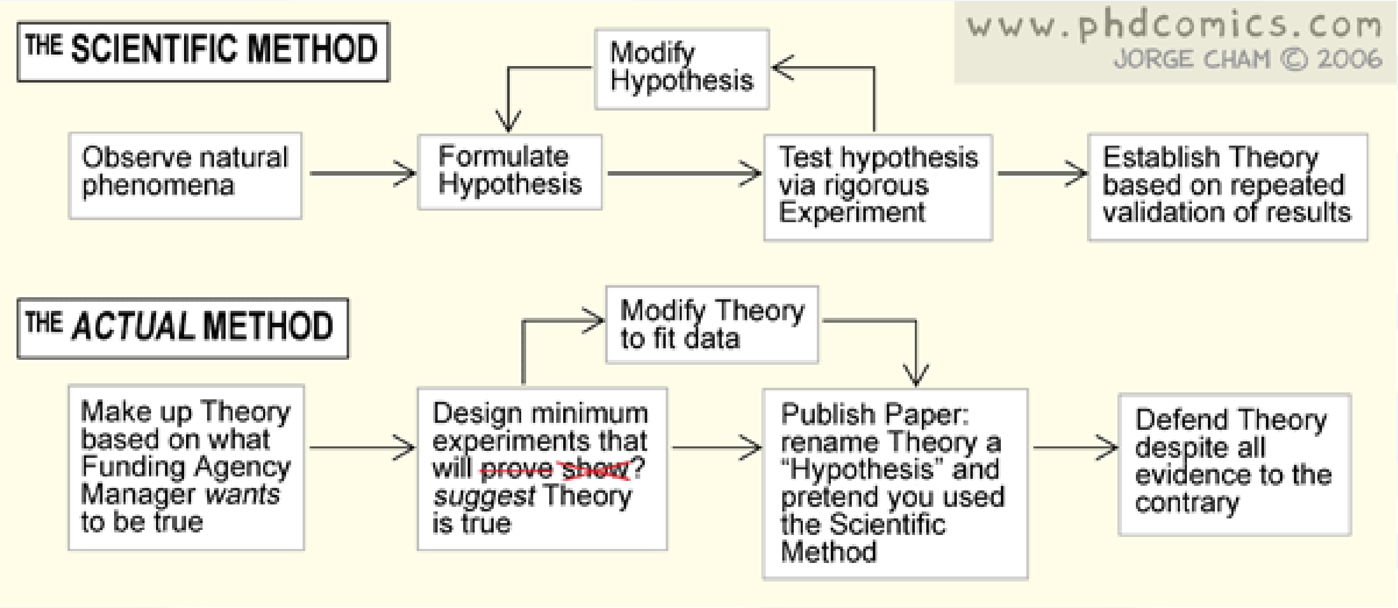
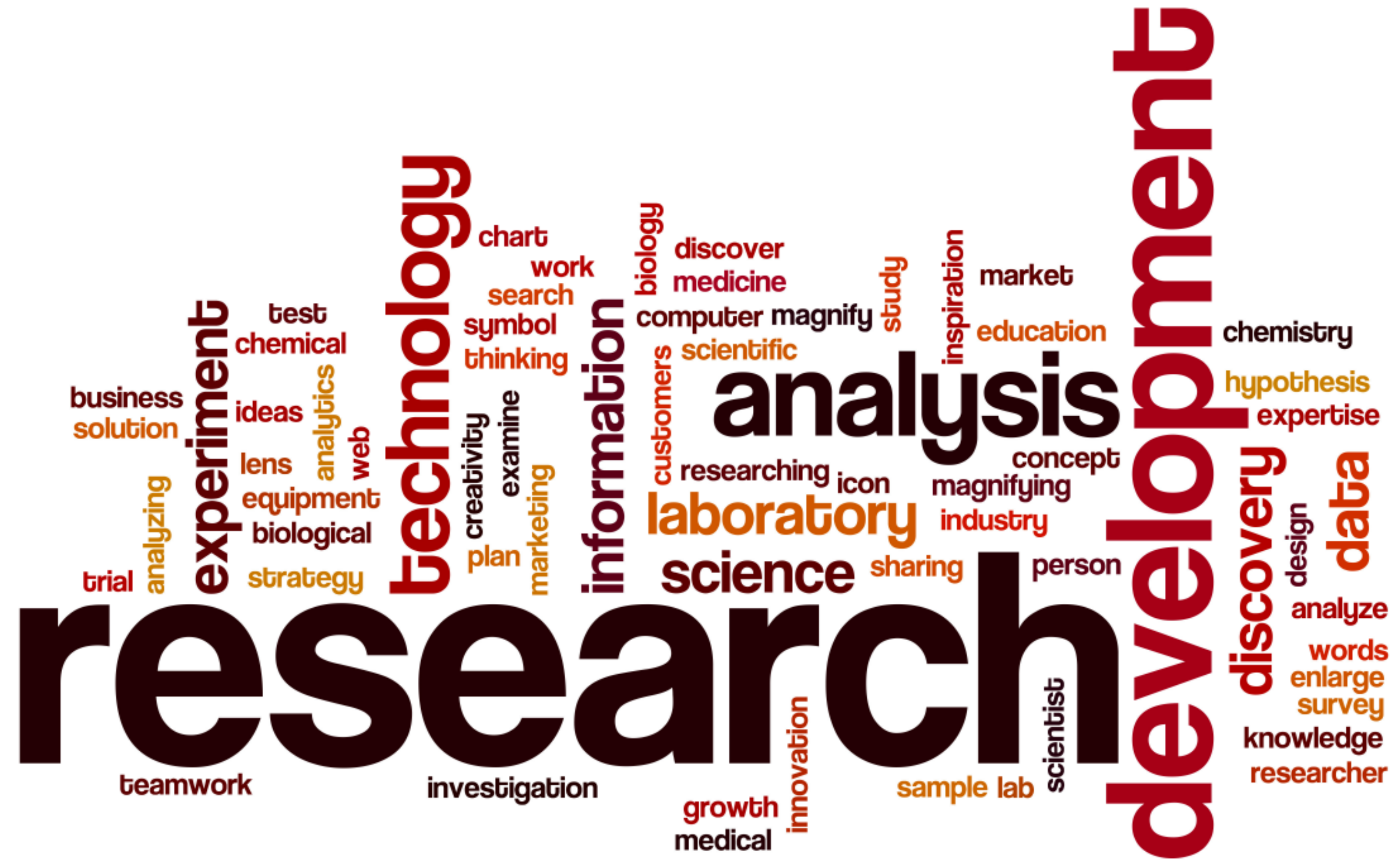

THE SCIENTIFIC METHOD
Observe natural phenomena
Formulate Hypothesis
Modify Hypothesis
Test hypothesis via rigorous Experiment
Establish Theory based on repeated validation of results
www.phdcomics.com
JORGE CHAM © 2006
THE *ACTUAL* METHOD
Make up Theory based on what Funding Agency Manager *wants* to be true
Design minimum experiments that will ~~prove~~ ~~show~~? *suggest* Theory is true
Modify Theory to fit data
Publish Paper: rename Theory a "Hypothesis" and pretend you used the Scientific Method
Defend Theory despite all evidence to the contrary

Conceptos básicos de investigación científica

José Biurrun Manresa

UNER Facultad de Ingeniería

Qué es la investigación científica?


research
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symbol
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biology
discover
medicine
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magnify
study
inspiration
market
education
chemistry
test
chemical
scientific
hypothesis
expertise
business
solution
ideas
analytics
web
creativity
examine
customers
lens
equipment
biological
strategy
analyzing
trial
plan
marketing
researching
icon
concept
magnifying
industry
sharing
person
design
analyze
words
enlarge
survey
knowledge
researcher
teamwork
investigation
growth
medical
innovation
sample lab
scientist

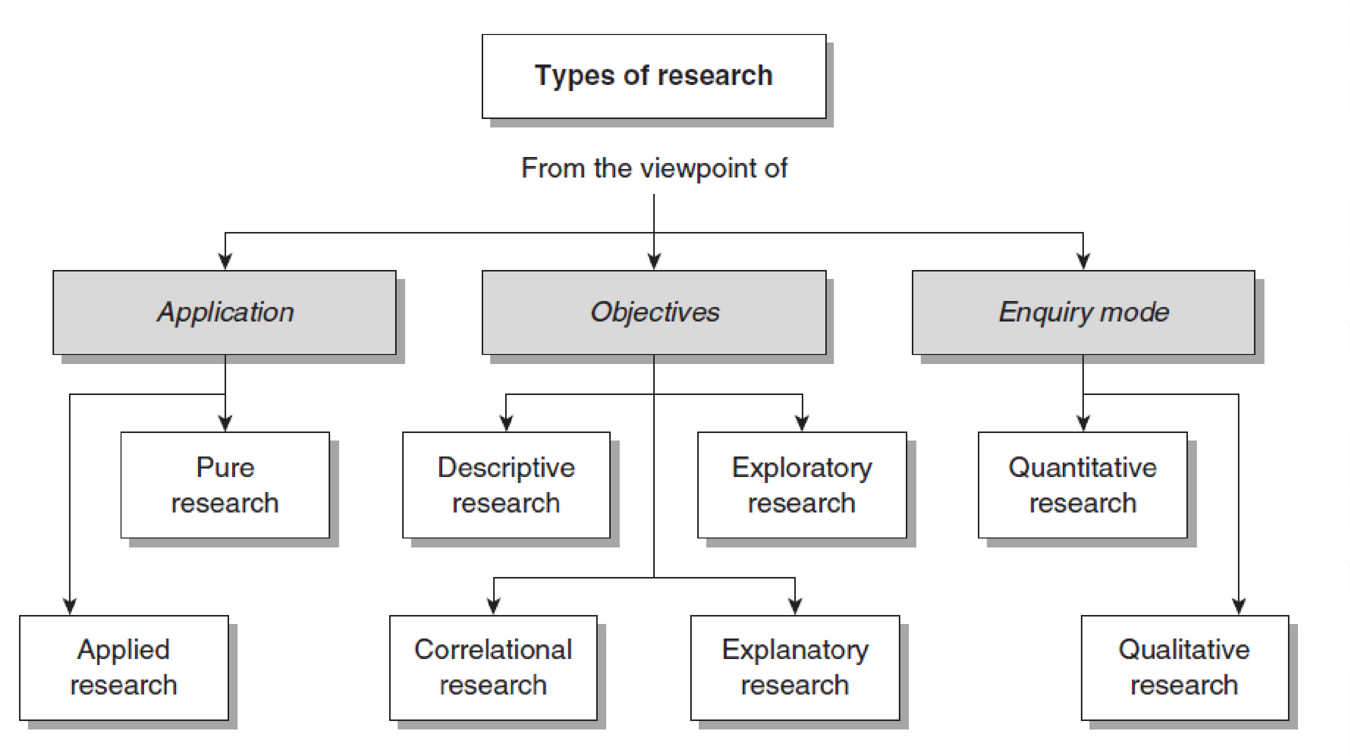
Investigación científica

Definición

La **investigación científica** es un conjunto de procesos *sistemáticos*, *críticos*, *empíricos* y *verificables* que se aplican a la recolección, análisis e interpretación de información con el fin de estudiar un fenómeno

Investigación científica

Tipos de investigación


Types of research

From the viewpoint of

Application
- Pure research
- Applied research

Objectives
- Descriptive research
- Exploratory research
- Correlational research
- Explanatory research

Enquiry mode
- Quantitative research
- Qualitative research

Investigación científica

Tipos de investigación según el enfoque

Enfoque cuantitativo

- Conjunto de procesos secuencial y probatorio, con un orden riguroso
- Parte de una *idea*, que una vez delimitada, permite derivar *preguntas de investigación* y *objetivos*, a partir de revisar la literatura construir un *marco teórico*
- De las preguntas se establecen *hipótesis* y determinan *variables*

Investigación científica

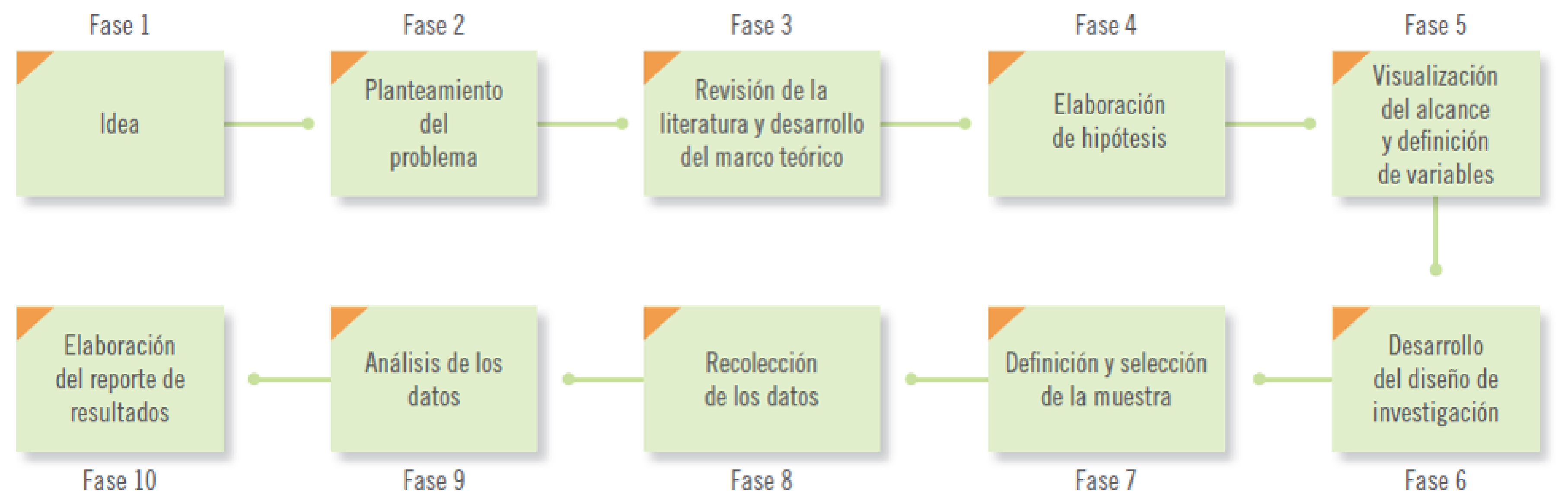
Tipos de investigación según el enfoque

Enfoque cuantitativo

- Se desarrolla un plan para probar las hipótesis (*diseño*)
- Se *miden* las variables en un determinado contexto
- Se *analizan* las mediciones obtenidas
- Se establece una serie de *conclusiones* respecto de las hipótesis
- Se *reportan* los resultados y las conclusiones

Investigación científica

Fases del enfoque cuantitativo



Fase 1
Idea

Fase 2
Planteamiento del problema

Fase 3
Revisión de la literatura y desarrollo del marco teórico

Fase 4
Elaboración de hipótesis

Fase 5
Visualización del alcance y definición de variables

Fase 6
Desarrollo del diseño de investigación

Fase 7
Definición y selección de la muestra

Fase 8
Recolección de los datos

Fase 9
Análisis de los datos

Fase 10
Elaboración del reporte de resultados

Investigación científica

Tipos de investigación según la aplicación

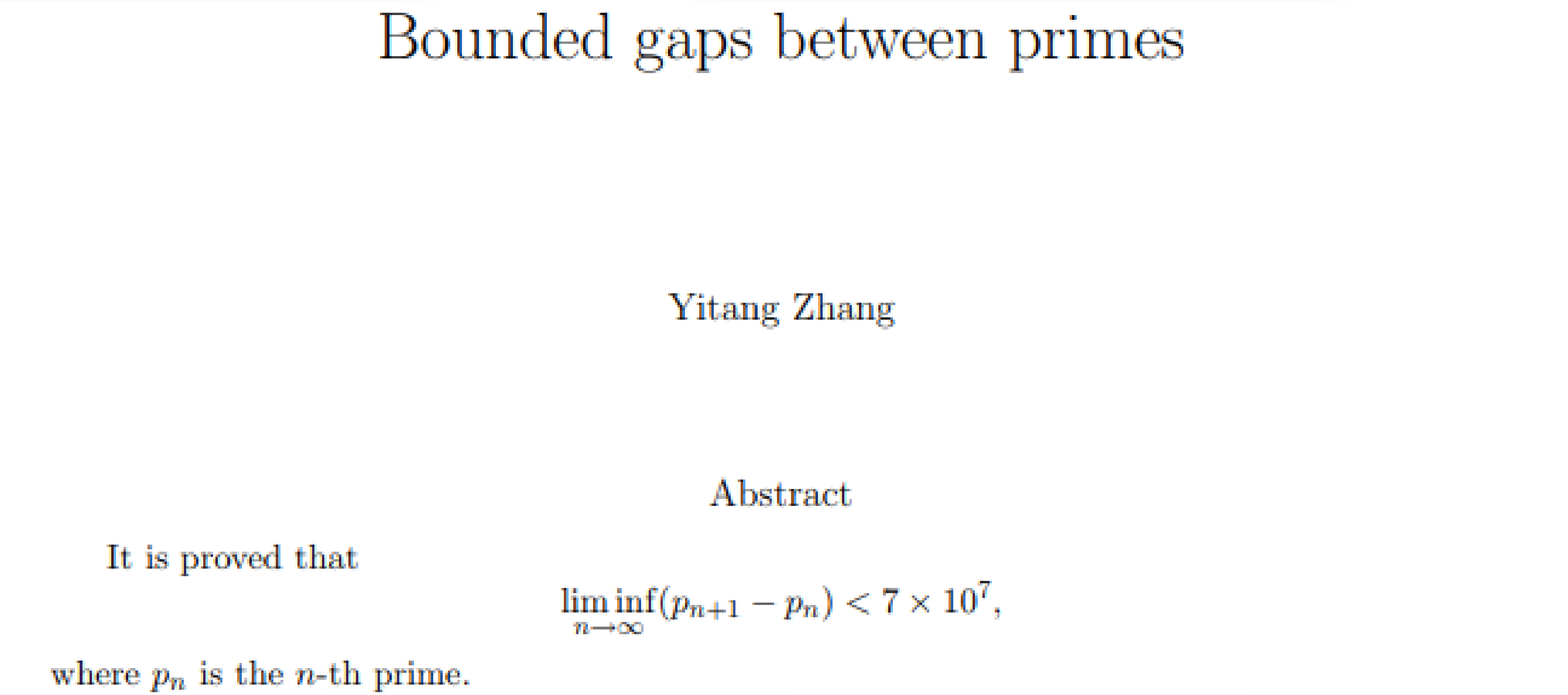
Investigación pura

- Desarrollo y prueba de teorías e hipótesis que son intelectualmente desafiantes al investigador

- Pueden o no tener aplicación práctica en la actualidad o en el futuro

Investigación científica

Ejemplo de investigación pura



Bounded gaps between primes

Yitang Zhang

Abstract

It is proved that

$$\liminf_{n \to \infty}(p_{n+1} - p_n) < 7 \times 10^7,$$

where p_n is the n-th prime.

Investigación científica

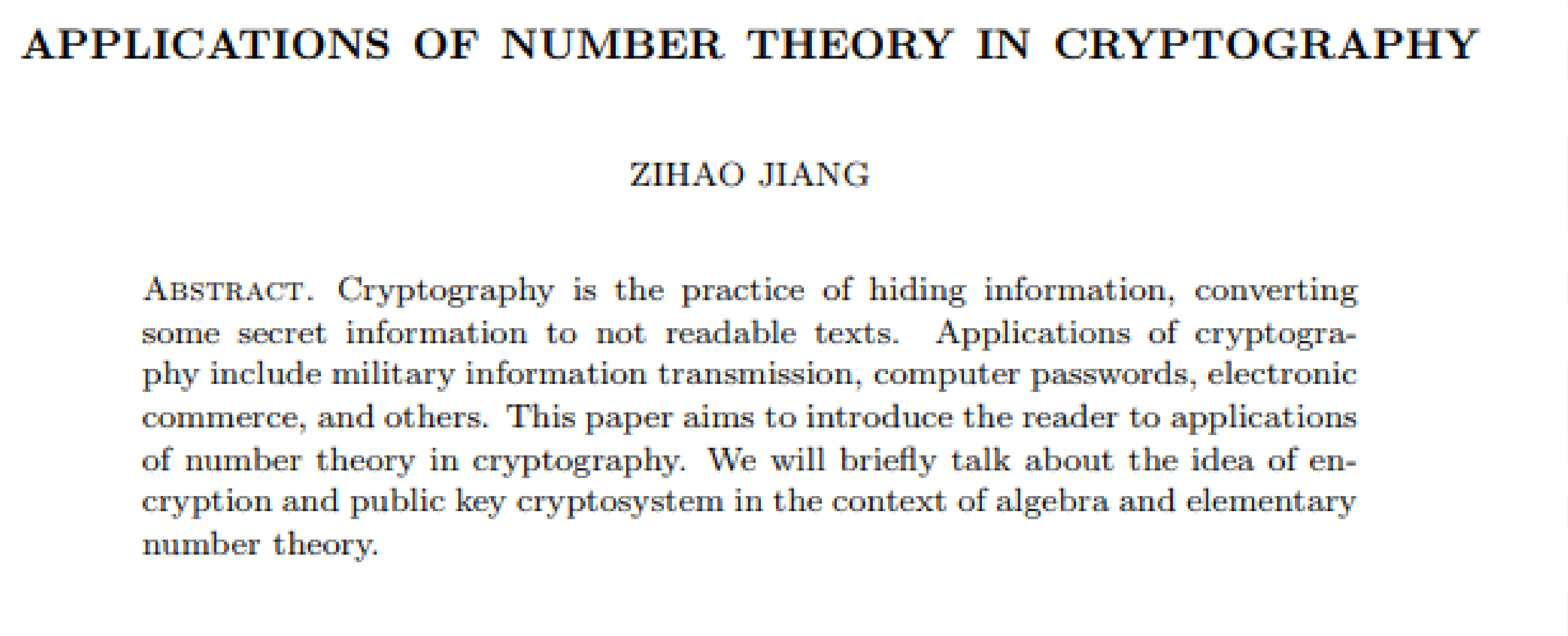
Tipos de investigación según la aplicación

Investigación aplicada

- Recopilación y análisis de información sobre diversos aspectos de una situación, tema, problema o fenómeno
- La información obtenida puede usarse de forma práctica

Investigación científica

Ejemplo de investigación aplicada



APPLICATIONS OF NUMBER THEORY IN CRYPTOGRAPHY

ZIHAO JIANG

Abstract. Cryptography is the practice of hiding information, converting some secret information to not readable texts. Applications of cryptography include military information transmission, computer passwords, electronic commerce, and others. This paper aims to introduce the reader to applications of number theory in cryptography. We will briefly talk about the idea of encryption and public key cryptosystem in the context of algebra and elementary number theory.

Investigación científica

Tipos de investigación según los objetivos

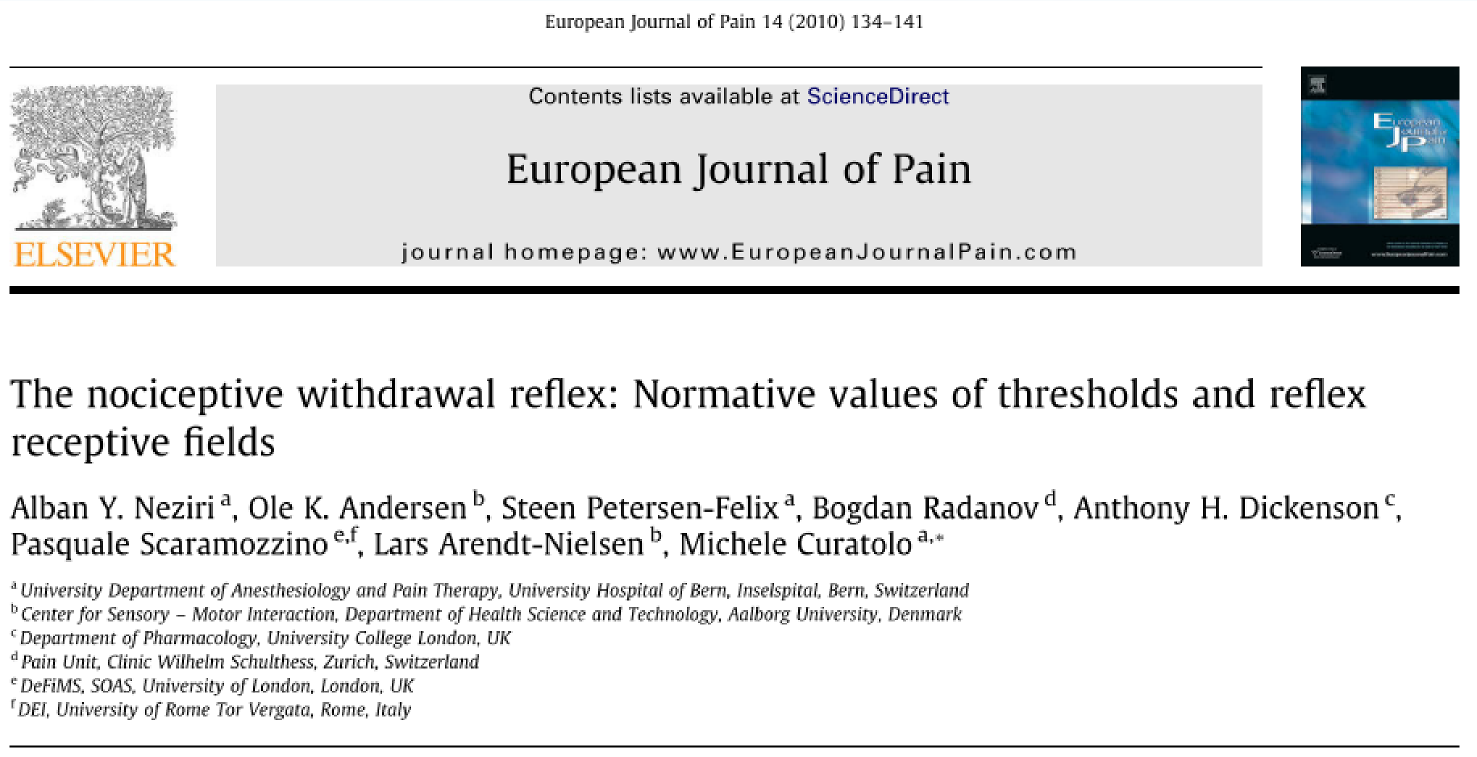
Estudios descriptivos

- Intentan describir sistemáticamente una situación, problema, o fenómeno

- El objetivo principal es describir lo que es prevalente con respecto al cuestión o problema en estudio

Investigación científica

Ejemplos de estudios descriptivos



European Journal of Pain 14 (2010) 134–141

Contents lists available at ScienceDirect

European Journal of Pain

journal homepage: www.EuropeanJournalPain.com

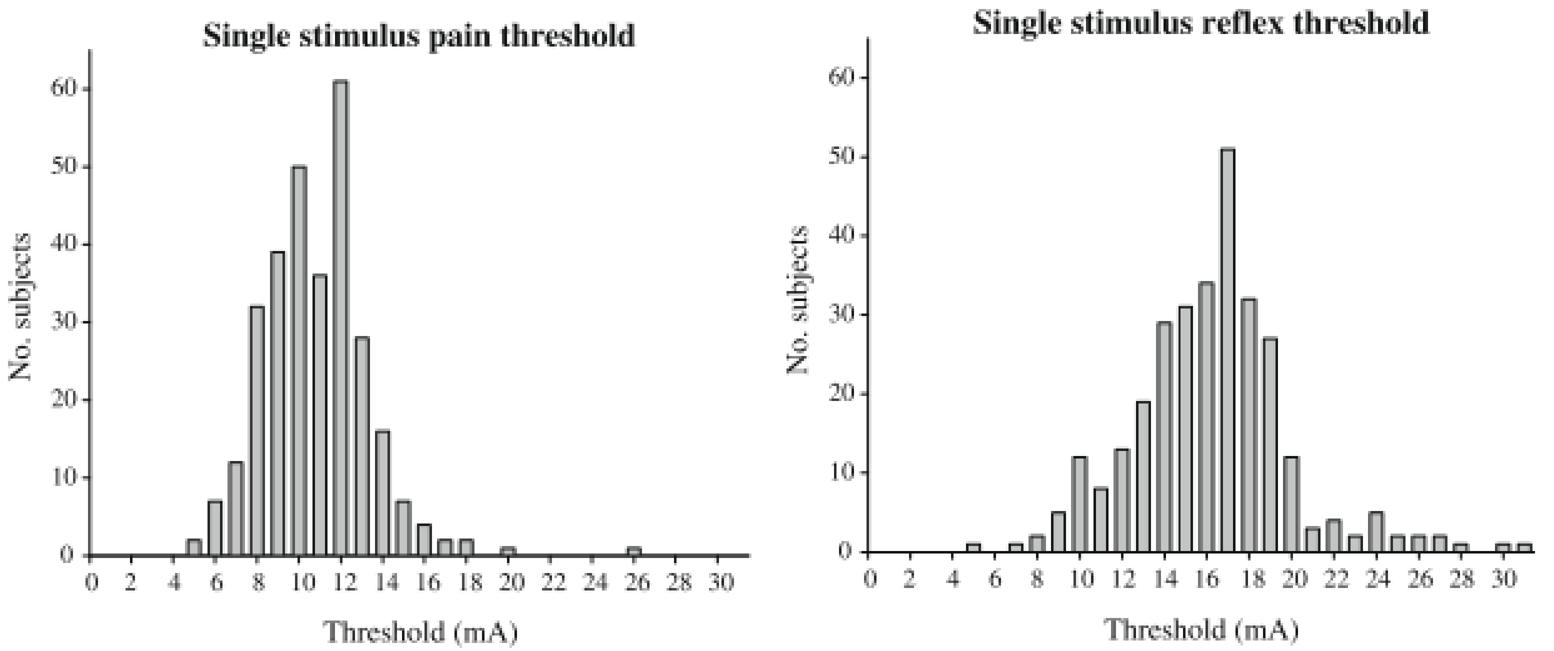
The nociceptive withdrawal reflex: Normative values of thresholds and reflex receptive fields

Alban Y. Neziri [a], Ole K. Andersen [b], Steen Petersen-Felix [a], Bogdan Radanov [d], Anthony H. Dickenson [c], Pasquale Scaramozzino [e,f], Lars Arendt-Nielsen [b], Michele Curatolo [a,*]

[a] University Department of Anesthesiology and Pain Therapy, University Hospital of Bern, Inselspital, Bern, Switzerland
[b] Center for Sensory – Motor Interaction, Department of Health Science and Technology, Aalborg University, Denmark
[c] Department of Pharmacology, University College London, UK
[d] Pain Unit, Clinic Wilhelm Schulthess, Zurich, Switzerland
[e] DeFiMS, SOAS, University of London, London, UK
[f] DEI, University of Rome Tor Vergata, Rome, Italy

Investigación científica

Ejemplos de estudios descriptivos


Single stimulus pain threshold

Single stimulus reflex threshold

Fig. 1. Distribution of pain and reflex threshold to single stimulus in the 300 pain-free subjects.

Investigación científica

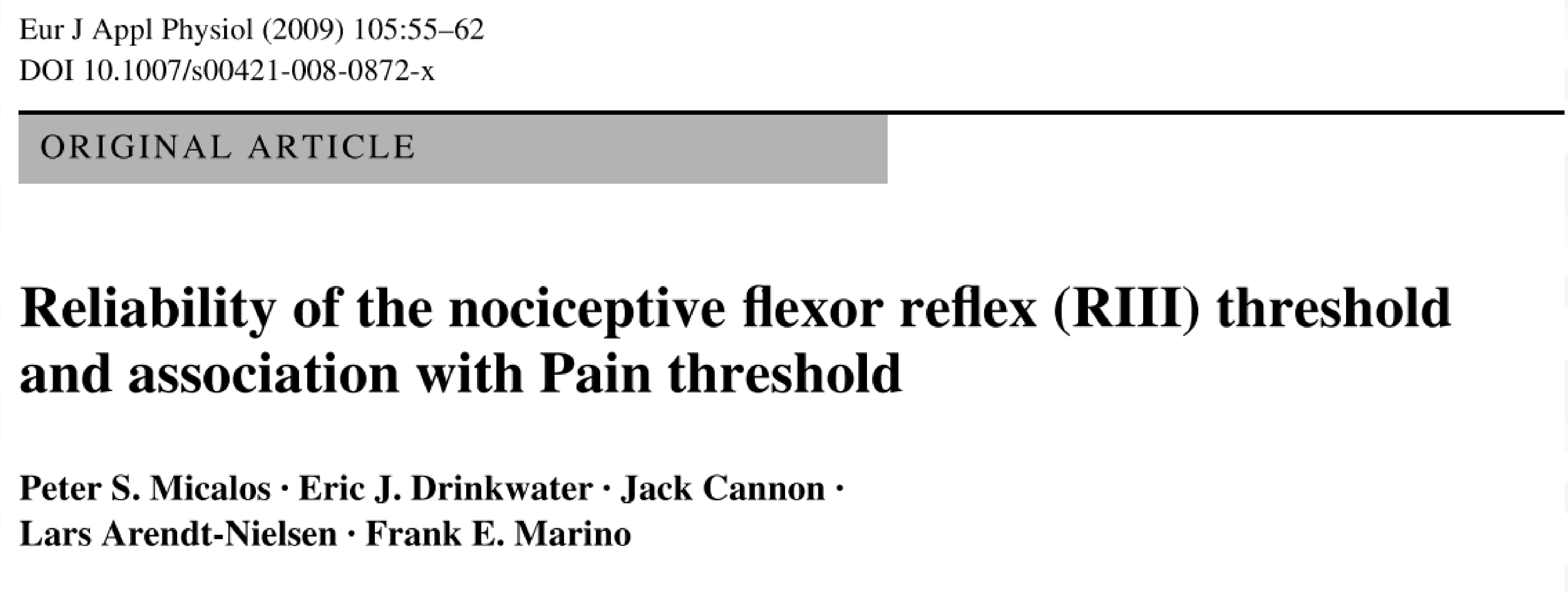
Tipos de investigación según los objetivos

Estudios correlacionales

- El objetivo es descubrir o establecer la existencia de una relación/asociación/interdependencia entre dos o más aspectos de una situación o problema

Investigación científica

Ejemplos de estudios correlacionales



Eur J Appl Physiol (2009) 105:55–62
DOI 10.1007/s00421-008-0872-x

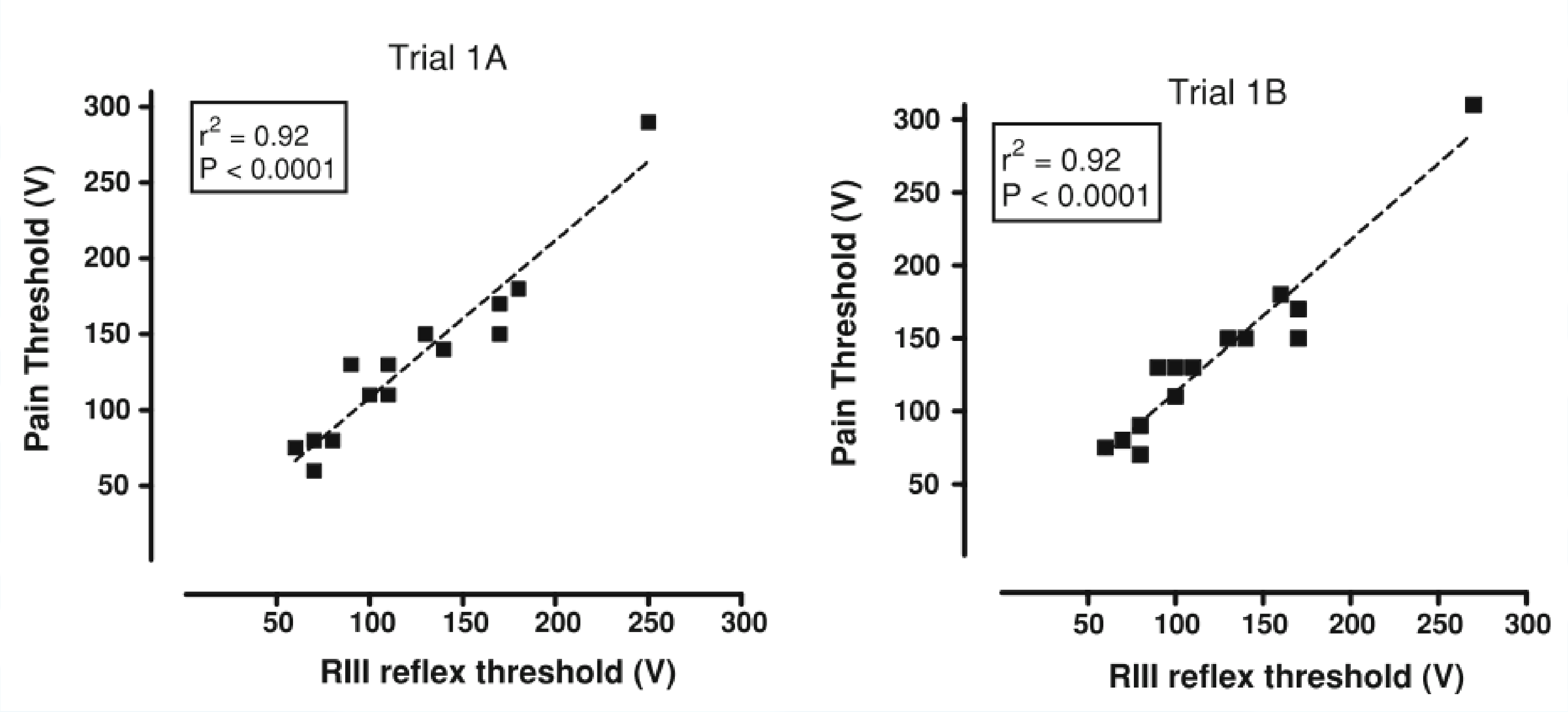
ORIGINAL ARTICLE

Reliability of the nociceptive flexor reflex (RIII) threshold and association with Pain threshold

Peter S. Micalos · Eric J. Drinkwater · Jack Cannon ·
Lars Arendt-Nielsen · Frank E. Marino

Investigación científica

Ejemplos de estudios correlacionales



Investigación científica

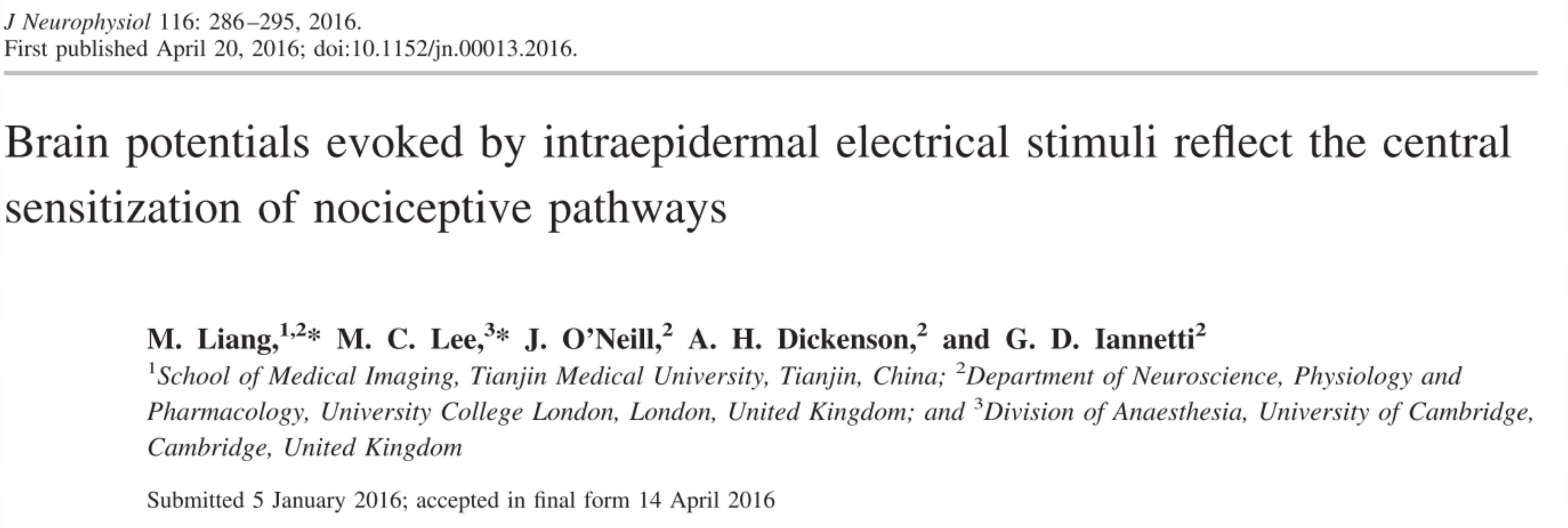
Tipos de investigación según los objetivos

Estudios explicativos

- El objetivo es aclarar por qué y cómo es la relación entre dos aspectos de una situación o fenómeno

Investigación científica

Ejemplos de estudios explicativos



J Neurophysiol 116: 286–295, 2016.
First published April 20, 2016; doi:10.1152/jn.00013.2016.

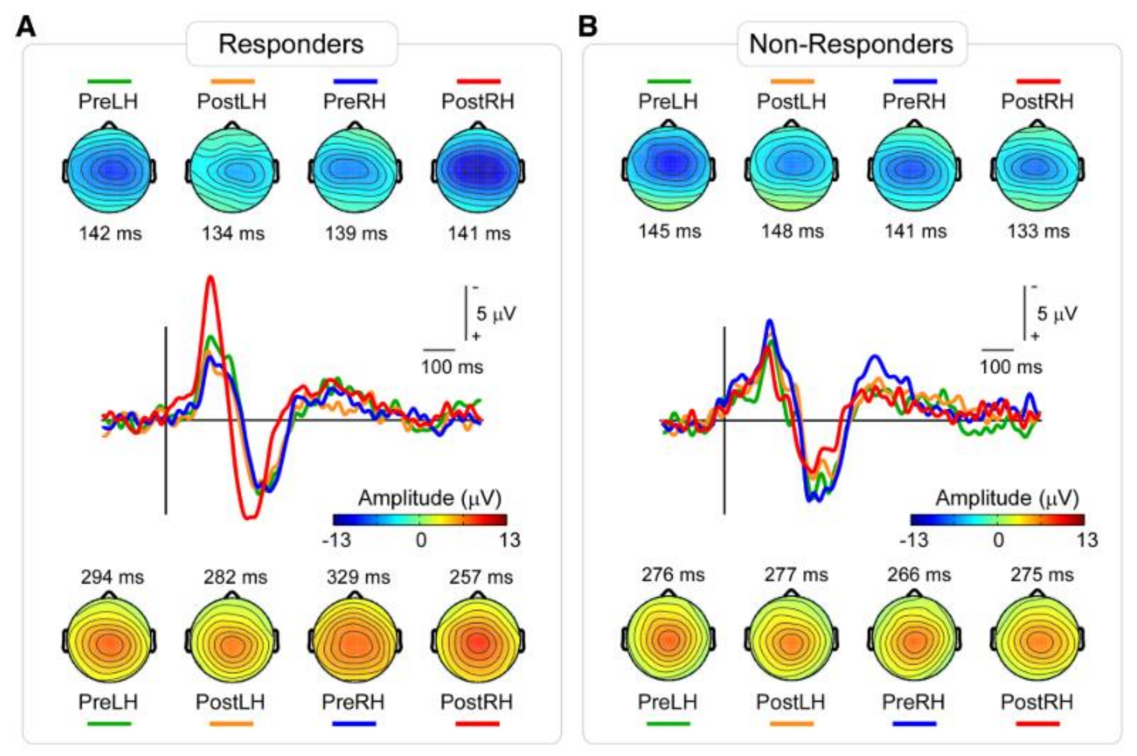
Brain potentials evoked by intraepidermal electrical stimuli reflect the central sensitization of nociceptive pathways

M. Liang,[1,2]* M. C. Lee,[3]* J. O'Neill,[2] A. H. Dickenson,[2] and G. D. Iannetti[2]
[1]School of Medical Imaging, Tianjin Medical University, Tianjin, China; [2]Department of Neuroscience, Physiology and Pharmacology, University College London, London, United Kingdom; and [3]Division of Anaesthesia, University of Cambridge, Cambridge, United Kingdom

Submitted 5 January 2016; accepted in final form 14 April 2016

Investigación científica

Ejemplos de estudios explicativos



Investigación científica

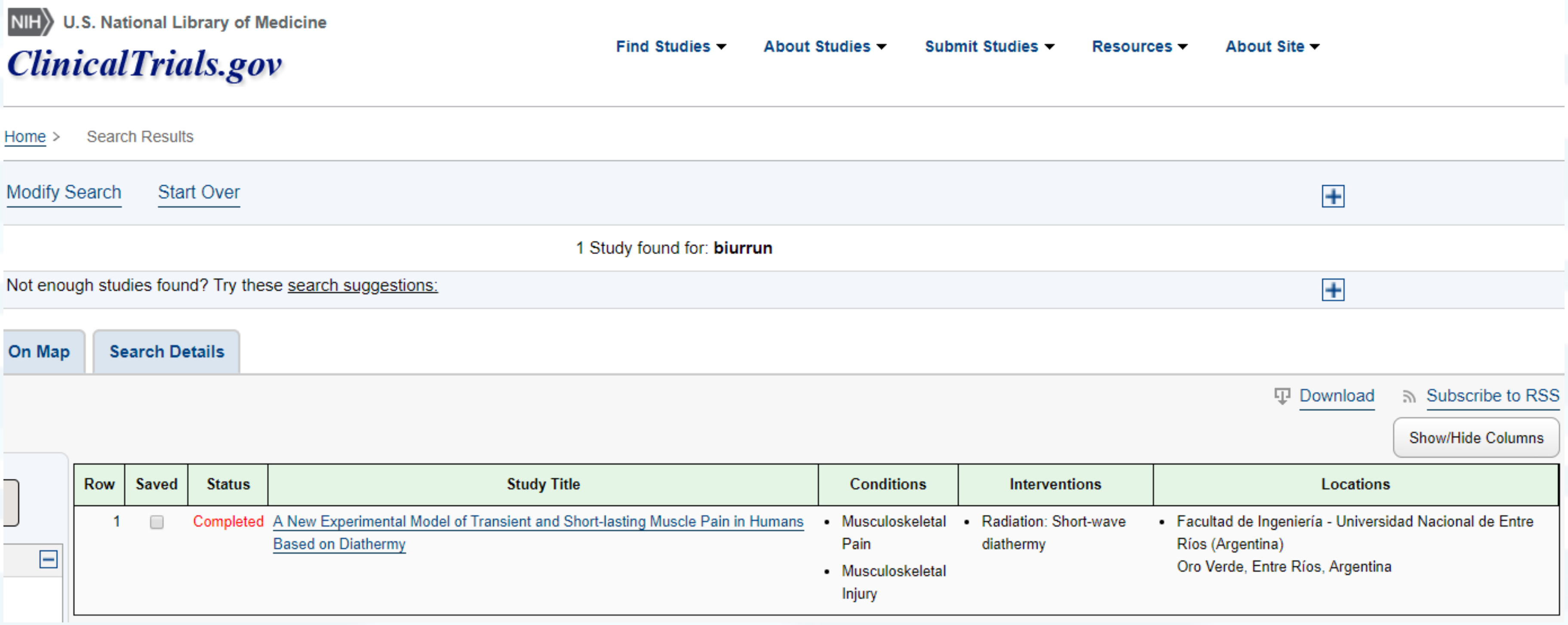
Tipos de investigación según los objetivos

Estudios exploratorios

- Se llevan a cabo para explorar un área donde se sabe poco o para investigar las posibilidades de llevar a cabo un estudio de investigación en particular
- También se llaman *estudios de viabilidad* o *estudios piloto*

Investigación científica

Ejemplos de estudios exploratorios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ClinicalTrials.gov
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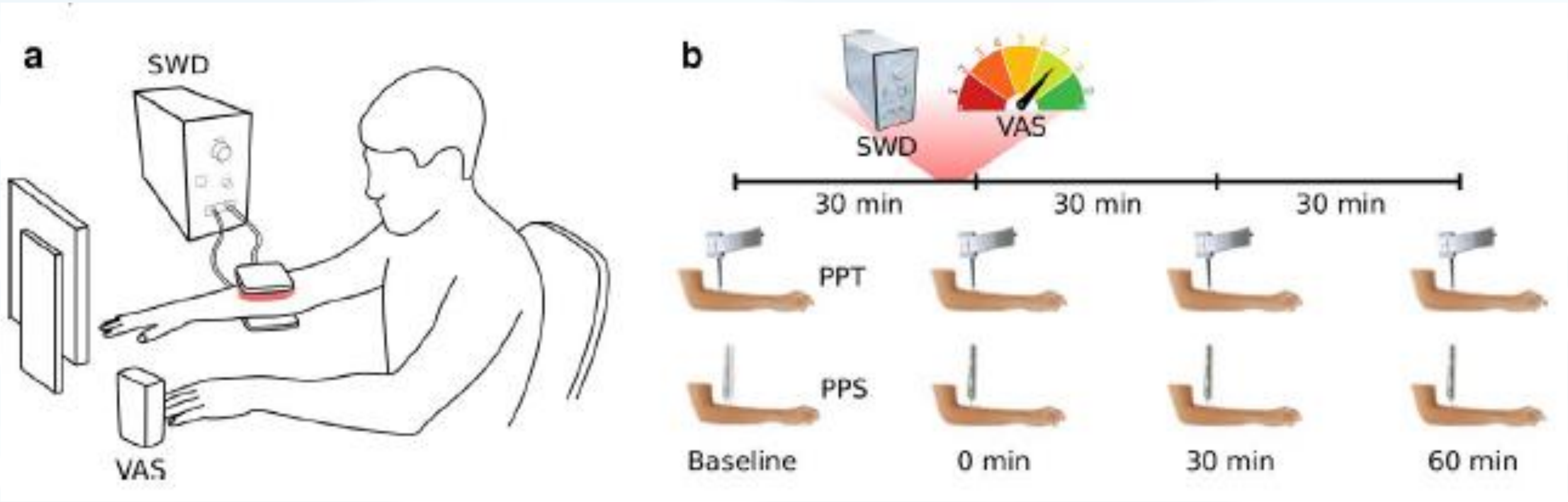
1 Study found for: **biurrun**

Not enough studies found? Try these search suggestions:

Row	Saved	Status	Study Title	Conditions	Interventions	Locations
1	☐	Completed	A New Experimental Model of Transient and Short-lasting Muscle Pain in Humans Based on Diathermy	- Musculoskeletal Pain - Musculoskeletal Injury	- Radiation: Short-wave diathermy	- Facultad de Ingeniería - Universidad Nacional de Entre Ríos (Argentina) Oro Verde, Entre Ríos, Argentina

Investigación científica

Ejemplos de estudios exploratorios


a
SWD
VAS
b
SWD
VAS
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Baseline
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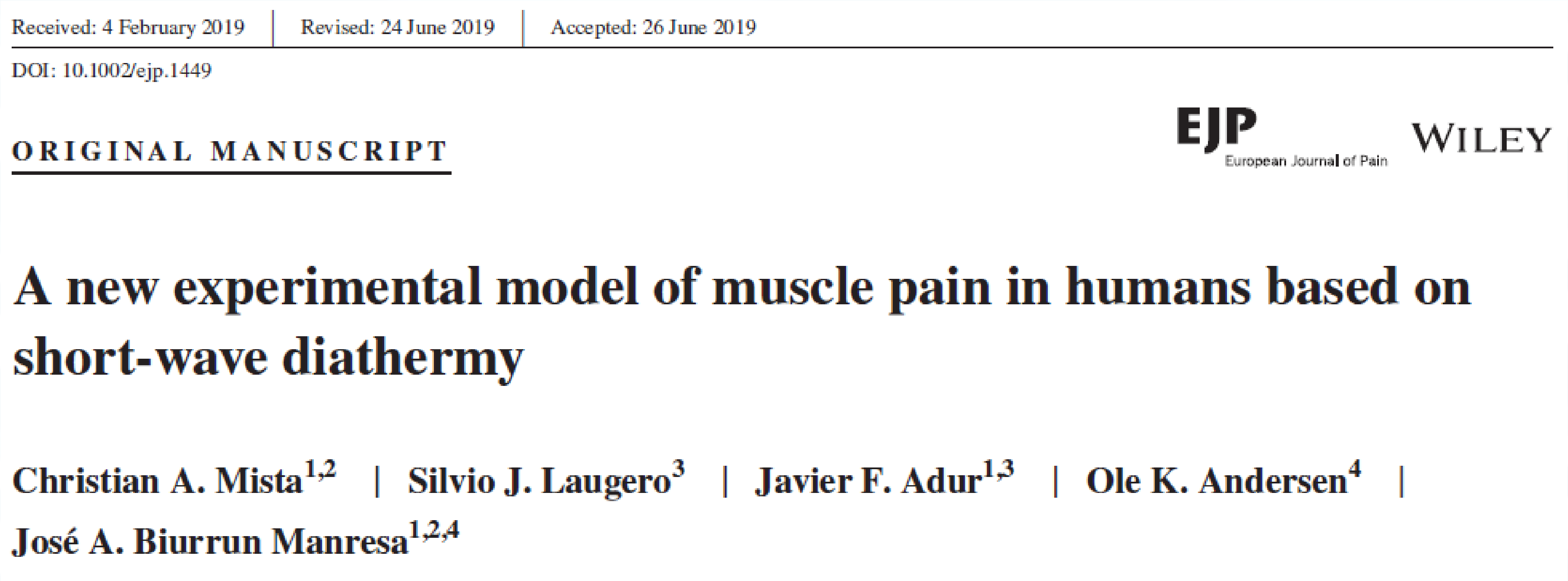
60 min

Investigación científica

Ejemplos de estudios exploratorios



Received: 4 February 2019 | Revised: 24 June 2019 | Accepted: 26 June 2019

DOI: 10.1002/ejp.1449

ORIGINAL MANUSCRIPT

EJP European Journal of Pain

WILEY

A new experimental model of muscle pain in humans based on short-wave diathermy

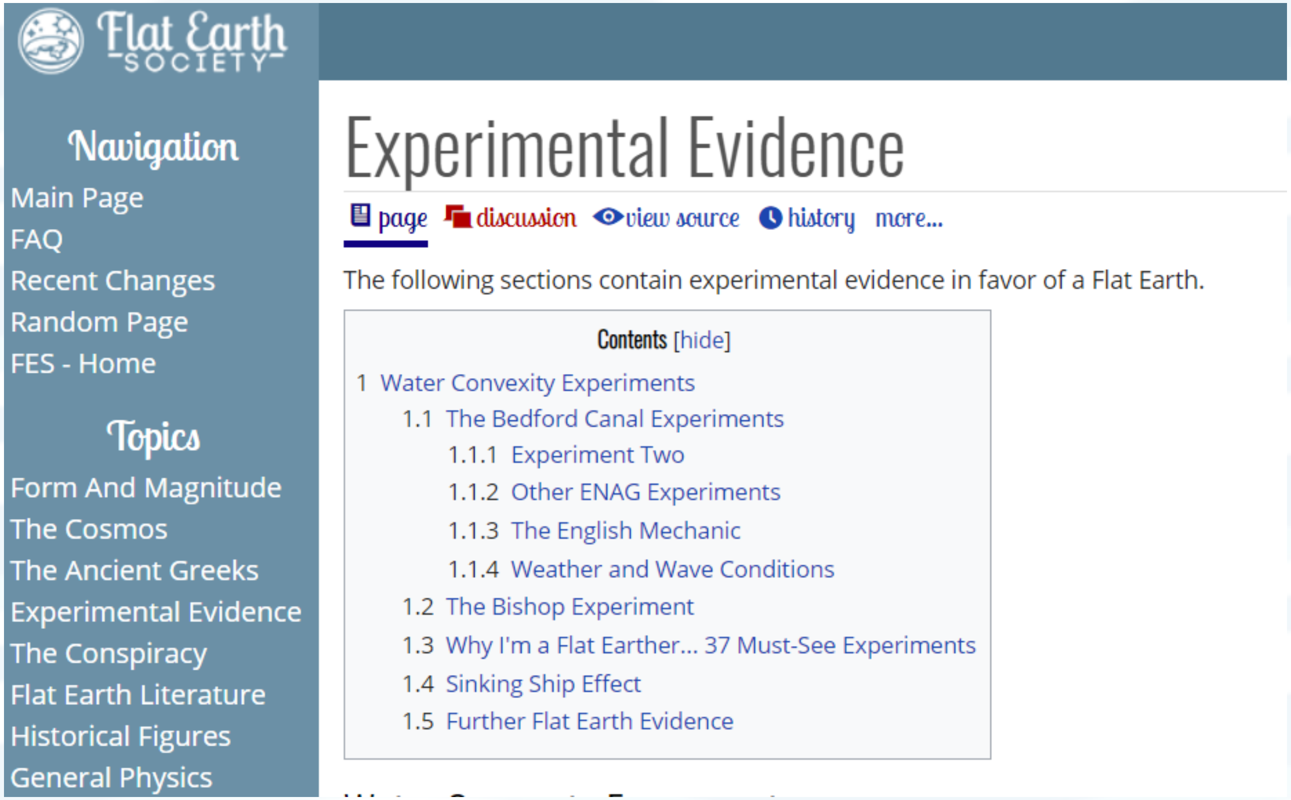
Christian A. Mista[1,2] | Silvio J. Laugero[3] | Javier F. Adur[1,3] | Ole K. Andersen[4] | José A. Biurrun Manresa[1,2,4]

Indicadores de investigación de calidad

- Se basa generalmente en construir conocimiento a partir de trabajos previos (es incremental)
- Puede ser replicada
- Es generalizable a otras circunstancias
- Está basado en un razonamiento lógico y acompañado por una teoría explicativa plausible
- Funciona como disparador de nuevas preguntas de investigación
- Se realiza teniendo como objetivo final el mejoramiento del bienestar de la sociedad

Y la investigación de mala calidad?

Se intenta demostrar algo a sabiendas de que es falso


Flat Earth SOCIETY
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FES - Home
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The Cosmos
The Ancient Greeks
Experimental Evidence
The Conspiracy
Flat Earth Literature
Historical Figures
General Physics
page
discussion
view source
history
more...

Experimental Evidence

The following sections contain experimental evidence in favor of a Flat Earth.

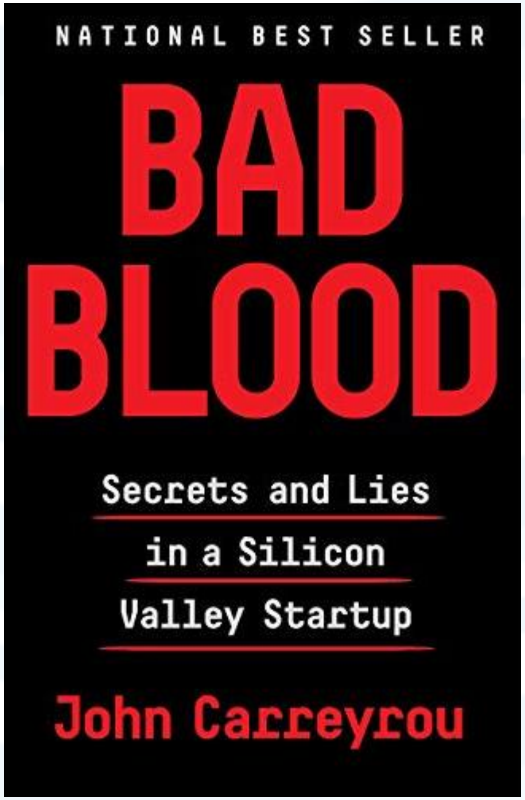
Contents [hide]

1 Water Convexity Experiments
  1.1 The Bedford Canal Experiments
    1.1.1 Experiment Two
    1.1.2 Other ENAG Experiments
    1.1.3 The English Mechanic
    1.1.4 Weather and Wave Conditions
  1.2 The Bishop Experiment
  1.3 Why I'm a Flat Earther... 37 Must-See Experiments
  1.4 Sinking Ship Effect
  1.5 Further Flat Earth Evidence

Y la investigación de mala calidad?

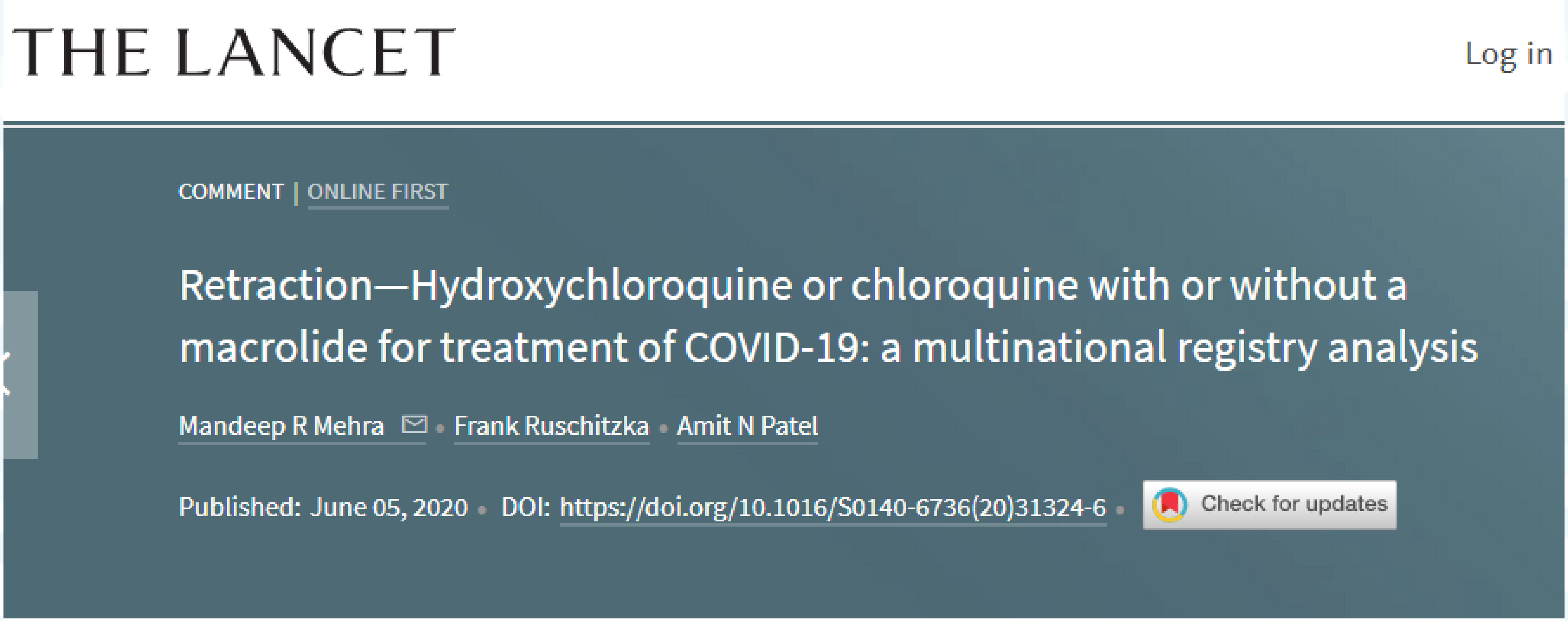
Tergiversar información y engañar al público

Inc.
HOW TO BUILD A COMPANY TO LAST 100 YEARS
THE NEXT STEVE JOBS
8 WOMEN WHO COULD OWN THE FUTURE
THE ART OF GIVING (AND TAKING) EQUITY
DO YOU REALLY WANT TO GO PUBLIC?


NATIONAL BEST SELLER
BAD BLOOD
Secrets and Lies in a Silicon Valley Startup
John Carreyrou

Y la investigación de mala calidad?

Se utiliza datos poco confiables



COMMENT | ONLINE FIRST

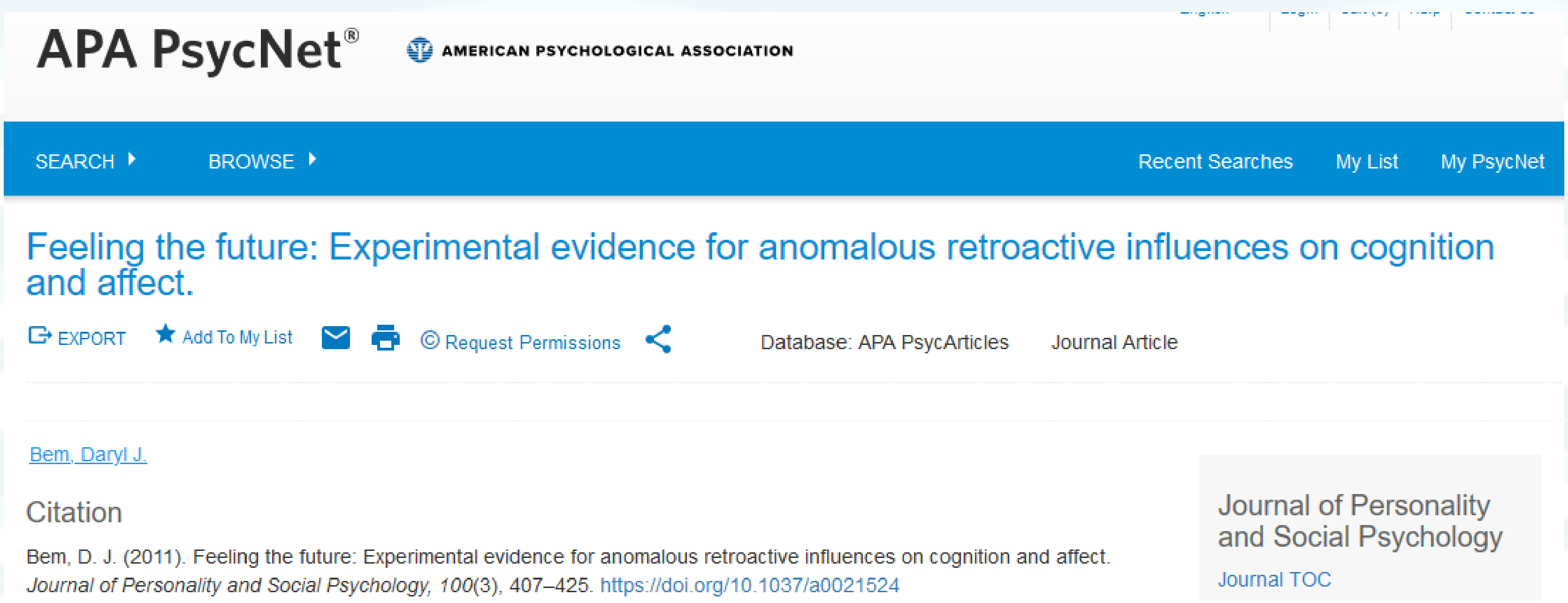
Retraction—Hydroxychloroquine or chloroquine with or without a macrolide for treatment of COVID-19: a multinational registry analysis

Mandeep R Mehra • Frank Ruschitzka • Amit N Patel

Published: June 05, 2020 • DOI: https://doi.org/10.1016/S0140-6736(20)31324-6 •

Y la investigación de mala calidad?

Se utiliza una metodología equivocada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Journal TOC

Feeling the future: Experimental evidence for anomalous retroactive influences on cognition and affect.

Database: APA PsycArticles

Journal Article

Bem, Daryl J.

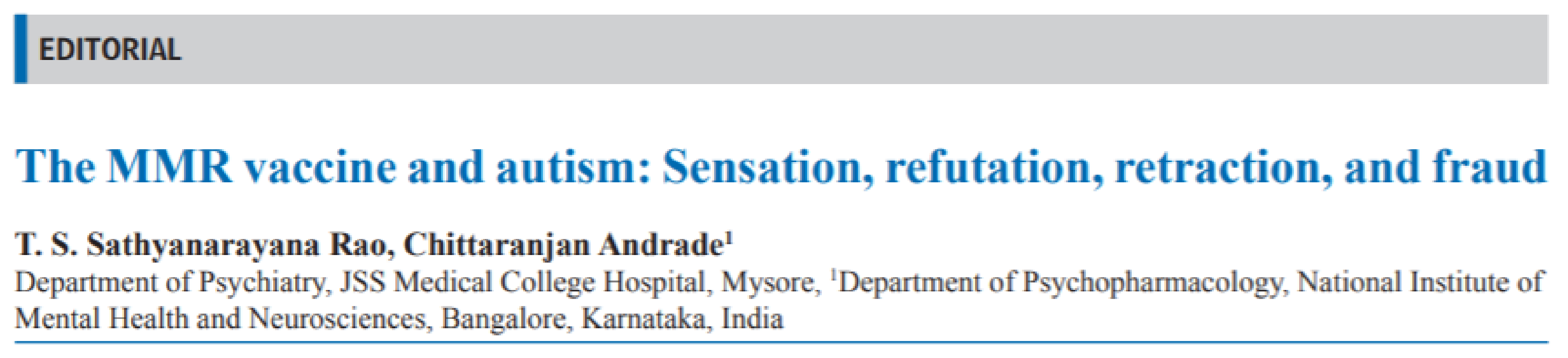
Citation

Bem, D. J. (2011). Feeling the future: Experimental evidence for anomalous retroactive influences on cognition and affect. *Journal of Personality and Social Psychology, 100*(3), 407–425. https://doi.org/10.1037/a0021524

Journal of Personality and Social Psychology

Y la investigación de mala calidad?

Falsificar datos para demostrar una teoría



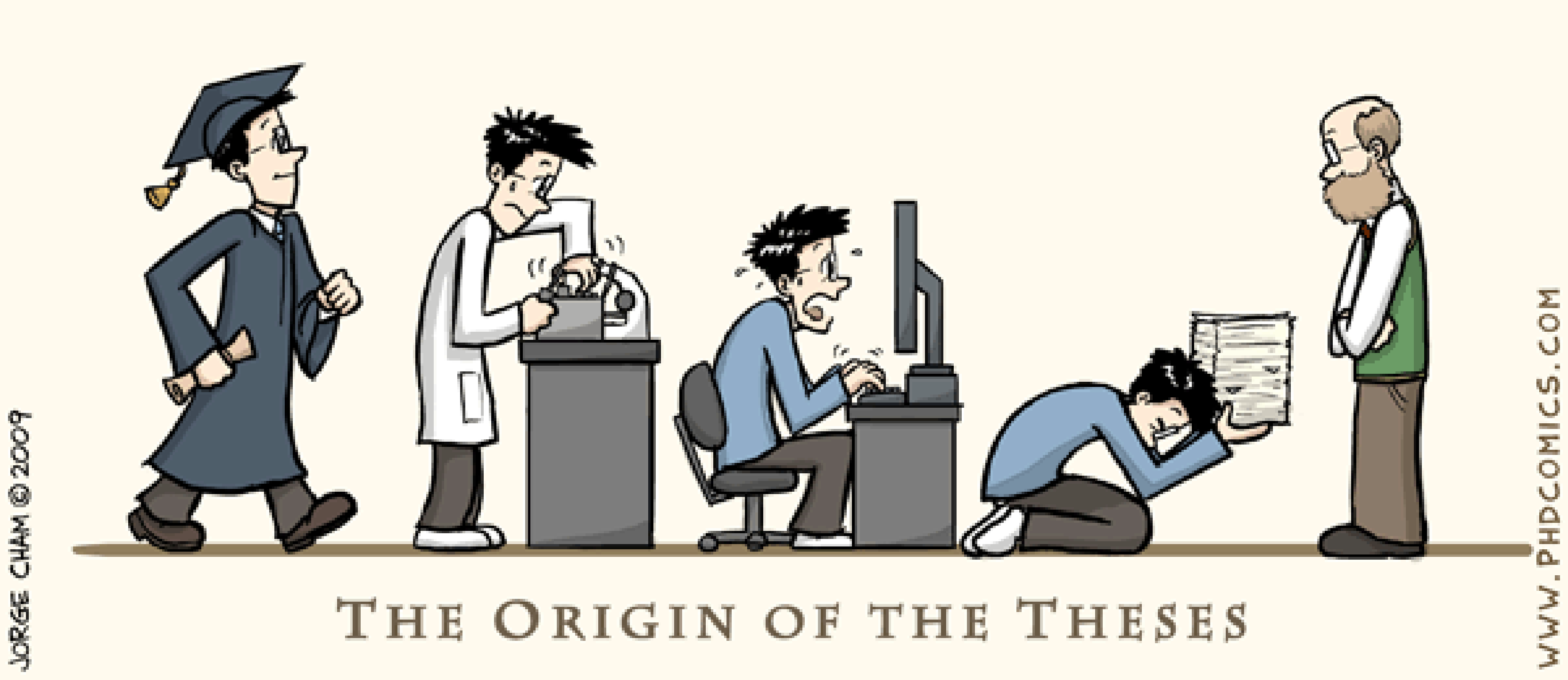
EDITORIAL

The MMR vaccine and autism: Sensation, refutation, retraction, and fraud

T. S. Sathyanarayana Rao, Chittaranjan Andrade[1]
Department of Psychiatry, JSS Medical College Hospital, Mysore, [1]Department of Psychopharmacology, National Institute of Mental Health and Neurosciences, Bangalore, Karnataka, India

Por qué se hace investigación?

Para conseguir un título de posgrado o una posición académica?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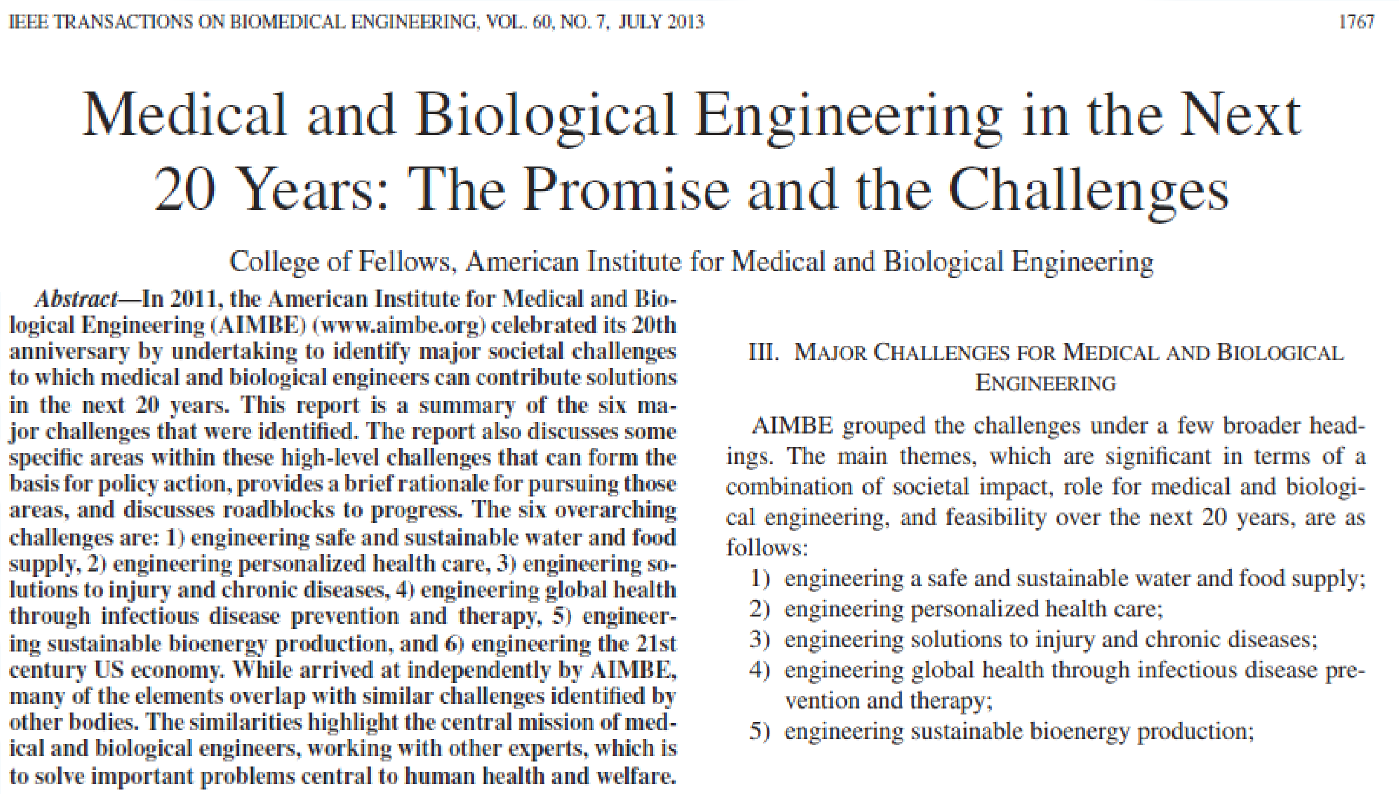
Por qué se hace investigación?

Para proveer soluciones a problemas complejos



IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING, VOL. 60, NO. 7, JULY 2013 1767

Medical and Biological Engineering in the Next 20 Years: The Promise and the Challenges

College of Fellows, American Institute for Medical and Biological Engineering

***Abstract*—In 2011, the American Institute for Medical and Biological Engineering (AIMBE) (www.aimbe.org) celebrated its 20th anniversary by undertaking to identify major societal challenges to which medical and biological engineers can contribute solutions in the next 20 years. This report is a summary of the six major challenges that were identified. The report also discusses some specific areas within these high-level challenges that can form the basis for policy action, provides a brief rationale for pursuing those areas, and discusses roadblocks to progress. The six overarching challenges are: 1) engineering safe and sustainable water and food supply, 2) engineering personalized health care, 3) engineering solutions to injury and chronic diseases, 4) engineering global health through infectious disease prevention and therapy, 5) engineering sustainable bioenergy production, and 6) engineering the 21st century US economy. While arrived at independently by AIMBE, many of the elements overlap with similar challenges identified by other bodies. The similarities highlight the central mission of medical and biological engineers, working with other experts, which is to solve important problems central to human health and welfare.**

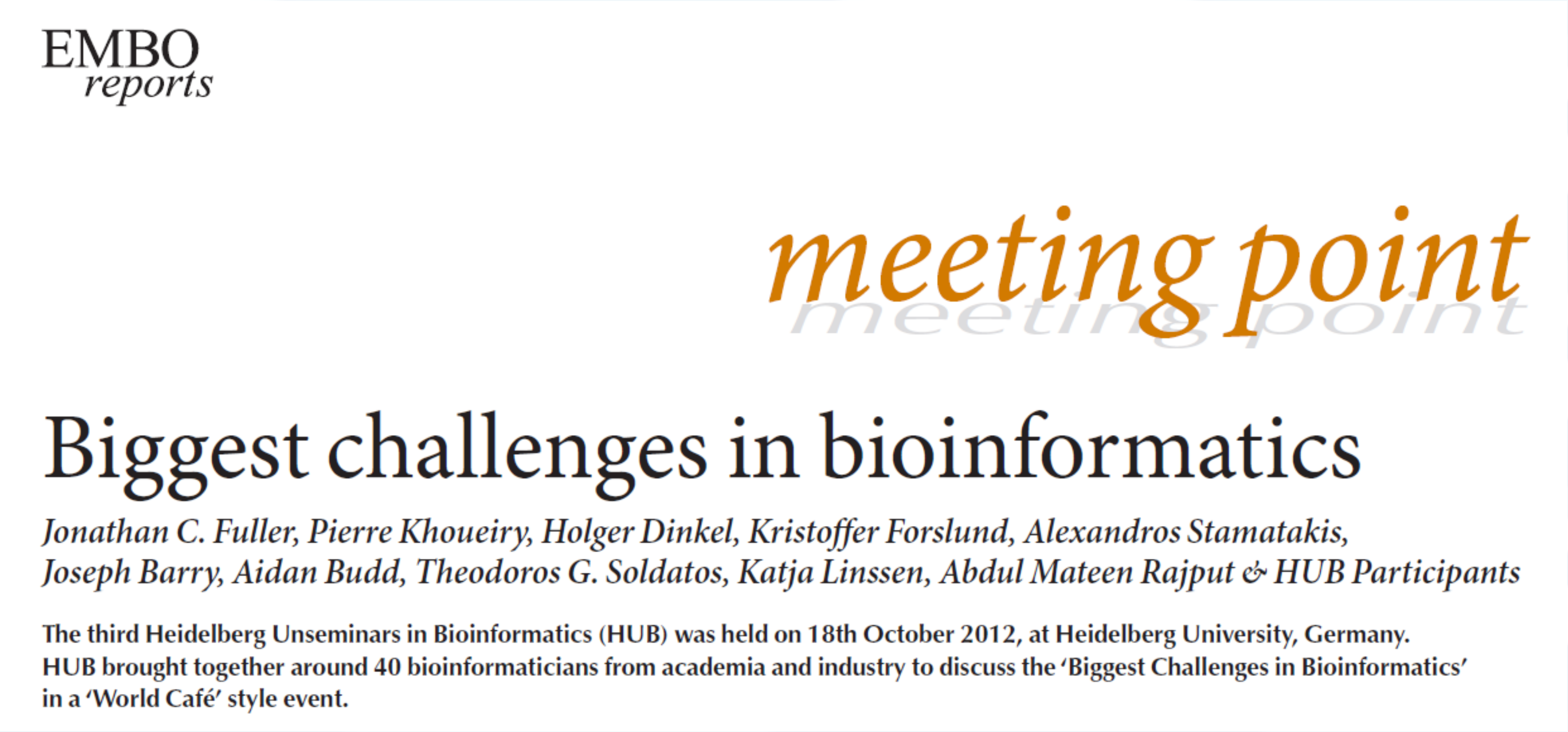
III. MAJOR CHALLENGES FOR MEDICAL AND BIOLOGICAL ENGINEERING

AIMBE grouped the challenges under a few broader headings. The main themes, which are significant in terms of a combination of societal impact, role for medical and biological engineering, and feasibility over the next 20 years, are as follows:

1) engineering a safe and sustainable water and food supply;
2) engineering personalized health care;
3) engineering solutions to injury and chronic diseases;
4) engineering global health through infectious disease prevention and therapy;
5) engineering sustainable bioenergy production;

Por qué se hace investigación?

Para proveer soluciones a problemas complejos



EMBO
reports

meeting point

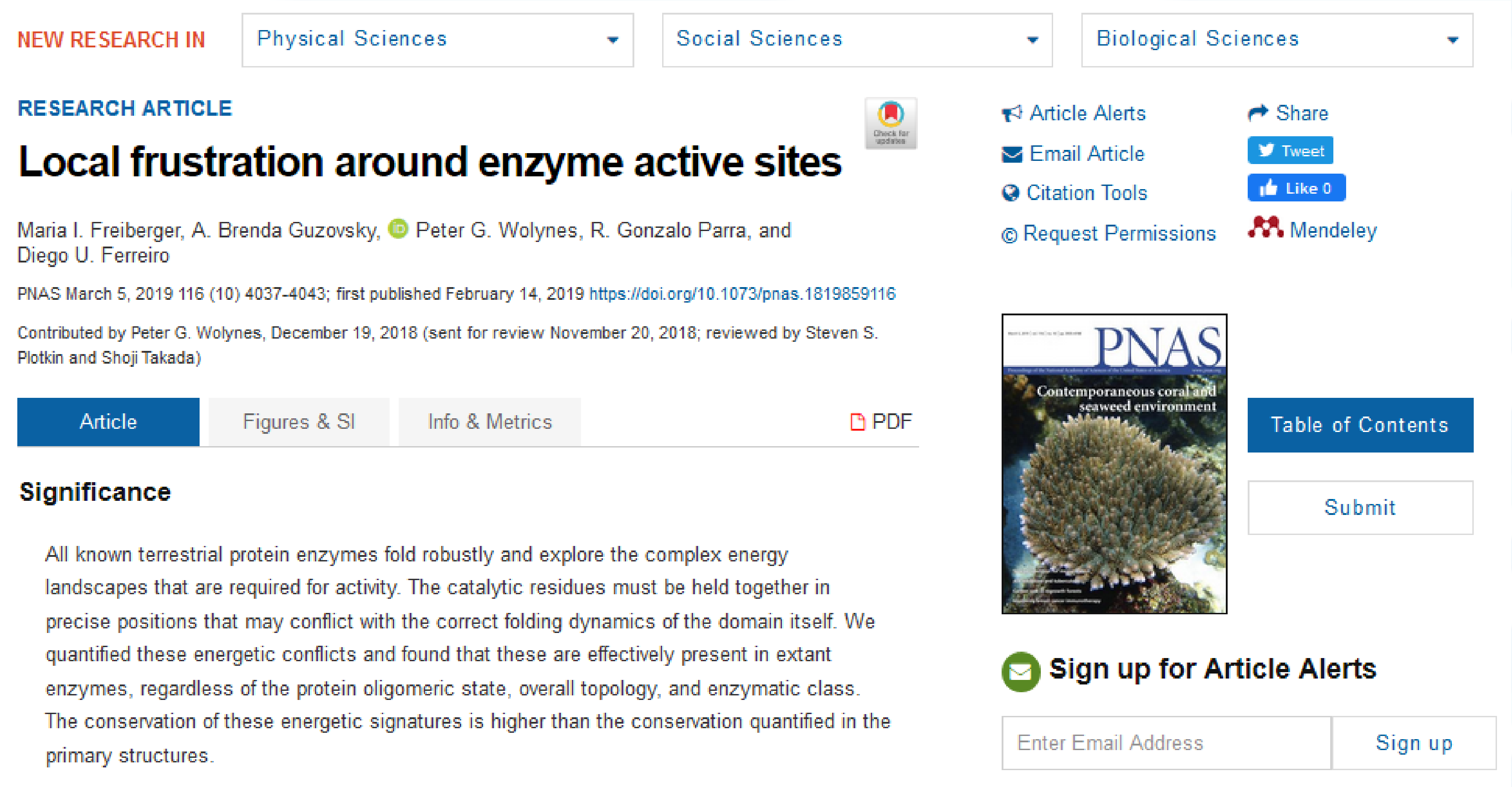
Biggest challenges in bioinformatics

Jonathan C. Fuller, Pierre Khoueiry, Holger Dinkel, Kristoffer Forslund, Alexandros Stamatakis, Joseph Barry, Aidan Budd, Theodoros G. Soldatos, Katja Linssen, Abdul Mateen Rajput & HUB Participants

The third Heidelberg Unseminars in Bioinformatics (HUB) was held on 18th October 2012, at Heidelberg University, Germany. HUB brought together around 40 bioinformaticians from academia and industry to discuss the 'Biggest Challenges in Bioinformatics' in a 'World Café' style event.

Por qué se hace investigación?

Para investigar las leyes de la naturaleza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RESEARCH ARTICLE

Local frustration around enzyme active sites

Maria I. Freiberger, A. Brenda Guzovsky, Peter G. Wolynes, R. Gonzalo Parra, and Diego U. Ferreiro

PNAS March 5, 2019 116 (10) 4037-4043; first published February 14, 2019 https://doi.org/10.1073/pnas.1819859116

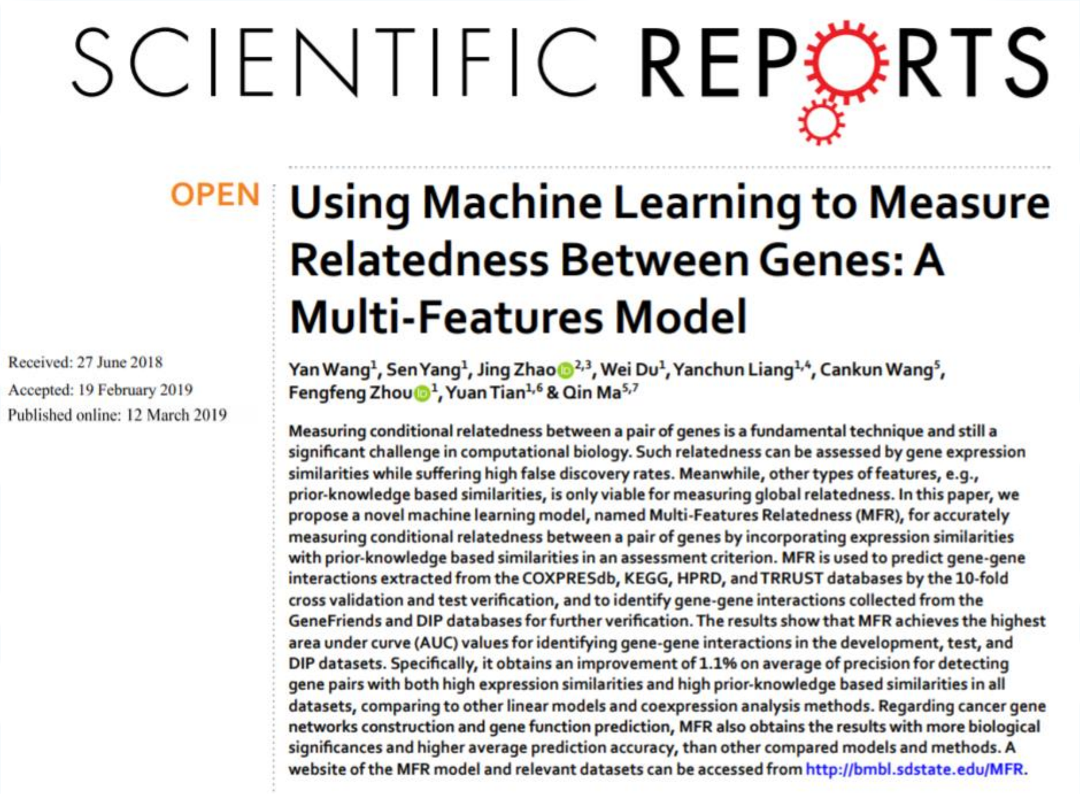
Contributed by Peter G. Wolynes, December 19, 2018 (sent for review November 20, 2018; reviewed by Steven S. Plotkin and Shoji Takada)

Significance

All known terrestrial protein enzymes fold robustly and explore the complex energy landscapes that are required for activity. The catalytic residues must be held together in precise positions that may conflict with the correct folding dynamics of the domain itself. We quantified these energetic conflicts and found that these are effectively present in extant enzymes, regardless of the protein oligomeric state, overall topology, and enzymatic class. The conservation of these energetic signatures is higher than the conservation quantified in the primary structures.

Por qué se hace investigación?

Para hacer nuevos descubrimientos



SCIENTIFIC REPORTS

OPEN

Using Machine Learning to Measure Relatedness Between Genes: A Multi-Features Model

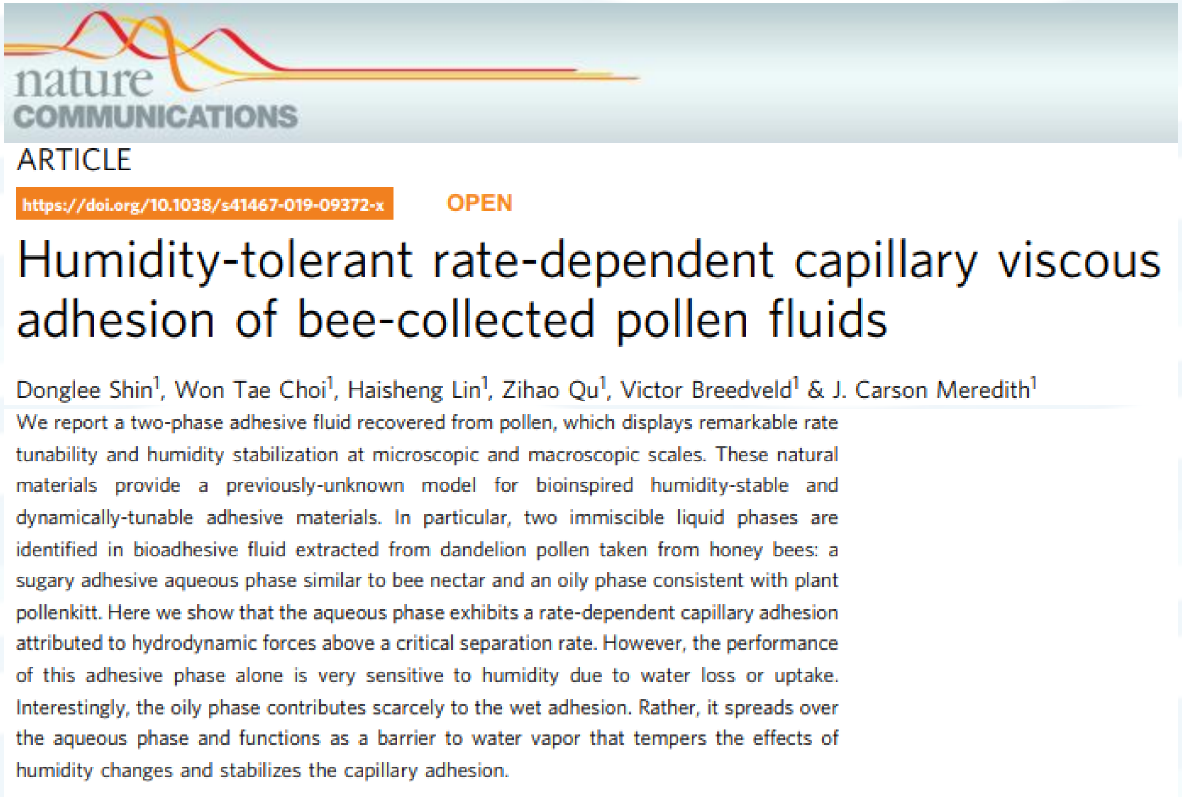
Received: 27 June 2018
Accepted: 19 February 2019
Published online: 12 March 2019

Yan Wang[1], Sen Yang[1], Jing Zhao[2,3], Wei Du[1], Yanchun Liang[1,4], Cankun Wang[5], Fengfeng Zhou[1], Yuan Tian[1,6] & Qin Ma[5,7]

Measuring conditional relatedness between a pair of genes is a fundamental technique and still a significant challenge in computational biology. Such relatedness can be assessed by gene expression similarities while suffering high false discovery rates. Meanwhile, other types of features, e.g., prior-knowledge based similarities, is only viable for measuring global relatedness. In this paper, we propose a novel machine learning model, named Multi-Features Relatedness (MFR), for accurately measuring conditional relatedness between a pair of genes by incorporating expression similarities with prior-knowledge based similarities in an assessment criterion. MFR is used to predict gene-gene interactions extracted from the COXPRESdb, KEGG, HPRD, and TRRUST databases by the 10-fold cross validation and test verification, and to identify gene-gene interactions collected from the GeneFriends and DIP databases for further verification. The results show that MFR achieves the highest area under curve (AUC) values for identifying gene-gene interactions in the development, test, and DIP datasets. Specifically, it obtains an improvement of 1.1% on average of precision for detecting gene pairs with both high expression similarities and high prior-knowledge based similarities in all datasets, comparing to other linear models and coexpression analysis methods. Regarding cancer gene networks construction and gene function prediction, MFR also obtains the results with more biological significances and higher average prediction accuracy, than other compared models and methods. A website of the MFR model and relevant datasets can be accessed from http://bmbl.sdstate.edu/MFR.

Por qué se hace investigación?

Para hacer nuevos descubrimientos



nature
COMMUNICATIONS

ARTICLE

https://doi.org/10.1038/s41467-019-09372-x OPEN

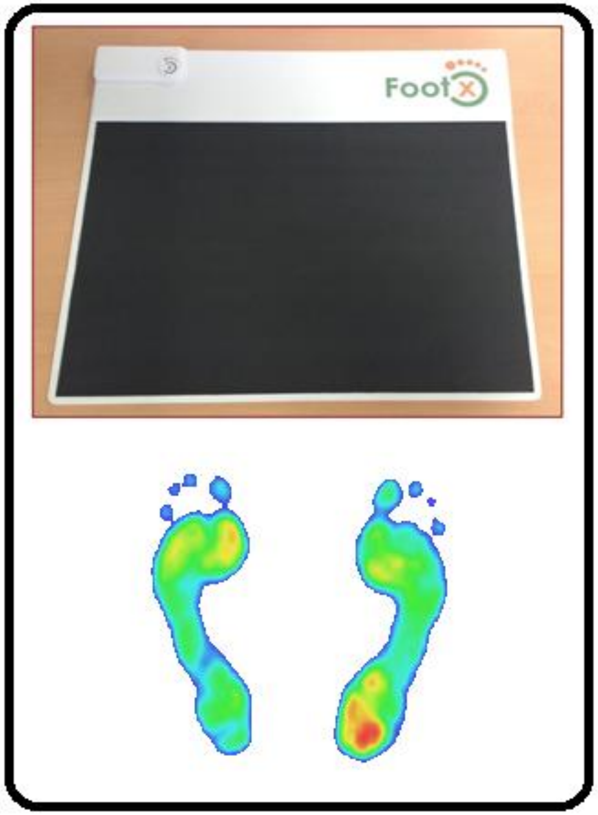
Humidity-tolerant rate-dependent capillary viscous adhesion of bee-collected pollen fluids

Donglee Shin[1], Won Tae Choi[1], Haisheng Lin[1], Zihao Qu[1], Victor Breedveld[1] & J. Carson Meredith[1]

We report a two-phase adhesive fluid recovered from pollen, which displays remarkable rate tunability and humidity stabilization at microscopic and macroscopic scales. These natural materials provide a previously-unknown model for bioinspired humidity-stable and dynamically-tunable adhesive materials. In particular, two immiscible liquid phases are identified in bioadhesive fluid extracted from dandelion pollen taken from honey bees: a sugary adhesive aqueous phase similar to bee nectar and an oily phase consistent with plant pollenkitt. Here we show that the aqueous phase exhibits a rate-dependent capillary adhesion attributed to hydrodynamic forces above a critical separation rate. However, the performance of this adhesive phase alone is very sensitive to humidity due to water loss or uptake. Interestingly, the oily phase contributes scarcely to the wet adhesion. Rather, it spreads over the aqueous phase and functions as a barrier to water vapor that tempers the effects of humidity changes and stabilizes the capillary adhesion.

Por qué se hace investigación?

Para desarrollar nuevos productos



Por qué se hace investigación?

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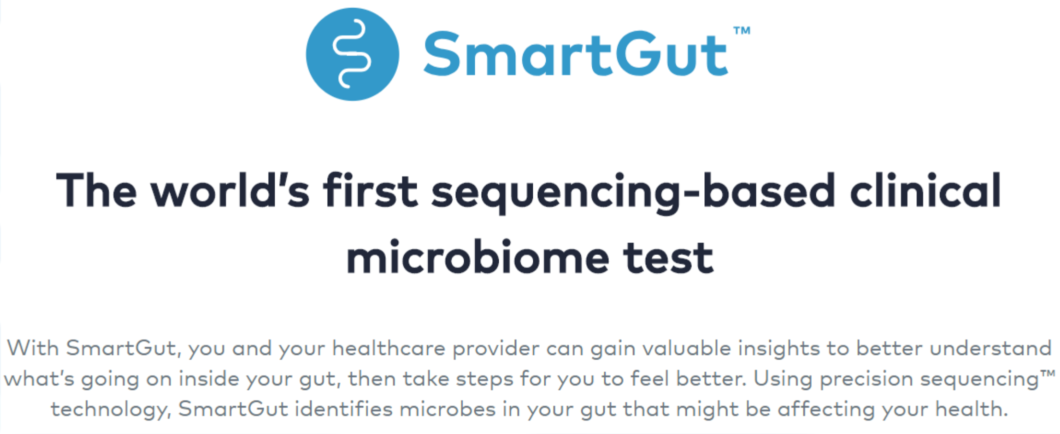

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Register
Send
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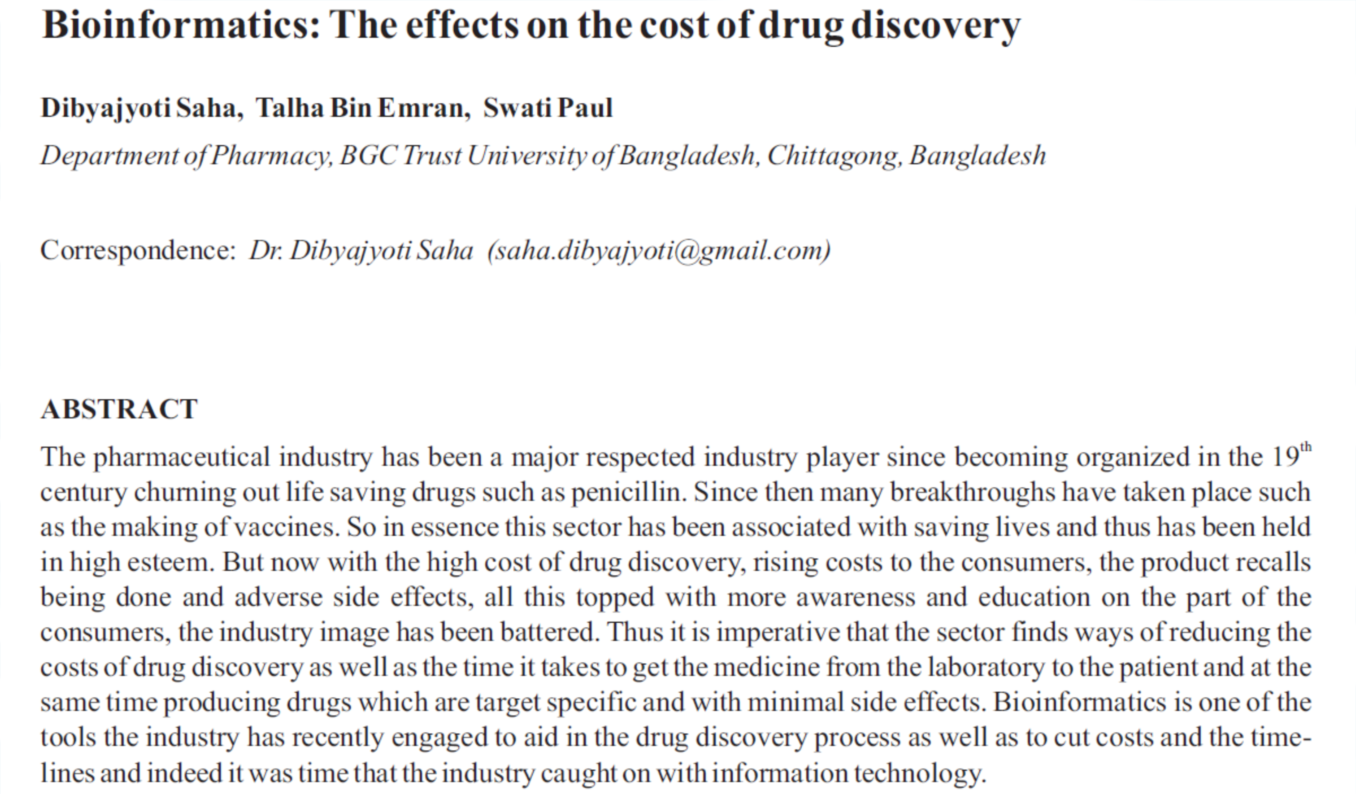
Before mailing, register your sample at smartgut.ubiome.com

Por qué se hace investigación?

Para ahorrar costos



Bioinformatics: The effects on the cost of drug discovery

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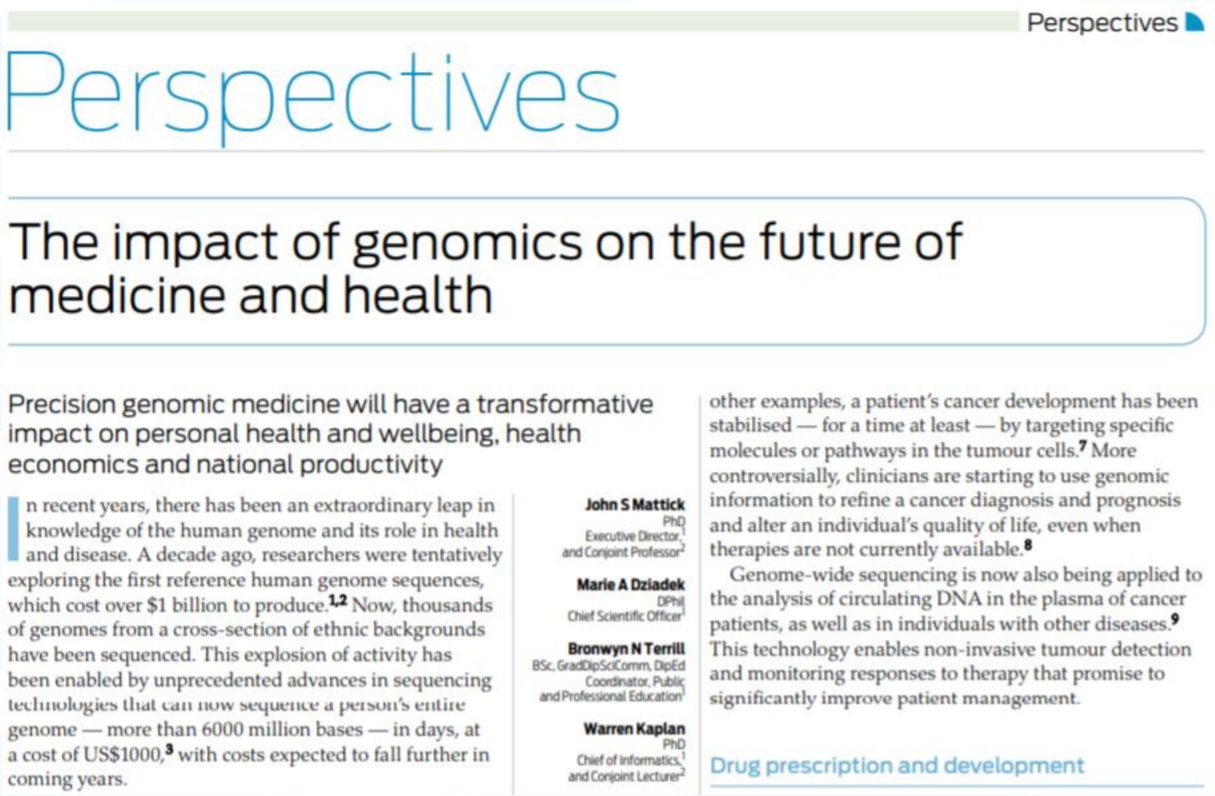
ABSTRACT

The pharmaceutical industry has been a major respected industry player since becoming organized in the 19th century churning out life saving drugs such as penicillin. Since then many breakthroughs have taken place such as the making of vaccines. So in essence this sector has been associated with saving lives and thus has been held in high esteem. But now with the high cost of drug discovery, rising costs to the consumers, the product recalls being done and adverse side effects, all this topped with more awareness and education on the part of the consumers, the industry image has been battered. Thus it is imperative that the sector finds ways of reducing the costs of drug discovery as well as the time it takes to get the medicine from the laboratory to the patient and at the same time producing drugs which are target specific and with minimal side effects. Bioinformatics is one of the tools the industry has recently engaged to aid in the drug discovery process as well as to cut costs and the time-lines and indeed it was time that the industry caught on with information technology.

Por qué se hace investigación?

Para mejorar la calidad de vida de las personas



Perspectives

Perspectives

The impact of genomics on the future of medicine and health

Precision genomic medicine will have a transformative impact on personal health and wellbeing, health economics and national productivity

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Executive Director,[1]
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In recent years, there has been an extraordinary leap in knowledge of the human genome and its role in health and disease. A decade ago, researchers were tentatively exploring the first reference human genome sequences, which cost over $1 billion to produce.[1,2] Now, thousands of genomes from a cross-section of ethnic backgrounds have been sequenced. This explosion of activity has been enabled by unprecedented advances in sequencing technologies that can now sequence a person's entire genome — more than 6000 million bases — in days, at a cost of US$1000,[3] with costs expected to fall further in coming years.

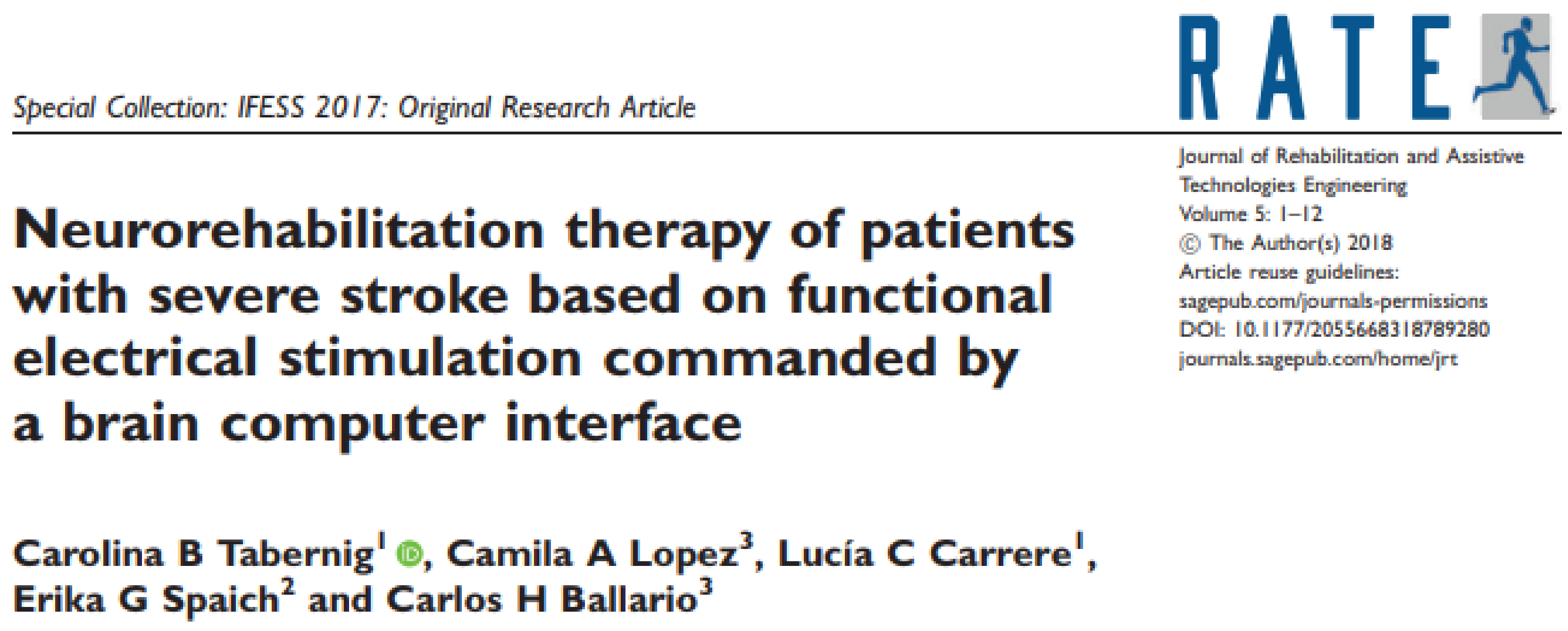
other examples, a patient's cancer development has been stabilised — for a time at least — by targeting specific molecules or pathways in the tumour cells.[7] More controversially, clinicians are starting to use genomic information to refine a cancer diagnosis and prognosis and alter an individual's quality of life, even when therapies are not currently available.[8]

Genome-wide sequencing is now also being applied to the analysis of circulating DNA in the plasma of cancer patients, as well as in individuals with other diseases.[9] This technology enables non-invasive tumour detection and monitoring responses to therapy that promise to significantly improve patient management.

Drug prescription and development

Por qué se hace investigación?

Para mejorar la calidad de vida de las personas



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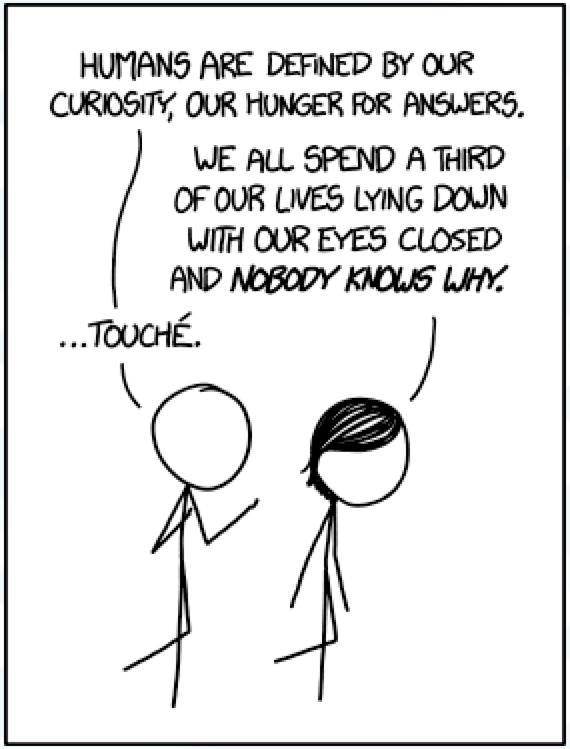
Neurorehabilitation therapy of patients with severe stroke based on functional electrical stimulation commanded by a brain computer interface

Carolina B Tabernig[1], Camila A Lopez[3], Lucía C Carrere[1], Erika G Spaich[2] and Carlos H Ballario[3]

Por qué se hace investigación?

Para satisfacer la curiosidad humana…


HUMANS ARE DEFINED BY OUR CURIOSITY, OUR HUNGER FOR ANSWERS.
WE ALL SPEND A THIRD OF OUR LIVES LYING DOWN WITH OUR EYES CLOSED AND NOBODY KNOWS WHY.
...TOUCHÉ.

Mensaje final

- Comprender la importancia de los pasos para realizar correctamente una investigación científica
- Comprender la diferencia entre investigación científica y académica
- Desarrollar espíritu crítico para evaluar la calidad de una investigación

Bibliografía

Hernández Sampieri, Roberto, y otros. Metodología de la investigación. McGraw-Hill, 2016. Capítulo 1.

Cegarra Sánchez, José. Metodología de investigación científica y tecnológica. Ediciones Díaz de Santos, 2004. Capítulos 1-4.

Monje Álvarez, Carlos. Metodología de la Investigación Cuantitativa y cualitativa. Neiva, 2001. Capítulo 1.