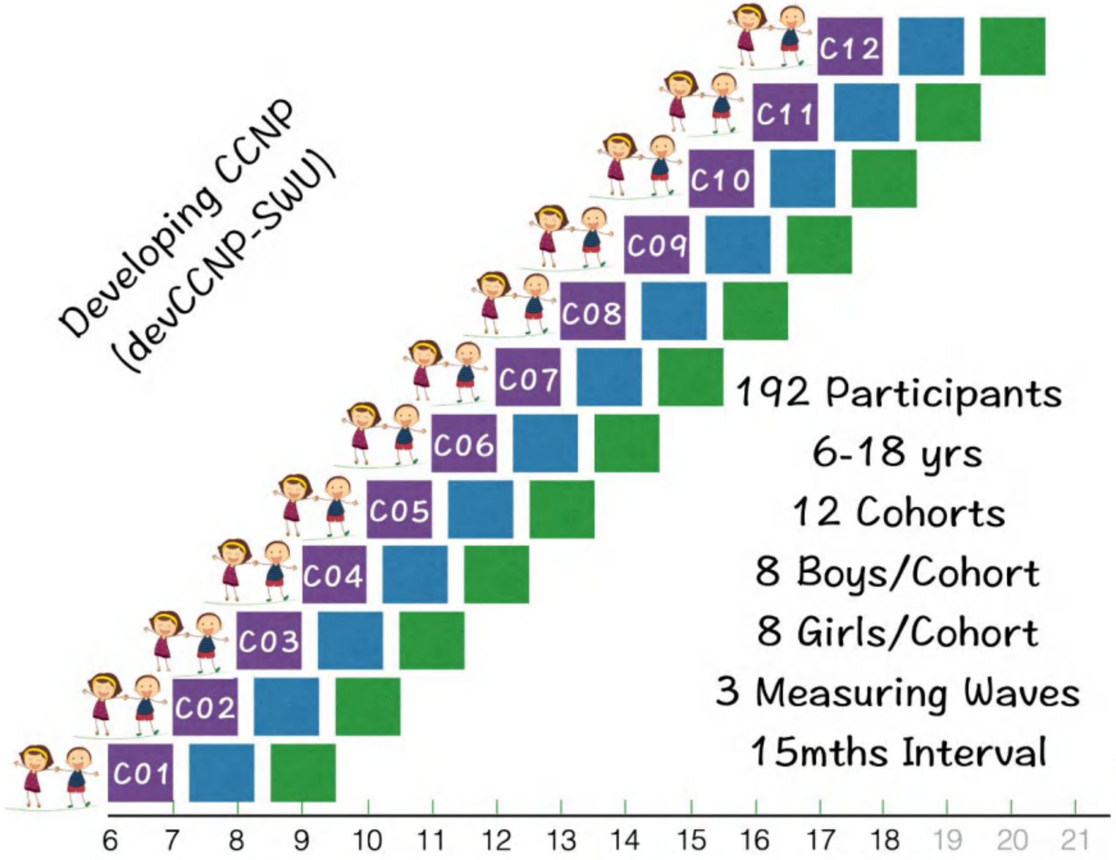

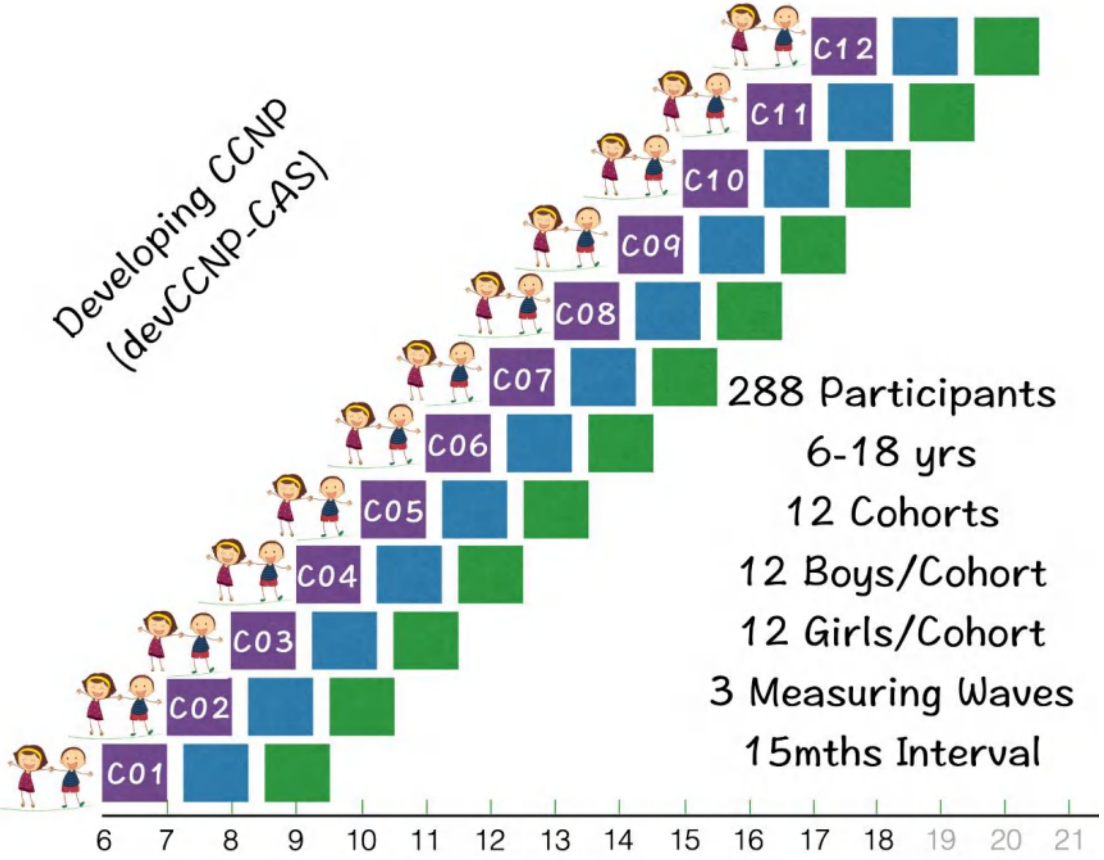

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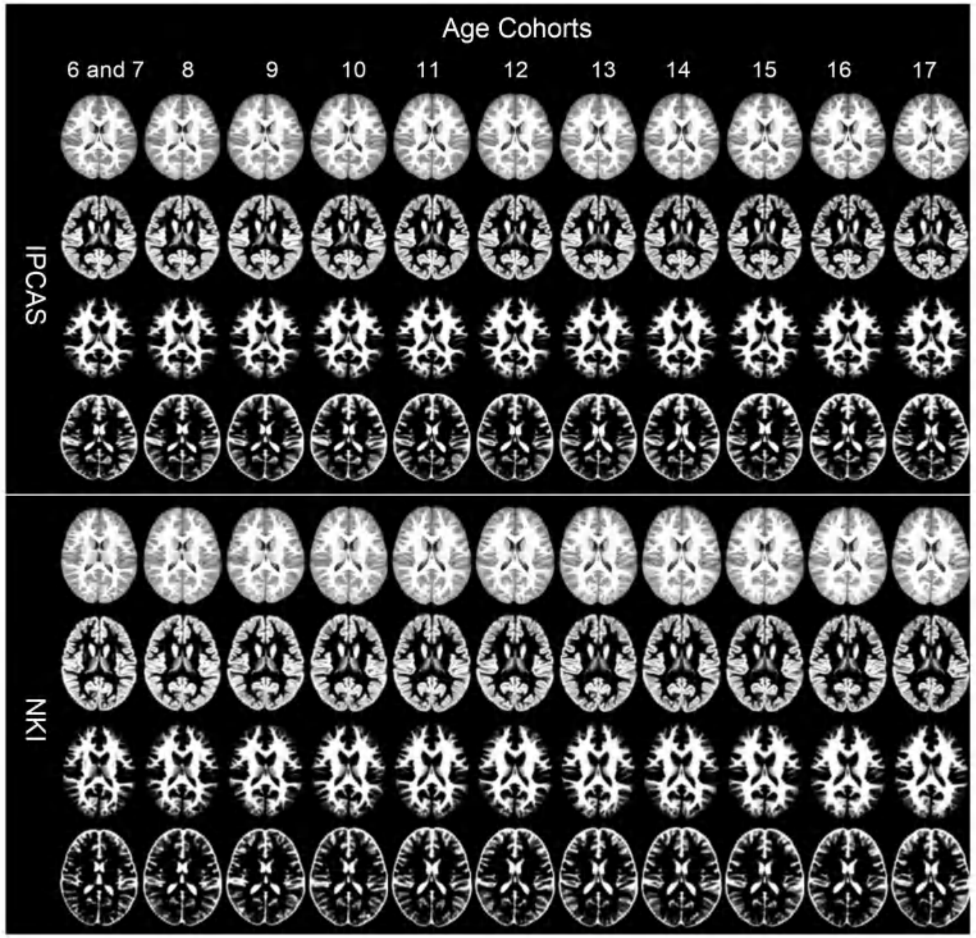

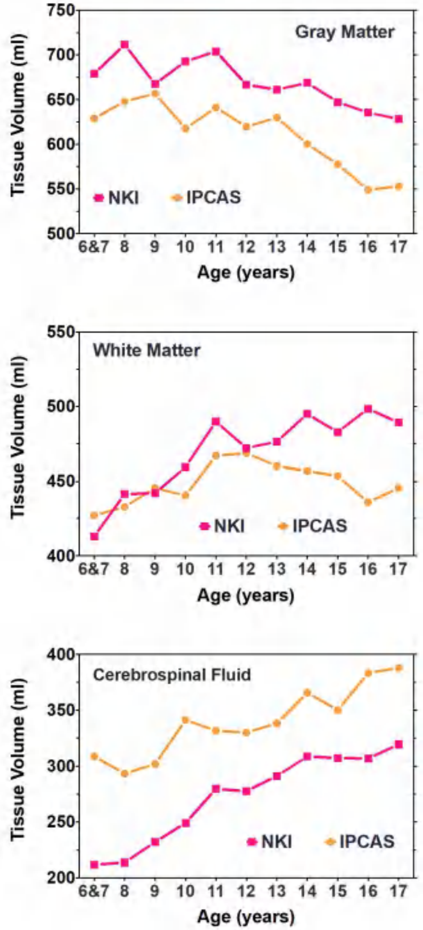

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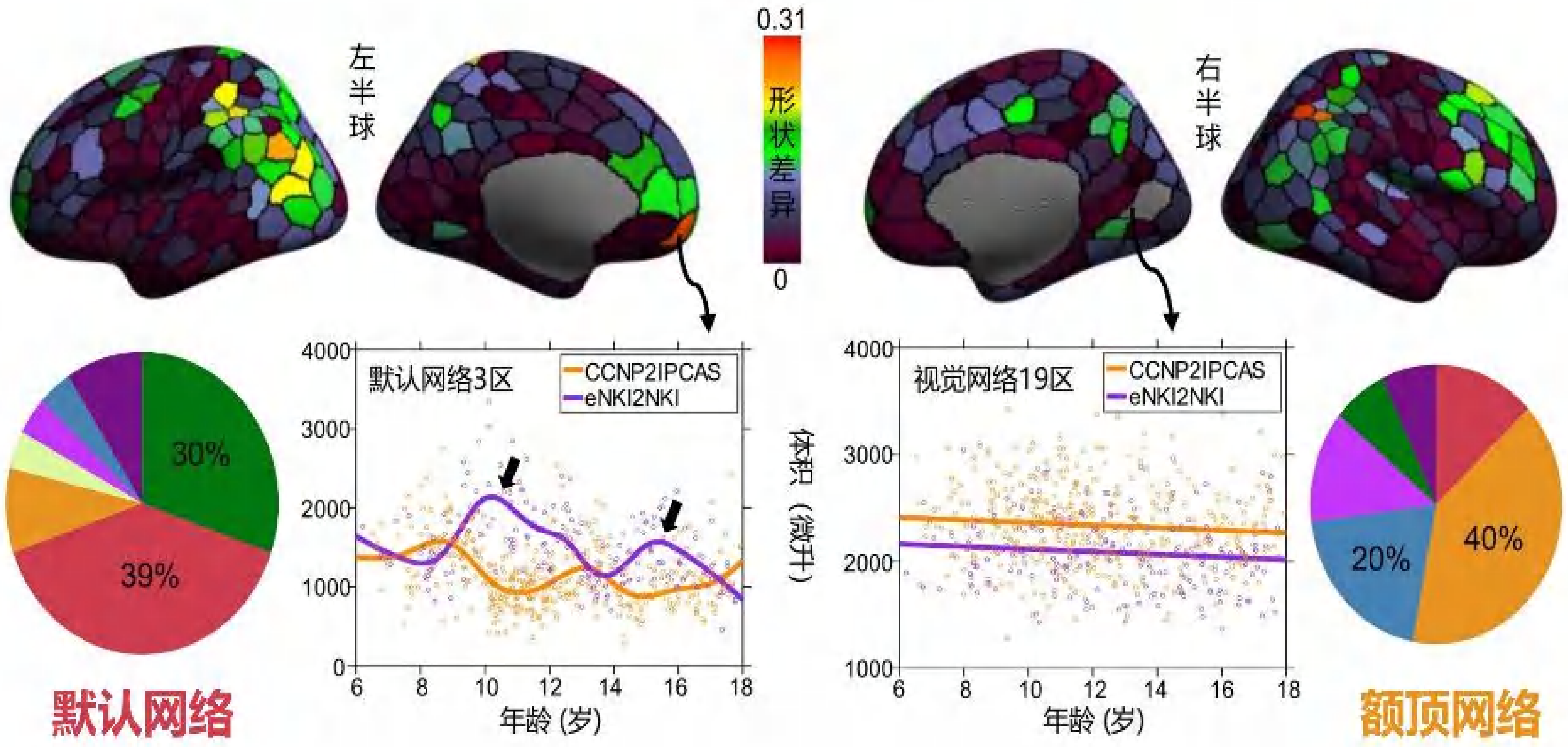


Share That Data for Open Science !
Open Resources for MRI Human Brain in China
admin, May 7, 2020
http://deepneuro.bnu.edu.cn/?p=43