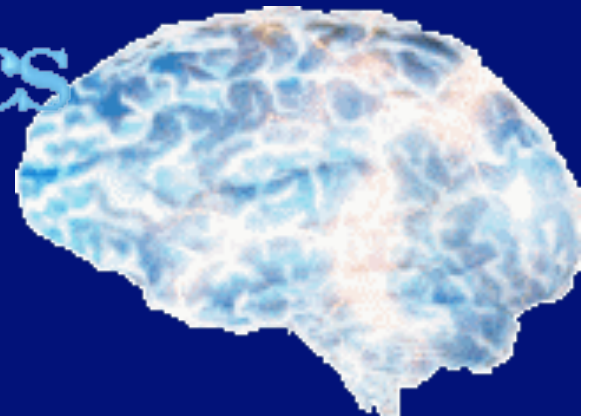


# *THE SCIENCE OF TRUST*

**PAUL J. ZAK**

**CLAREMONT GRADUATE UNIVERSITY**

Center for  
Neuroeconomics  
Studies



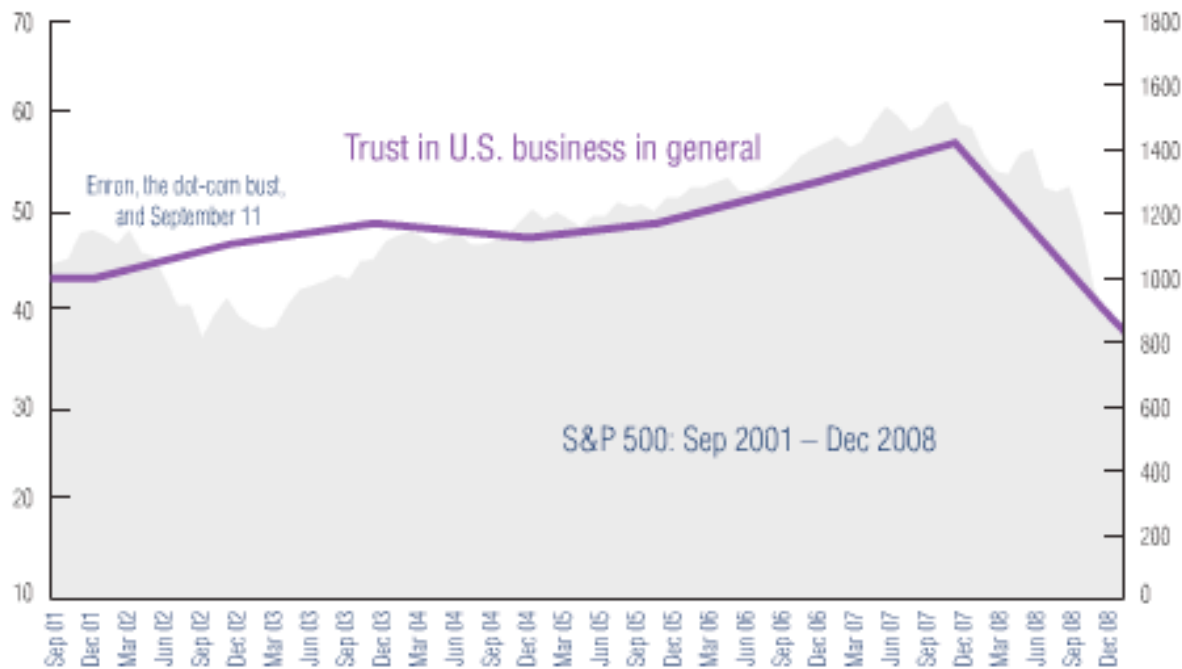
*CCST Oct 19, 2010*

# TRUST



**Figure 2: Trust is key in rebuilding investor confidence**

How much do you trust business to do what is right?



Informed publics ages 35 to 64 in the U.S.; Responses 6-9 only on 1-9 scale; 9 = highest



# MOST TRUSTED PROFESSIONS

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Feb 2002	Nov 2002	2003	2004	2005	2006
1. Nurses	--	--	--	--	--	--	--	73	79	84	83	79	83	79	82	84
2. Druggists, pharmacists	66	65	62	66	64	69	64	69	67	68	--	67	67	72	67	73
3. Veterinarians	--	--	--	--	--	--	--	63	66	--	--	--	68	--	--	71
4. Medical doctors	52	51	47	54	55	56	57	58	63	66	--	63	68	67	65	69
5. Dentists	50	50	51	54	53	54	53	52	58	56	--	--	61	--	--	62
6. Engineers	48	49	49	53	48	49	50	50	56	60	--	--	59	--	--	61
7. Clergy	54	53	54	56	56	59	59	56	60	64	--	52	56	56	54	58
8. College teachers	50	52	50	52	56	55	53	52	59	58	57	--	58	--	--	58
9. Policemen	42	50	46	41	49	49	49	52	55	68	61	59	59	60	61	54
10. Psychiatrists	--	--	--	--	--	--	--	--	--	--	--	--	38	--	--	38
11. Bankers	27	28	27	27	26	34	30	30	37	34	--	36	35	36	41	37
12. Chiropractors	--	--	--	--	--	--	--	26	--	--	--	--	31	--	--	36
13. Journalists	27	26	20	23	23	23	22	24	21	29	--	26	25	--	26	26
14. State governors	--	--	--	--	--	--	--	24	30	--	--	--	26	--	--	22
15. Business executives	18	20	22	19	17	20	21	23	23	25	16	17	18	20	16	18
16. Lawyers	18	16	17	16	17	15	14	13	17	18	--	18	16	18	18	18
17. Stockbrokers	13	13	15	16	15	18	19	16	19	19	--	12	15	--	16	17
18. Senators	13	18	12	12	15	14	19	17	24	25	--	--	20	--	16	15
19. Congressmen	11	14	10	10	14	12	17	11	21	25	--	17	17	20	14	14
20. Insurance salesmen	9	10	9	11	11	12	11	10	10	13	--	--	12	--	--	13
21. HMO Managers	--	--	--	--	--	--	--	10	--	--	--	--	9	--	--	12
22. Advertising practitioners	10	8	12	10	11	12	10	9	10	11	14	9	12	10	11	11
23. Car salesmen	5	6	6	5	8	8	5	8	7	8	--	6	7	9	8	7

Source: Gallup

# ARE SCIENTISTS TRUSTED?

## How Much Do People Trust What Scientists Say?

Whom do you typically trust to provide accurate information about important issues in society?



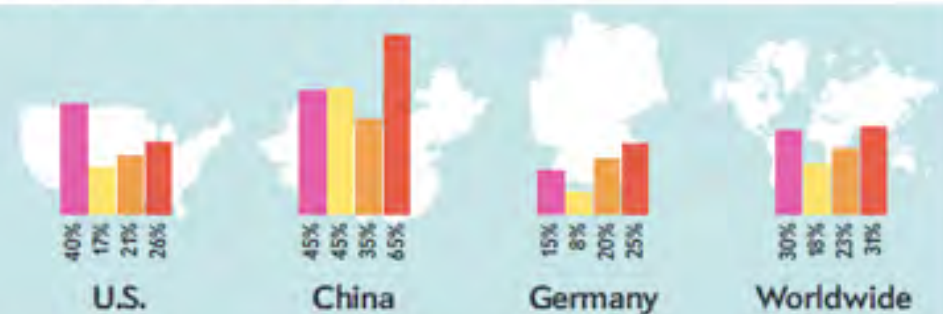
Source: Scientific American Oct. 2010

# ARE SCIENTISTS TRUSTED?

## When Science Meets Politics: A Tale of Three Nations

Respondents who agreed with the following statements:

- Scientists should speak out about what the science says but avoid advocacy
- Scientists should stay out of politics
- Scientists know best what is good for the public
- Scientists should pay attention to the wishes of the public, even if they think citizens are mistaken or do not understand their work



Source: Scientific American Oct. 2010

# IS THERE A TRUST GAP?

Forbes  
U.S. | EUROPE | ASIA

Home Page for the World's Business Leaders

Home | LIME | Business | Tech | Markets | Personal Finance | Entrepreneur | Leadership | Portfolio

Governance | Corporate Citizenship | Governance | Managing | CEO Network | CFO Network | Productivity

Governance

## The 100 Most Trustworthy Companies

Helen Coster, 04/05/10, 06:00 PM EDT

Page 2 of 2

### Most Trustworthy Large-Cap Companies

COMPANY #	AUDIT INTEGRITY INDUSTRY #	AVERAGE AGR SCORE 1 +	CURRENT QUARTER AGR SCORE #	MARKET CAP (\$ ML) 2 #
Bed Bath & Beyond	Retail (Specialty)	96	92	11,560
Enbridge Energy Partners LP <sup>3</sup>	Oil Well Services & Equipment	95	90	5,925
Hess <sup>3</sup>	Oil & Gas - Integrated	94	97	20,105
Jacobs Engineering Group	Construction Services	93	98	5,727
Ameren	Electric Utilities	92	95	6,056
Estee Lauder Cos	Personal & Household Prods.	81	89	12,543
Consolidated Edison <sup>3</sup>	Electric Utilities	79	68	12,334
Fastenal	Const. & Agric. Machinery	79	88	7,127
Salesforce.com	Software & Programming	79	75	9,888
Fluorserve	Misc. Capital Goods	78	90	6,067
Low's Companies	Retail (Home Improvement)	78	87	35,570
Consol Energy	Coal	77	71	8,279
Hormel Foods	Food Processing	75	84	5,594
Fluor	Construction Services	74	59	8,382
Paychex	Business Services	74	73	11,688
Chubb	Insurance (Prop. & Casualty)	73	62	17,033
Genuine Parts	Auto & Truck Parts	71	78	6,726
Cameron Int	Oil Well Services & Equipment	69	85	10,253
Whirlpool	Appliance & Tool	69	67	6,668

# IS THERE A TRUST GAP?



Click to Print

## South Korean stem cell scandal could sink deeper

By Elizabeth Weise

More new revelations about the scandal surrounding the scientist.

### Citing Scandal, Marc Hauser Cancels Extension

By NAVEEN N. SRIVATSA, CRIMSON STAFF WRITER  
Published: Wednesday, September 01, 2010

Like

5

Revert

1

4

COMMENT

EMAIL

PRINT



Among them is the about the fatal flaws



Psychology Professor Marc D. Hauser canceled his two courses at the Harvard Extension School due to the "controversy surrounding investigation" into his alleged scientific misconduct, according to a letter sent Monday night to students enrolled in his fall courses.

The Harvard Crimson



The TalkOrigins Archive  
Exploring the Creation/Evolution Controversy

Browse

Search

Feedback

Links

## Pittdown Man The Bogus Bones Caper

PLASTIC  
FANTASTIC

VOODOO  
SCIENCE

THE BIGGEST  
RAUD

SCIS SHOOK THE  
TIFIC WORLD  
SAMUEL REICH

The  
Road  
from  
Foolishness  
to Fraud

ROBERT  
PARK

Organic transistors

Cold fusion

Center for  
Neuroeconomics  
Studies



# THE BANALITY OF MISCONDUCT



NIH Public Access  
Author Manuscript

Published in final edited form as:

*J Empir Res Hum Res Ethics*, 2006 March ; 1(1): 43–50.

## Normal Misbehavior: Scientists Talk About the Ethics of Research

Raymond De Vries,  
*University of Michigan*

Melissa S. Anderson, and  
*University of Minnesota*

Brian C. Martinson  
*HealthPartners Research Foundation*

### Abstract

THOSE CONCERNED WITH PROTECTING the integrity of science generally focus on the serious but rare infractions of falsification, fabrication, and plagiarism (FFP). While the violations of FFP are clear threats to the quality of scientific work and public trust in science, are they the behaviors that researchers themselves find most troubling? Noticing that scientists seldom are asked to report their perceptions of the behaviors that pose problems for the enterprise of science, we conducted six focus groups with researchers from major research universities. A total of 51 scientists participated in our focus-group discussions, which lasted from 1.5 to 2 hours each. We found that while researchers were aware of the problems of FFP, in their eyes **misconduct generally is associated with more mundane, everyday problems in the work environment. These more common problems fall into four categories: the meaning of data, the rules of science, life with colleagues, and the pressures of production in science.** Focus on the “normal misbehaviors” that are part of the ordinary life of researchers allows us to see the way the organization of science generates both compliance and deviance from ethical norms.



# HOW CAN SCIENCE BE TRUSTED?

- Recent research from my lab shows that trust is chemical
- High trust organizations can be built and this is a leadership choice
- The recipe to build trust is PAD-TEAA

# TRUST

Why Does Time Only Move Forward? (page 48)

## SCIENTIFIC AMERICAN

Therapies That Beat BREAST CANCER  
page 58

June 2008 \$4.99

## Ethics and Economics of Climate Change

Balancing Current Costs against Future Well-Being

### Meteor Mystery

What Really Happened 100 Years Ago in Siberia

### Trust Hormone

Neurobiology Reveals What Makes Us Connect

### Photo Frauds

Spot Digital Fakes

© 2008 SCIENTIFIC AMERICAN, INC.

BRAIN SCIENCE

Our inclination to trust a stranger stems in large part from exposure to a small molecule known for an entirely different task: inducing labor

## The Neurobiology of Trust

By Paul J. Zak

### KEY CONCEPTS

- The development of trust is essential for appropriate social interactions, so how do people decide whether to trust a new acquaintance or potential business partner?
- Using an experimental task called the trust game, researchers have found that oxytocin, a hormone and neurochemical, enhances an individual's propensity to trust a stranger when that person exhibits non-threatening signals.
- Greater understanding of oxytocin's functions and interactions with other key brain chemicals could lead to insights into many disorders marked by impaired social interactions, such as autism.

—The Editors

88 SCIENTIFIC AMERICAN

### Searching for Trust

I came to the study of oxytocin's relation to trust via a somewhat circuitous route. In 1998 Ste-

If you were asked to fall backward into the arms of a stranger, would you trust the other person to catch you? Such a situation, a common exercise in group therapy, is a bit extreme. But every day most people place some degree of trust in individuals they do not know. Unlike other mammals, we humans tend to spend a great deal of time around others who are unfamiliar. Those who live in cities, for instance, regularly navigate through a sea of strangers, deciding to avoid certain individuals but feeling secure that others will, in the very least, refrain from attacking them.

In the past several years, researchers have begun to uncover how the human brain determines when to trust someone. And my colleagues and I have demonstrated that an ancient and simple molecule made in the brain—oxytocin (ox-toe-sin)—plays a major role in that process. The findings are suggesting new avenues for discovering the causes and treatments of disorders marked by dysfunctions in social interactions.

phen Knack, an economist in the World Bank's Development Research Group, and I began trying to find out why trust among people varies dramatically across different countries. As part of this effort, we constructed a mathematical model that described the kinds of social, legal and economic environments that might be expected to produce high and low levels of trust. In the course of the study, we discovered that trust is among the strongest known predictors of a country's wealth; nations with low levels of trust tend to be poor. Our model showed that societies with low levels are poor because the inhabitants undertake too few of the long-term investments that create jobs and raise incomes. Such investments depend on mutual trust that both sides will fulfill their contractual obligations. As I thought about the importance of trust in alleviating poverty, I began to wonder how two people decide whether to place faith in each other. Having that information could help policymakers design economic systems that facilitate this process. Laboratory studies had demonstrated that those in the same situation can vary widely in their propensity to trust another individual, but no one had described a coherent mechanism for what goes on in the human



© 2008 SCIENTIFIC AMERICAN, INC.

# WHO CARES?

- **Distrust undercuts effective management because when trust is low, employees are less likely to understand a manager's goals.**
- **In 2009, 60 percent of employees reported that they needed to hear information three to five times before believing it.**
- **Only 17% of employees in 2009 trusted statements made by a CEO**
- **Without trust, organizational goals will literally fall on deaf ears.**

# TRUST IS CHEMICAL

- **Experiments can be designed to measure trust and trustworthiness (reciprocation of trust) in the lab**
- **Neuroeconomics experiments do this by using money**
- **Money provides an objective measure of trust & trustworthiness**



# TRUST IS CHEMICAL

- **Oxytocin is a simple molecule made of 9 amino acids. A variant of it first appeared in fish 400M years ago. But oxytocin is uniquely mammalian.**

- **In monogamous mammals, oxytocin supports attachment to mates and maternal care for offspring.**



# A SOCIAL DILEMMA

Subjects receive \$10 when they show up and are randomly and anonymously matched in pairs

Decision-maker 1 chooses some amount  $X$  of his/her \$10 to send to decision-maker 2

Trustworthiness

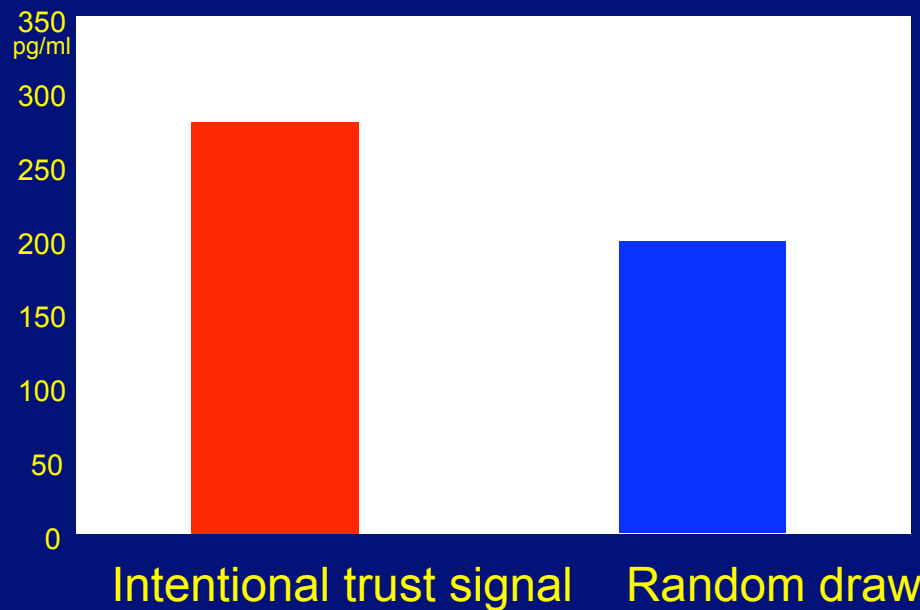
Trust signal

Decision-maker 2 receives  $\$3X$ , then can send all, some, or none back to decision-maker 1

Blood draws

# TRUST

•When someone trusts us, our brains release oxytocin which causes a sense of well-being and a desire to reciprocate even when this involves a direct monetary loss.



Zak et al. (2004)

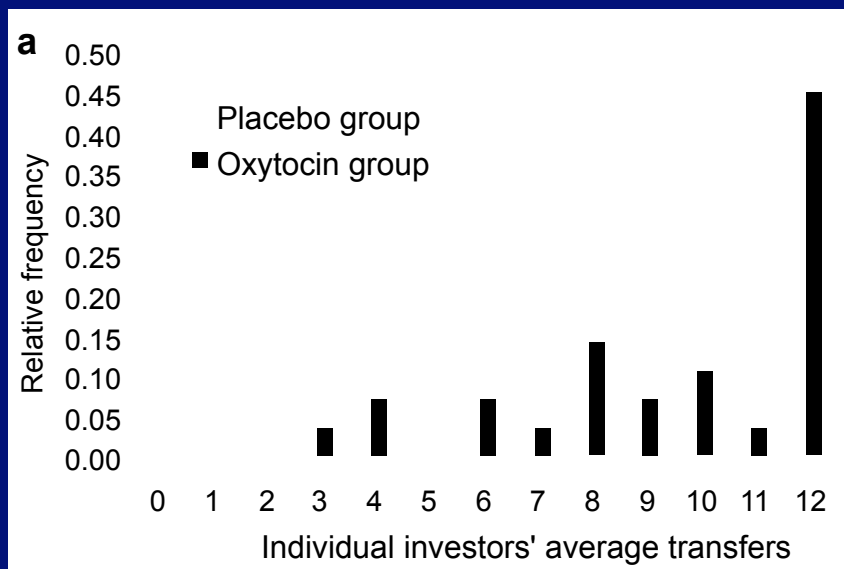
Zak et al. (2005)



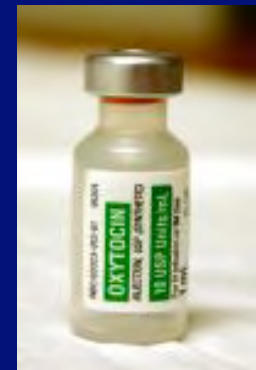
# TRUST

## Causation

- Intranasal administration with oxytocin more than doubles the number of people trust a stranger with all of their money
- **This response is emotional, not cognitive**



Kosfeld et al. (2005)



# WHAT DOES OXYTOCIN FEEL LIKE?

- **Participants watched one of two 100sec videos**
- **Emotion condition: father and his 4 yr old son who has terminal brain cancer**
- **Control condition: same father and son at the zoo, no mention of cancer or death**
- **Blood draws before and immediately after viewing**

VALUES, EMPATHY, AND FAIRNESS ACROSS SOCIAL BARRIERS  
**Empathy toward Strangers Triggers Oxytocin Release and Subsequent Generosity**  
Jorge A. Barraza<sup>a</sup> and Paul J. Zak<sup>b</sup>

**ANNALS of**  
The New York Academy of Sciences

# WHAT DOES OXYTOCIN FEEL LIKE?

- **The change in oxytocin correlated with the subjective experience of empathy**
- **Those who felt the most empathy were the most generous towards a stranger**
- **Generous people also gave the most to charity.**
- **Women show more: empathy, generosity, charity, and oxytocin release**

# INHIBITING OXYTOCIN

- **Testosterone inhibits OT binding to its receptor**
- **10g testosterone administration nearly doubled DHT levels**
- **Within-subjects design with blood draws to document change in testosterone**



# INHIBITING OXYTOCIN

- **Testosterone decreased generosity by 27% compared to men themselves on placebo**
- **Generosity declined linearly as testosterone increased**
- **Costly punishment of others for being stingy rises with testosterone levels**

OPEN ACCESS Freely available online

PLoS one

## Testosterone Administration Decreases Generosity in the Ultimatum Game

Paul J. Zak<sup>1\*</sup>, Robert Kurzban<sup>2</sup>, Sheila Ahmadi<sup>3</sup>, Ronald S. Swerdloff<sup>4</sup>, Jang Park<sup>1</sup>, Levan Efremidze<sup>1</sup>, Karen Redwine<sup>1</sup>, Karla Morgan<sup>5</sup>, William Matzner<sup>1</sup>

<sup>1</sup> Center for Neuroeconomics Studies, Claremont Graduate University, Claremont, California, United States of America, <sup>2</sup> University of Pennsylvania, Philadelphia, Pennsylvania, United States of America, <sup>3</sup> Department of Entomology, University of California Los Angeles, Los Angeles, California, United States of America, <sup>4</sup> Division of Endocrinology, Harbor University of California Los Angeles Medical Center, Torrance, California, United States of America, <sup>5</sup> Department of Economics, Whitworth University, Spokane, Washington, United States of America

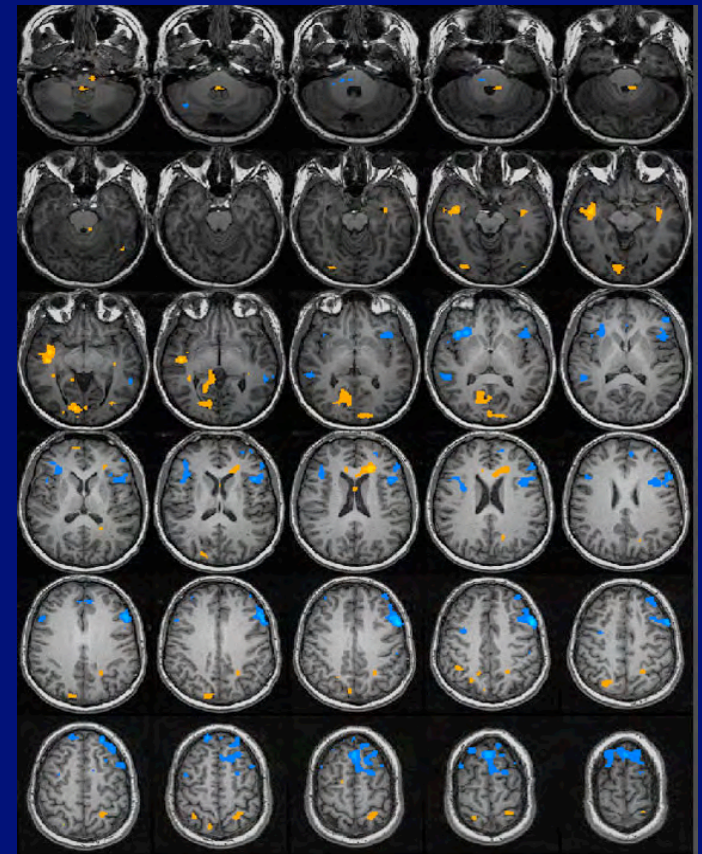


# TRUST

- We are highly social creatures and have a physiology that permits us to determine who is likely trustworthy and who is not, and to reciprocate when trusted

- Oxytocin induces a temporary attachment to, or empathy for, a stranger

- The neural substrates of trustworthiness utilize oxytocin receptors, especially in the amygdala (Zak et al, 2006; Bumgartner et al 2008)



# ODD: OXYTOCIN DEFICIT DISORDER



## Reiser seeks to appeal - says lawyer 'hates me'

Henry K. Lee, Chronicle Staff Writer

Wednesday, November 19, 2008



Hans Reiser, the computer programmer who admitted to strangling his estranged wife, is trying to appeal his conviction and sentence on the grounds of ineffective assistance from his lead attorney.

Reiser accused defense attorney William Du Bois of basing jury selection in part on Chinese astrology and said the lawyer had "oxytocin excess" because people who have too much of the hormone "enjoy betraying others."

**The 5% of those I've studied have ODD. Psychologically they are similar to psychopaths.**

# DISORDERS

• **Autism, Social Anxiety Disorder, Williams Syndrome, Alzheimer's Disease, etc.**

SHORT COMMUNICATION

CNS Neuroscience & Therapeutics

## **Oxytocin Levels in Social Anxiety Disorder**

Elizabeth A. Hoge,<sup>2</sup> Mark H. Pollack,<sup>1</sup> Rebecca E. Kaufman,<sup>1</sup> Paul J. Zak<sup>2</sup> and Naomi M. Simon<sup>1</sup>

<sup>1</sup> Department of Psychiatry, Massachusetts General Hospital, Boston, MA, USA

<sup>2</sup> Department of Economics, Claremont University, Claremont, CA, USA

# IMPLICATIONS

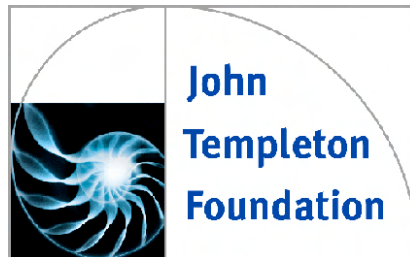
- **Trust in scientists and scientific findings are vitally important to California's economy**
- **Understanding the chemical basis for trust can inform both scientists and policy-makers on how research is done: transparency, empathy and autonomy are critical.**
- **Research should be presented to the public in a way that induces trust and accountability. People are curious and do not want to be dictated to: Involving citizens in public science can help with this**

# ACKNOWLEDGEMENTS

## Coauthors:

**Robert Kurzban (Penn), William Matzner (Pepperdine), Karla Borja (Whitworth), Ernst Fehr (Zurich), Michael Kosfeld (Zurich), Markus Heinrichs (Zurich), Jang Park (Claremont), Vera Morhenn (UC San Diego), Moana Vercoe (CGU), Jorge Barraza (CGU), and the CNS Lab**

## Funding:



**VISIT CNS ON THE WEB:  
[WWW.NEUROECONOMICSTUDIES.ORG](http://WWW.NEUROECONOMICSTUDIES.ORG)**

**MORALMOLECULE.COM**

**TWITTER: @PAULJZAK**



Center for  
Neuroeconomics  
Studies

