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FOR
TECHNOLOGY TRANSFER AND RESEARCH COMMITTEE

Committee Meeting: 2/10/2016

Board Meeting: 2/11/2016
Galveston, Texas

Wallace L. Hall, Jr., Chairman
Ernest Aliseda
Alex M. Cranberg
Brenda Pejovich
Sara Martinez Tucker

1. U. T. System Board of Regents: Discussion and appropriate action regarding Consent Agenda items, if any, assigned for Committee consideration

RECOMMENDATION

No Consent Agenda items are assigned for review by this Committee. The Consent Agenda begins on Page 426.

2. U. T. System: Discussion and appropriate action regarding an update to the U. T. Horizon Fund investment thesis

RECOMMENDATION

The Chancellor concurs in the recommendation of the Deputy Chancellor, the Executive Vice Chancellor for Business Affairs, the Vice Chancellor for Research and Innovation, and the Vice Chancellor and General Counsel that the U. T. System Board of Regents

a. authorize the U. T. Horizon Fund to refine its investment thesis to include both investments (i) in companies utilizing U. T. System innovations, as has been a precondition to investment since the inception of the U. T. Horizon Fund, and (ii) in companies in which U. T. System holds an existing equity interest, but which may not necessarily be utilizing U. T. System innovations; and

b. delegate to the Vice Chancellor and General Counsel, with no further delegation, the authority to execute all documents, instruments, and other agreements, and to take all further actions necessary or advisable to carry out the purpose and intent of the foregoing authorization concerning investments in companies in which U. T. System holds an existing equity interest, but which may not necessarily be utilizing U. T. System innovations.

Ms. Julie K. Goonewardene, Associate Vice Chancellor for Innovation and Strategic Investment and Managing Director of the U. T. Horizon Fund, will provide an update on the U. T. Horizon Fund, as well as present the proposed refined investment thesis using the PowerPoint presentation set forth on the following pages.

BACKGROUND INFORMATION

From an extensive analysis performed by the U. T. Horizon Fund team in response to questions from the Technology Transfer and Research Committee on August 19, 2015, it is requested that the U. T. System Board of Regents approve an update to the existing U. T. Horizon Fund investment thesis to best position the U. T. Horizon Fund to achieve its objectives.

The dual-purpose mission of the U. T. Horizon Fund is to: 1) help move novel technologies to the marketplace to impact the world, and 2) create a positive financial return. To better achieve its dual-purpose mission, the U. T. Horizon Fund needs to refine its investment thesis to include both investments in companies utilizing U. T. System innovations, as has been a precondition to investment since the inception of the U. T. Horizon Fund, and in companies in which U. T. System holds an existing equity interest, but which may not necessarily be utilizing U. T. System innovations.

State law and Regents' *Rules and Regulations*, Rule 90101, concerning Intellectual Property, provide existing authority and delegation to make investments in companies utilizing U. T. System innovations. The proposed action will provide delegated authority, as permitted to the U. T. System Board of Regents by State law, to invest in companies in which U. T. System holds an existing equity interest, but which may not necessarily be utilizing U. T. System innovations.

The U. T. Horizon Fund, a strategic investment fund for the U. T. System, was initially approved by the U. T. System Board of Regents on August 25, 2011, and was capitalized with $10 million of Available University Funds (AUF) (Phase I). On February 14, 2013, the U. T. Horizon Fund was reauthorized with expanded funding from AUF (Phase II) to be disbursed in four annual installments of $12.5 million each (including $10 million for investments and $2.5 million for associated services), subject to annual authorization by the Board of Regents upon receipt of a satisfactory report of activities undertaken as a result of the previous year's allocation. The total committed investment capital from both Phase I and Phase II is $50 million, and the total disbursed investment capital of the U. T. Horizon Fund to date is $30 million.

The U. T. Horizon Fund helps to create an environment that values innovation and entrepreneurship, which enables recruiting faculty and students. Additionally, the U. T. Horizon Fund utilizes existing U. T. System rights where possible, leverages the collective resources of private sector investors, enhances partnerships by attending and supporting entrepreneurial events, and strives to add value by connecting entrepreneurs with investors, subject-matter experts, advisors, and potential customers.

U. T. Horizon Fund

Ms. Julie Goonewardene
Associate Vice Chancellor for Innovation and Strategic Investment and
Managing Director of the U. T. Horizon Fund

U. T. System Board of Regents' Meeting
Technology Transfer and Research Committee
February 2016

Investment Update

- New investment by 1Q16
  - Estimated $1.1M capital investment
- Follow on investment (from 3Q15 – 1Q16)
  - Estimated $1.7M capital investment
- Other portfolio updates
- Currently reviewing five companies

Mission

- To accelerate the success of U. T. System institution-based companies

Vision

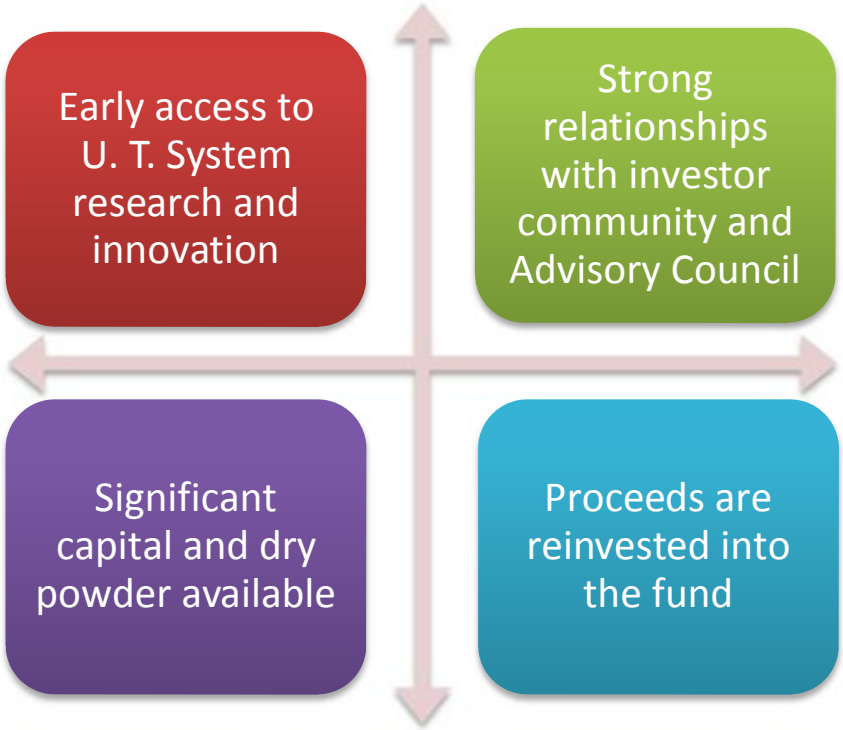
- The U. T. Horizon Fund (UTHF) is a dual-purpose venture fund that strives to generate top quartile returns by investing in U. T. System institution-based companies, improving the human condition

Investment Approach

- UTHF is a formative stage venture capital fund
- UTHF invests in companies that have U. T. System institution Intellectual Property or equity*
- UTHF is a collaborative co-investor and a committed long-term partner
- UTHF does not price or lead a round

** Subject to Regental approval in February 2016*

Competitive Advantage of UTHF



Business Development

Enhancing deal flow and building stronger relationships

Track U. T. System startup landscape that includes

- Campus visits
- Company calls
- Track potential pipeline companies

Effective investment screening process

- Business viability and market scope
- Strong syndicate
- Capital requirements and exit potential

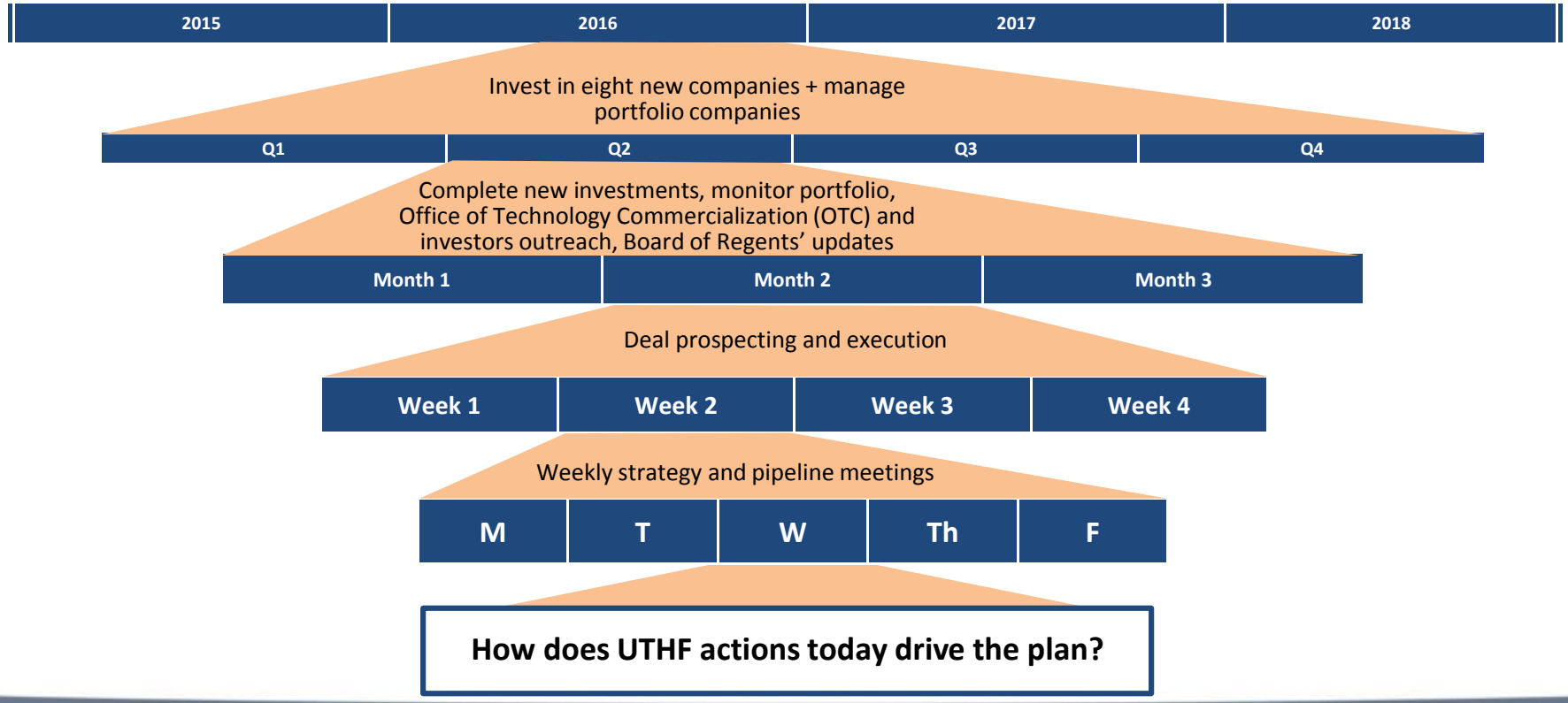
Monitor portfolio performance

- Quarterly company calls + Board meetings
- Track company health, follow-on rounds, capital requirements, and valuation changes
- Provide advisory services

Building investor relationships

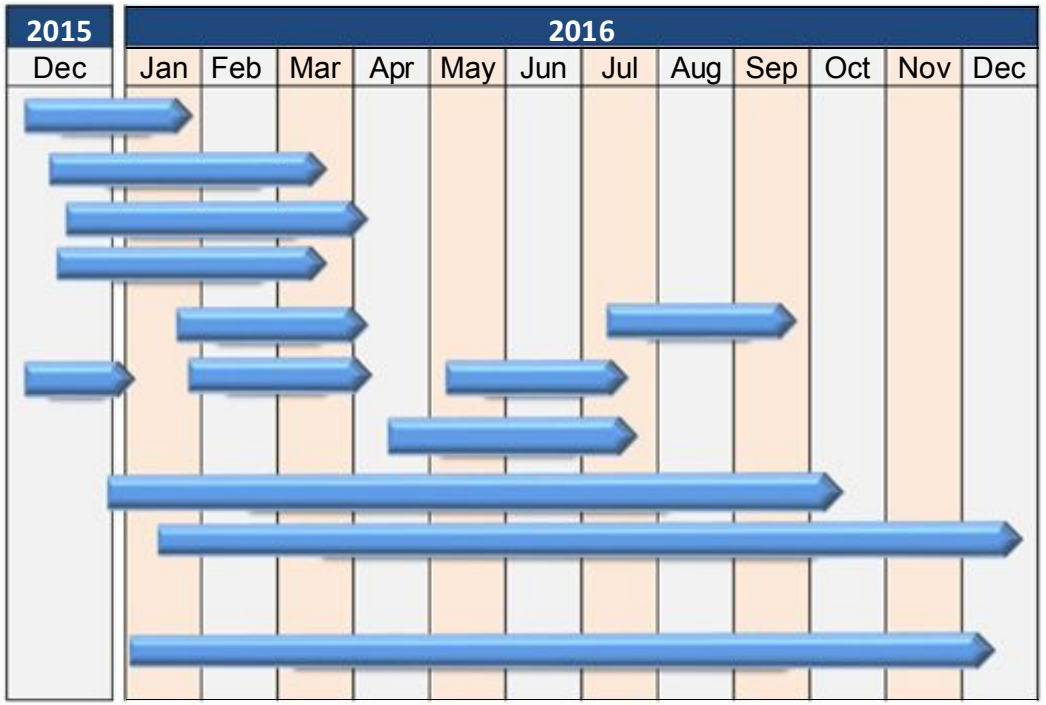
- Network with other investors, incubators, and accelerators
- Enhance feeder and syndicate network

Turning Strategy into Action



Strategic Initiatives

Topic
Website
Software acquisition + implementation
Portfolio review
Quarterly package
OTC outreach
Pipeline company outreach
Connect with UTIMCO, accelerators, and incubators
Business processes and transparency
Predictive analytics approach
Added services offered to the companies
Contracted a marketing advisor to work with certain portfolio companies



Fall 2015 Pipeline-Building Exercise

UTHF constantly scans the U. T. System universe for potential investment opportunities

Companies with U. T. System institution IP or equity	**124**	• Data driven by back-testing model • Includes information from U. T. System institution OTC offices
UTHF screened companies	**61**	• UTHF created an in-house rating mechanism • Focus on the A and B rated companies to start with • Track these pipeline companies on quarterly basis
Companies contacted	**20**	• The UTHF reviewed the top 20 highest rated companies in 4Q15
Companies raising capital	**4**	• Four companies raising capital in 1Q16
Companies raising capital with strong syndicate	**3**	• Three companies have strong syndicate

Original Fund Design

- Invests in U. T. System-based companies where:
  - The company is utilizing a U. T. System institution innovation AND
  - U. T. System institution holds an equity interest in the company
  - Pre-emptive rights as an important consideration
- A *pre-emptive right* in this case is defined to be "the privilege of a stockholder to maintain a proportionate share of the ownership of a corporation by purchasing a proportionate share of any new stock issues"

Source: http://legal-dictionary.thefreedictionary.com/Pre-emptive+Right

Back-testing Model Results

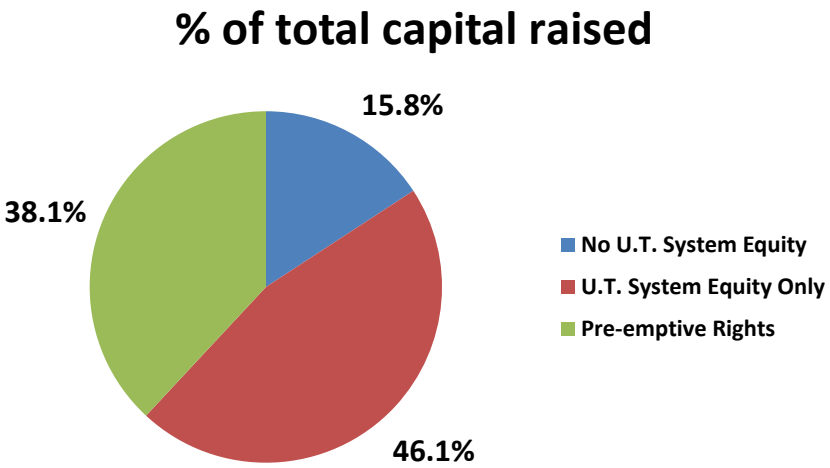
- Returns are larger when investing in companies with no pre-emptive rights

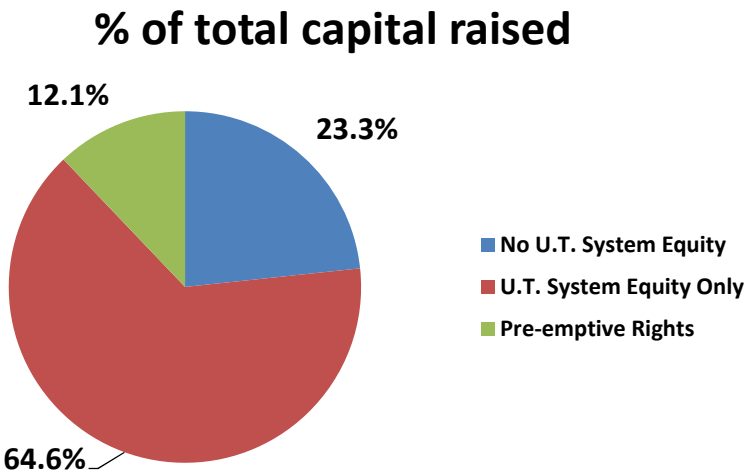
Performance Ratio	Scenario 1 : UT Equity and IP	Scenario 2 : Pre-emptive Rights
Distributions to paid-in capital (DPI)	1.19	0.90
Residual value to paid-in capital (RVPI)	0.62	0.64
Total value to paid-in capital (TVPI)	1.81	1.54
Time to return committed capital	Year 8	Year 9

Source: http://legal-dictionary.thefreedictionary.com/Pre-emptive+Right

Learning Since Fund Inception

- For companies utilizing U. T. System innovations, investing only in pre-emptive rights deals excludes a substantial number of investment opportunities and the largest portion of returns

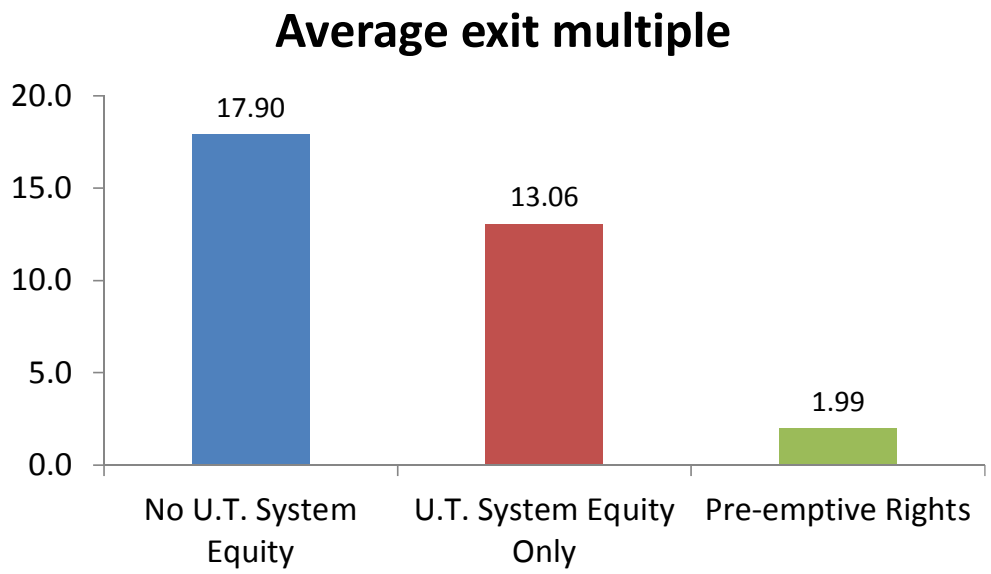




Source: U. T. Institution OTC Data, PitchBook Data

Learning Since Fund Inception (cont.)

- The exit multiple for an investment is the ratio of capital returned to capital invested
- At a company level, exit multiples are higher for non-pre-emptive rights-based investment opportunities



Source: U. T. Institution OTC Data, PitchBook Data

Discussion Regarding a Refined UTHF Thesis

- Refine UTHF thesis to better position for improved financial returns
- Invest in U. T. System-based companies where:
  - The company is utilizing U. T. System institution innovations OR
  - U. T. System institution holds an equity interest in the company
- Better positions UTHF for future strategic investments (i.e., cybersecurity, ed-tech)

3. U. T. System: Report on progress of U. T. BRAIN, a virtual U. T. System Neuroscience and Neurotechnology Institute

REPORT

Dr. Patricia Hurn, Vice Chancellor for Research and Innovation, and Dr. Tom Jacobs, Associate Vice Chancellor for Federal Relations, will report on the activities and progress of U. T. BRAIN, a virtual U. T. System Neuroscience and Neurotechnology Institute. The following U. T. System faculty scientists will present on research funded by the Institute.

- **Dr. Consuelo Walss-Bass**, Associate Professor, Department of Psychiatry and Behavioral Sciences, U. T. Health Science Center - Houston
- **Dr. Greg Dussor**, Associate Professor, School of Behavioral and Brain Sciences, U. T. Dallas

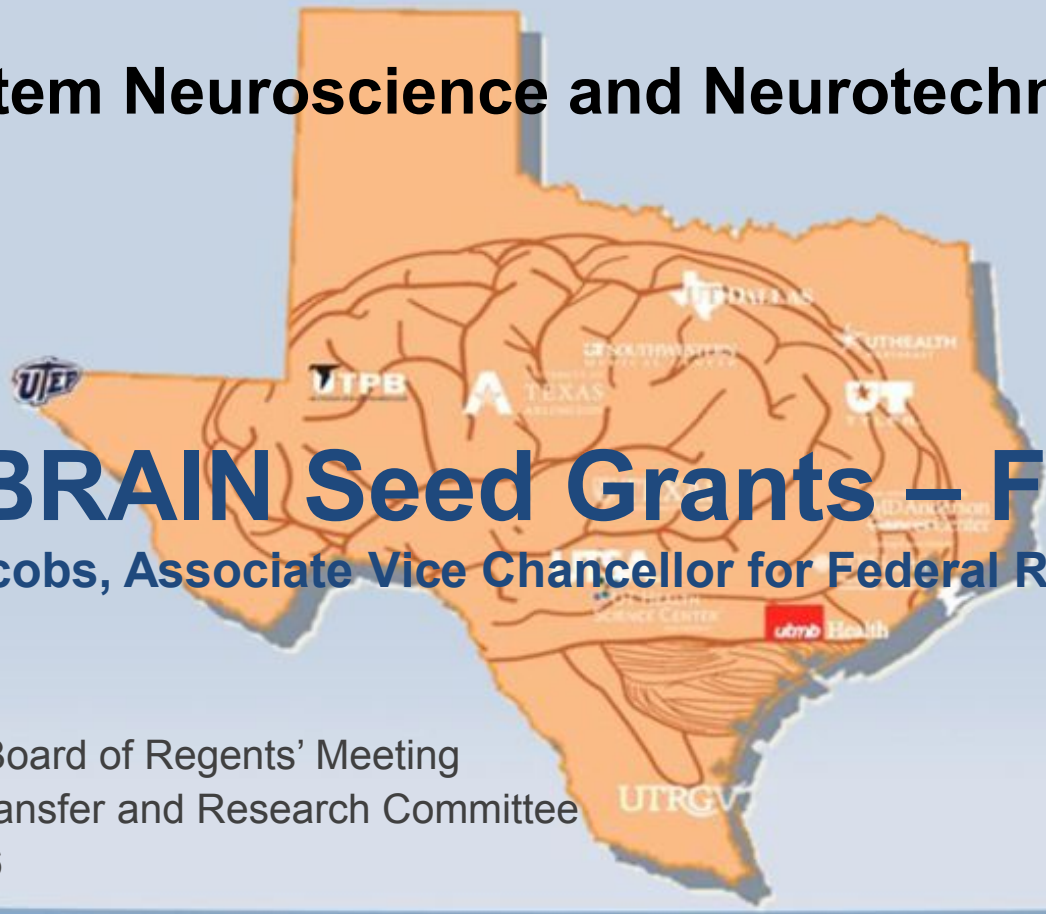
BACKGROUND INFORMATION

U. T. System institutions host an impressive variety of neuroscientists and the accompanying disciplines necessary to move neuroscience and neurotechnology into innovative waters, e.g., engineering, computer science, mathematics, material science, physics, and chemistry. To assist U. T. System scientists to compete for ongoing federal research funding and private-sector investments in neuroscience research, the U. T. System Board of Regents approved the creation of the Systemwide virtual U. T. System Neuroscience and Neurotechnology Institute on August 21, 2014. The purpose of this presentation is to report on the progress of the Institute to date.

The primary purpose of the Institute is to enable U. T. System researchers to build competitive collaborations. The main, but not exclusive, focus of the Institute is on neurotechnology development and creation of innovative tools and techniques that will transform research in the field. Areas of special interest include, but are not limited to, imaging, neurocomputational techniques, development of neuro-devices for research or treatment purposes, and molecular mapping.

One significant initiative of the Institute, in partnership with U. T. Austin, is to create multi-institutional, collaborative research projects that have a high likelihood of success scientifically, and for extramural funding. Collaborations among health, engineering, and life sciences experts have been particularly encouraged.

U. T. System Neuroscience and Neurotechnology Institute



U. T. BRAIN Seed Grants – FY 2015

Dr. Tom Jacobs, Associate Vice Chancellor for Federal Relations

U. T. System Board of Regents' Meeting
Technology Transfer and Research Committee
February 2016

THE UNIVERSITY of TEXAS SYSTEM
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www.UTSYSTEM.EDU

Neuroscience
A National and Texas Research Priority

- Neurological/mental disorders cost the U.S. $760 billion per year

- 5 million Americans living with Alzheimer's Disease
- $226 billion estimated cost of care in 2015

- 340,000 Texans living with Alzheimer's Disease
- Estimated 17% increase by 2020
- 6th leading cause of death in Texas
- Cost of care for Texans is estimated at $716 million

U. T. BRAIN Seed Grant - First Funding Round

- Call for proposals February 2015
- 158 proposals submitted, all U. T. System institutions
- 103 expert peer reviewers selected from outside Texas
- All applicants received feedback and review results
- Abstracts and reviewer list available at: https://www.utsystem.edu/sites/neuroscience
- Award letters and funding administered in August 2015

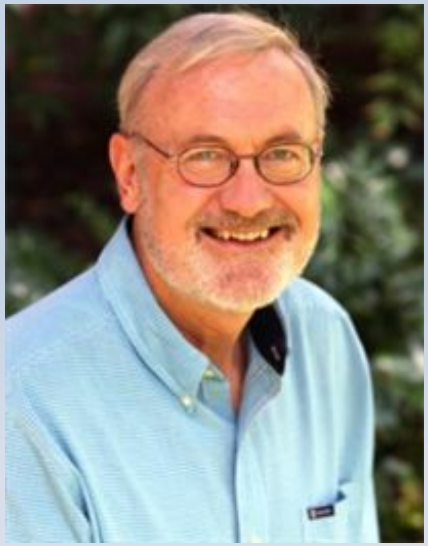
U. T. BRAIN Seed Grant - First Funding Round (cont.)

- Collaboration to create grant review and award infrastructure within the Department of Neuroscience, College of Natural Sciences at U. T. Austin
- Instrumental to this collaboration:

Dr. Daniel Johnston
Director, Center for Learning and Memory,
Karl Folkers Chair in Interdisciplinary Biomedical Research

Cynthia Thompson
Senior Grants and Contracts Specialist, Center for Learning and Memory

Kathleen Pantalion
Assistant Director, Center for Learning and Memory



U. T. BRAIN - Peer Review Results

- Payline: average score = 2.67 (range 1 - 9)
- Top 45 of 158 applications awarded $100K ($4.5M total)
- Success rate - 28% (NIH success rate - 17%)
  - New collaborations - 100%
  - Trans-disciplinary collaborations - 96%
  - Trans-institutional collaborations - 44%
  - Early stage investigators - 48%

Examples of new collaborations seeding innovative neurotechnologies

- Optogenetics
  - Design a virus-based reporter of neural activity (*Zemelman/Drew)
    - Potential: uncover the cellular basis of behavior
- Circuitry
  - Identify neuronal specific viruses (*Roberts/Schoggins)
    - Potential: new tools to explore multiple circuits simultaneously
  - Develop DNA fluorescent tracers for imaging circuit rewiring (*Xu/Vitella)
    - Potential: visualize neuronal circuit connectivity and plasticity over time
- Material Science
  - Develop bio-compatible, highly integrated, multifunctional devices (*Luan/Xie)
    - Potential: enable long-term optical stimulation and electrical recording in a 3D array

U. T. BRAIN is already stimulating national interest and recognition

- Contact with >300 labs nationally during the review process
- Agencies following U. T. BRAIN progress
  - White House – Office of Science and Technology Policy
  - National Institute of Neurological Disease and Stroke/NIH
  - Society for Neuroscience, the largest scientific society for the field
- > 1,000 hits on the U. T. System Neuroscience website

The BRAIN Initiative® Partners*

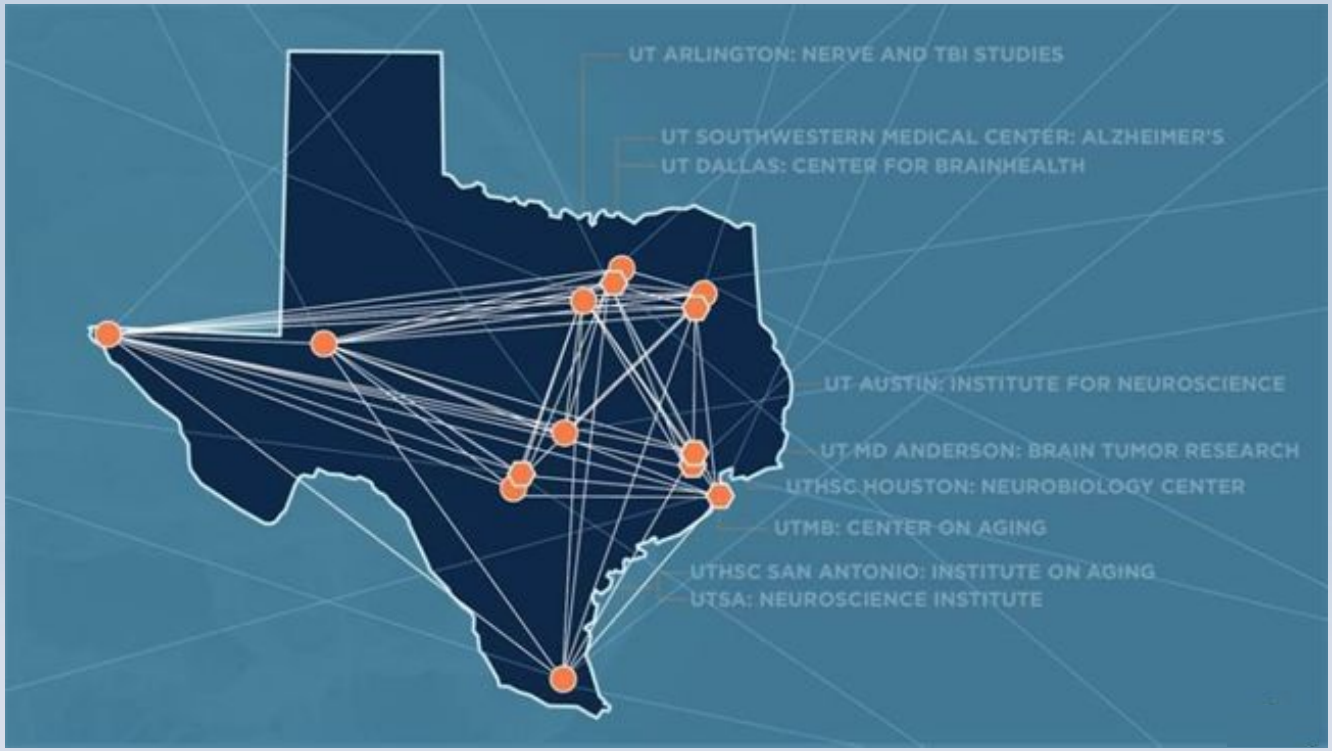
Federal
NIH
NSF
DARPA
IARPA
FDA
WH-OSTP

Non-Federal
Foundations
Universities
Institutes
Industry

Boston University
Carnegie Mellon University
Pacific Northwest Neuroscience
University of California System
University of Pittsburgh
The University of Texas System
University of Utah

*http://www.braininitiative.nih.gov/

U. T. System → Texas → U.S. Neuroscience Network



U. T. BRAIN - Resources

- U. T. System Neuroscience Website: https://www.utsystem.edu/sites/neuroscience
  - Seed Grant Announcement
  - Peer Reviewer & Affiliation List
- U. T. System Neuroscience Blog: https://www.utsystem.edu/sites/neuroscience/blog
- Office of Federal Relations Twitter: #UTBRAIN
- U. T. BRAIN Contacts:
  - Tom Jacobs: tjacobs@utsystem.edu
  - Cindy Thompson: cynthia@austin.utexas.edu
  - Dan Johnston: djohnston@mail.clm.utexas.edu
  - Patricia Hurn: phurn@utsystem.edu
  - Dale Klein: dklein@utsystem.edu
  - William Shute: wshute@utsystem.edu

Generation of Human-Derived Neurons for the Study of Psychiatric Disorders

Consuelo Walss-Bass, Ph.D.
Associate Professor, Department of Psychiatry and Behavioral Sciences
U. T. Health Science Center - Houston

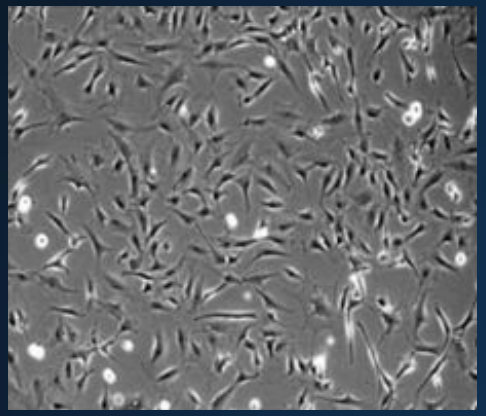
U. T. System Board of Regents' Meeting
Technology Transfer and Research Committee
February 2016

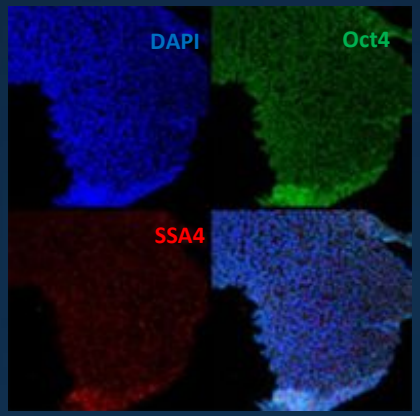
UTHealth | McGovern Medical School
The University of Texas Health Science Center at Houston

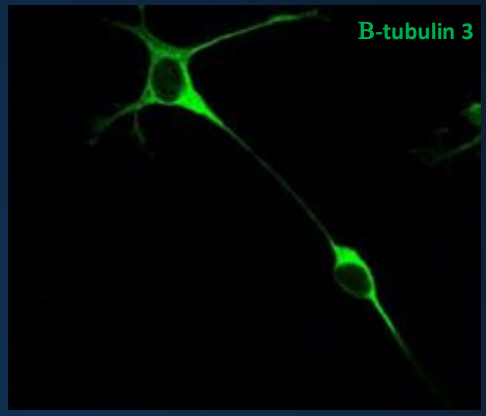
The Challenge

- Psychiatric disorders are currently diagnosed based on behavioral symptoms. No biological test available.
- Biological mechanisms are unknown.
- It is difficult to obtain brain tissue from living human patients.

Generation of Neurons from Skin Cells







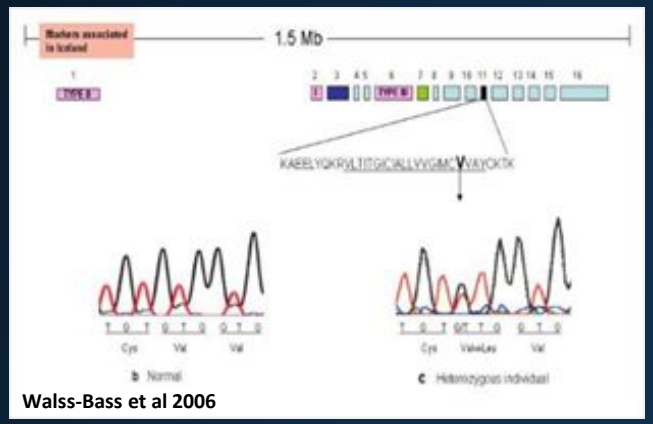
Fibroblasts
(Skin Cells)

iPSC
(Stem-like cells)

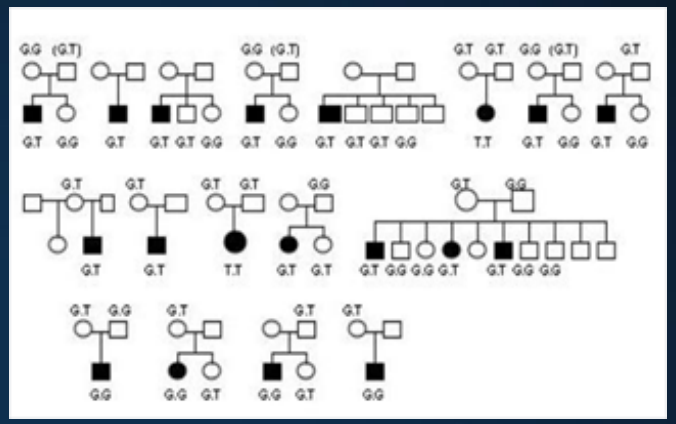
Neurons

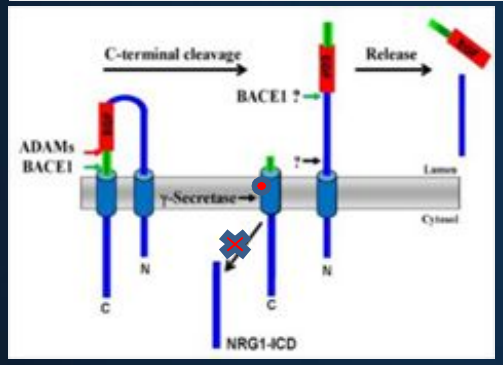
UTHealth | McGovern Medical School
The University of Texas Health Science Center at Houston

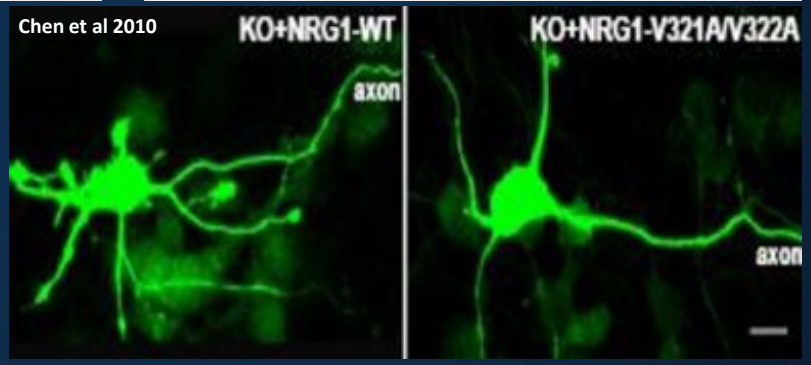
Neuregulin 1 Mutation in Schizophrenia Families from Costa Rica



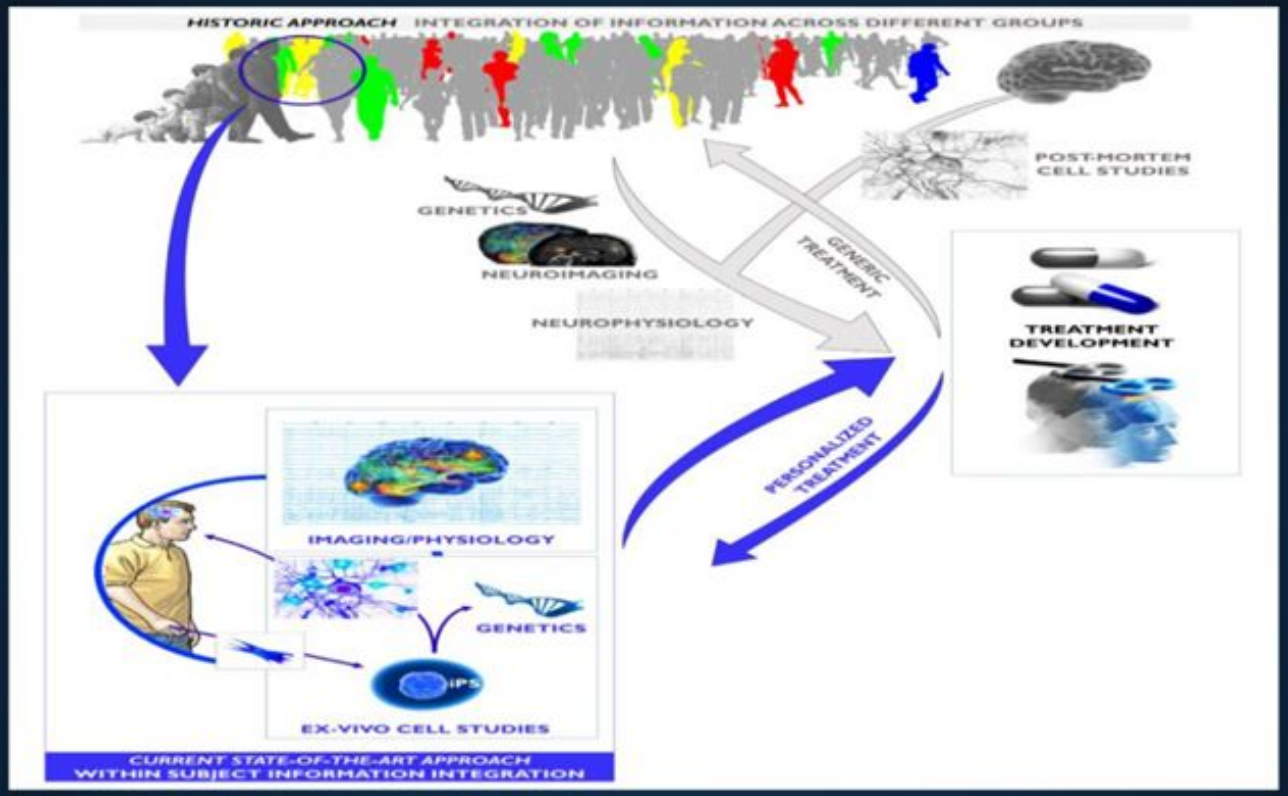
Walss-Bass et al 2006







Goal: Development of Personalized Treatments



UTHealth The University of Texas Health Science Center at Houston | McGovern Medical School

Prolactin and sex dependence of migraine

Greg Dussor, Ph.D. (presenter)
Associate Professor, Neurobiology of Pain, Migraine
U. T. Dallas

Armen Akopian, Ph.D. (collaborator)
Associate Professor, Endodontics
U. T. Health Science Center - San Antonio

Technology Transfer and Research Committee
U. T. System Board of Regents' Meeting
February 2016

U. T. BRAIN Institute of Neuroscience Seed Funding Award

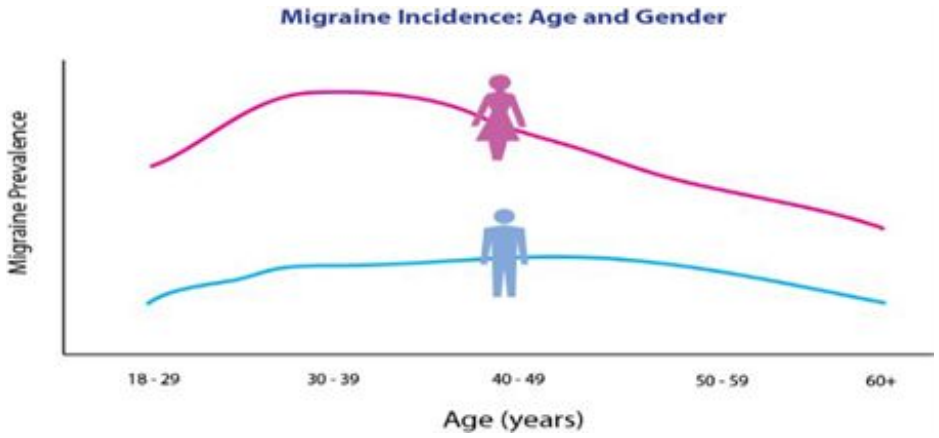
Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010

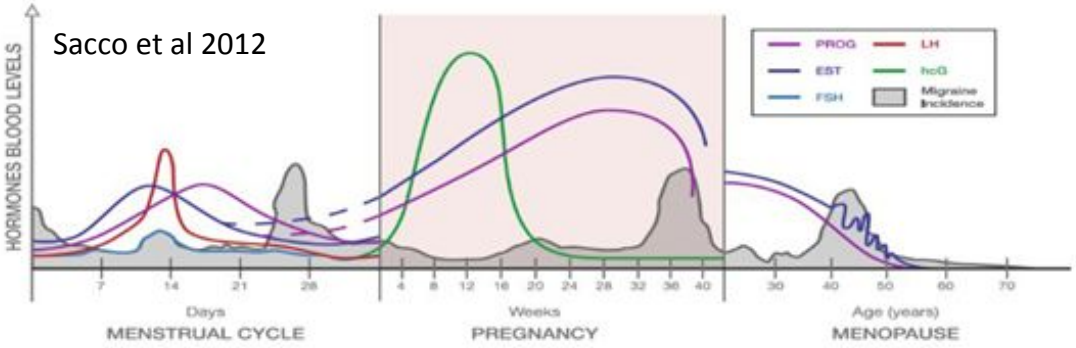
www.thelancet.com Vol 380 December 15/22/29, 2012

	Prevalence (both sexes)		Male prevalence		Female prevalence	
	Total (thousands)	Proportion of population (%)	Total (thousands)	Proportion of population (%)	Total (thousands)	Proportion of population (%)
Dental caries of permanent teeth	2431636	35·29%	1194051	34·37%	1237585	36·23%
Tension-type headache	1431067	20·77%	655937	18·88%	775131	22·69%
Migraine	1012944	14·70%	371072	10·68%	641873	18·79%
Fungal skin diseases	985457	14·30%	516167	14·86%	469291	13·74%
Other skin and subcutaneous disease					386468	11·32%
Chronic periodontitis					364780	10·68%
Mild hearing loss with perinatal onset					338543	9·91%
Acne vulgaris					335140	9·81%
Low back pain					297252	8·70%
Dental caries of baby teeth					269421	7·89%

2010		
Disorder	Mean rank (95% UI)	% change (95% UI)
1 Low back pain	1·1 (1 to 2)	43 (34 to 53)
2 Major depressive disorder	1·9 (1 to 3)	37 (25 to 50)
3 Iron-deficiency anaemia	3·3 (2 to 6)	−1 (−3 to 2)
4 Neck pain	4·3 (3 to 7)	41 (28 to 55)
5 COPD	5·8 (3 to 10)	46 (32 to 62)
6 Other musculoskeletal disorders	5·9 (4 to 8)	45 (38 to 51)
7 Anxiety disorders	6·4 (4 to 9)	37 (25 to 50)
8 Migraine	8·9 (6 to 15)	40 (31 to 51)
9 Diabetes	9·1 (6 to 13)	68 (56 to 81)
10 Falls	10·1 (7 to 14)	46 (30 to 64)

Migraine preferentially affects women





- **Migraine is three times more common in women than men**
- **Migraine prevalence in women increases after puberty and decreases after menopause**

Incidence of migraine is dependent on:

- **menstrual cycle**
- **pregnancy**
- **menopause**

There are likely different mechanisms contributing to migraines between men and women, which demonstrates a need for sex-specific migraine therapeutics

Prolactin contributes to migraine in humans

J Headache Pain (2008) 9:103–107
DOI 10.1007/s10194-008-0016-z

ORIGINAL

Relationship between high prolactine levels and migraine attacks in patients with microprolactinoma

D. Bosco · A. Belfiore · A. Fava · M. De Rose · M. Plastino · C. Ceccotti · P. Mungari · R. Iannacchero · A. Lavano

J Headache Pain (2006) 7:83–89
DOI 10.1007/s10194-006-0272-8

ORIGINAL

Cinzia Cavestro
Annalisa Rosatello
Maria Pia Marino
Gianmatteo Micca
Giovanni Asteggiano

High prolactin levels as a worsening factor for migraine

Original Article

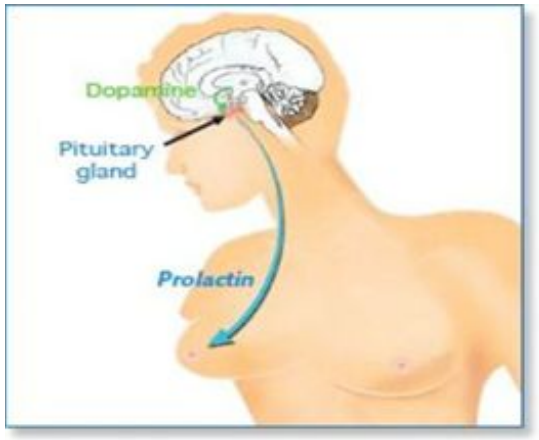
Cephalalgia
International Headache Society

Cephalalgia
2014, Vol. 34(7) 493–502

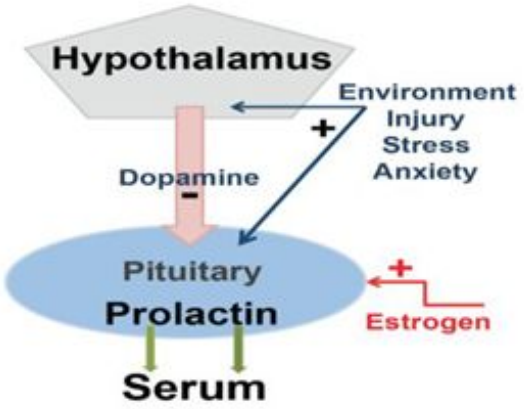
DOI: 10.1177/0333102413515343
cep.sagepub.com
SAGE

Prolactinoma-associated headache and dopamine agonist treatment

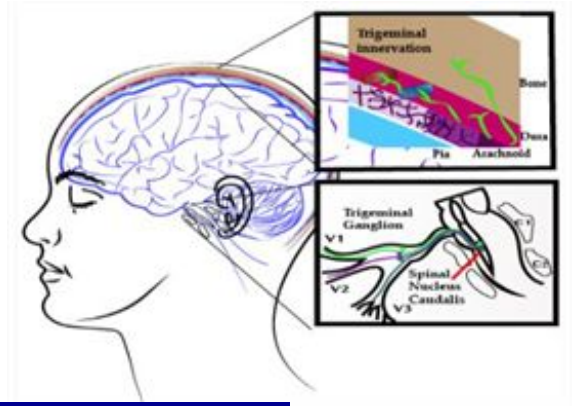
Mia-Maiken Kallestrup[1], Helge Kasch[2], Toke Østerby[1], Edith Nielsen[3], Troels S Jensen[2] and Jens OL Jørgensen[1]



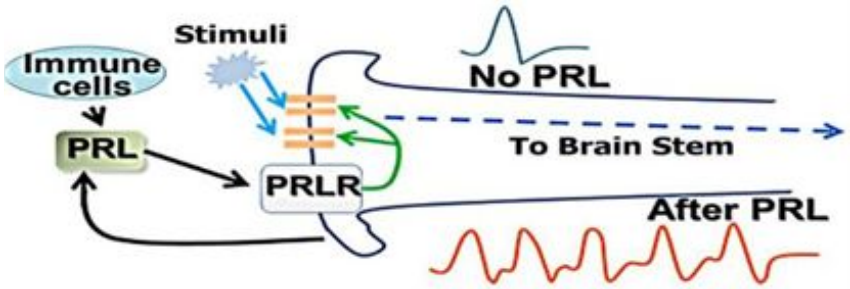
Neurosurgery.ucla.edu



The headache phase of migraine is due to pain signaling from the meninges: effects of prolactin on these pain-sensing neurons are completely unknown

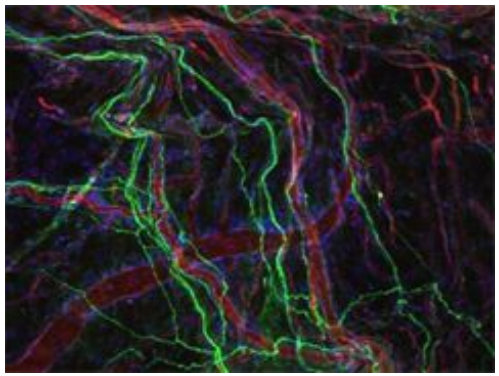


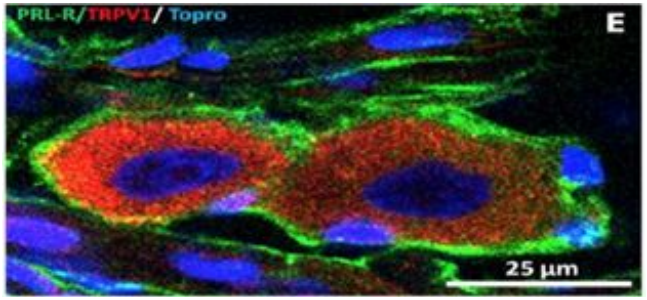
Hypothesis: prolactin sensitizes pain signaling from the meninges in females but not males



Experiments:

Is prolactin receptor differentially expressed in females?





Does prolactin increase neuronal activity in females but not males?