In Celebration of SPL’s 25th Reunion

Martha E. Shenton, PhD
April 9, 2016
1987 – Ron and I meet Ferenc

Ron
Post-doctoral Fellowship with Ferenc?
Meeting Ferenc – Wow!

Marty
Submit a K Award?
Don’t submit a K Award.
Talk to Ferenc.
Sitting in the bowels of BWH waiting outside his office to see Ferenc.
Meeting Ferenc – Wow!

1988 – Ron and I meet

Ron
Receives Nachwuchsförderungsstipendium, equivalent to a K Award.
Comes to BWH to work with Ferenc.

Marty
K01 Award is funded by NIMH.
Ferenc proclaims that nothing will be found in schizophrenia.
Ferenc introduces me to Ron.
Ron and I begin work in Thomas Sandor’s Lab. Teaches me neuroanatomy as seen in MR.
This is 1988, pre-Surgical Planning Laboratory.
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“Forever Young,” by Bob Dylan

1988 to the Present

28 years

His “oldest collaborator”

1992 Stanley Award Winners: Drs. Ron Kikinis and Martha Shenton use satellite technology to study brain abnormalities in schizophrenia.
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But

Ron had a Vision
Small opportunities are often the beginning of great enterprises.

- Demosthenes
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From Humble Beginnings

One day in 1990

Ron, Mark Anderson, Marianna Jakab, Diane Doolin, Marty

Now More than 1,000 Members or Associate Members
Ron’s Vision for the SPL

• While extracting information from images for clinical purposes may be difficult, the challenge becomes more difficult in attempting to learn about diseases such as schizophrenia, multiple sclerosis, or cancer by examining anatomical changes in thousands of patients. Without proper computational tools, medicine cannot fully leverage the potential of imaging for improving the understanding and treatment of diseases that humanity continues to face.

• The SPL was founded on the belief that often science, discovery, and new treatments for disease come from the development of advanced tools without which important questions can not be answered, and without which our knowledge of diseases and their improved treatment can not go forward.
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Time for Fun – 1990-1991

“Forever Young”

May God bless and keep you always
May your wishes all come true
May you always do for others
And let others do for you
May you build a ladder to the stars
And climb on every rung
May you stay forever young
Forever young, forever young
May you stay forever young.

May you grow up to be righteous
May you grow up to be true
May you always know the truth
And see the lights surrounding you
May you always be courageous
Stand upright and be strong
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May your hands always be busy
May your feet always be swift
May you have a strong foundation
When the winds of changes shift
May your heart always be joyful
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1992 – Boston Globe Article

Ron and David Altobelli – Pre-Surgical Planning for Craniofacial Surgery
ABNORMALITIES OF THE LEFT TEMPORAL LOBE AND THOUGHT DISORDER IN SCHIZOPHRENIA

A Quantitative Magnetic Resonance Imaging Study

Martha E. Shenton, Ph.D., Ron Kikinis, M.D., Ferenc A. Jolesz, M.D., Seth D. Pollak, M.A., Marjorie LeMay, M.D., Cynthia G. Wible, Ph.D., Hiroto Hokama, M.D., John Martin, B.S., Dave Metcalf, B.S., Michael Coleman, M.A., and Robert W. McCarley, M.D.

Healthy Control

Patient with Schizophrenia
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Automated Segmentation into Tissue Classes

1992-1994 Stanley Foundation Grant
1992-1995 Whitaker Foundation Grant

Assign a single label to a set of points in an image which belongs to the same structure.

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“Forever Young”
Visualization for Pre-Surgical Planning

Image Guided Surgery (IGT)
Multiple Sclerosis
Schizophrenia
Diagnostic Imaging
Other
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Extracting Visual Information from Medical Images
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1995-1997 – Scottish Rite Grant: Transcranial Magnetic Stimulation

GENIUS MACHINE or Too Much Time on Our Hands?
Ron Kikinis, Martha Shenton, Eric Grimson, Eben Alexander III, Laverne Gugino
(Gill Ettinger, Mike Leventon, Linda Aglio, Geoff Potts)
– Saturday Mornings –

TMS Figure 8 Coil
Suppressing Vision (Visual Blindness) Using TMS

![Graph showing percent errors vs. TMS onset latency after visual stimulus in milliseconds.](image)
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1999 Diffusion Tensor Imaging

Carl-Fredrik Westin

Marek Kubicki
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Principles of Diffusion Tensor Imaging

Unrestricted Isotropic Diffusion

Restricted Anisotropic Diffusion

Diffusion Ellipsoid

Myelin Sheath

Courtesy of Gordon Kindlmann
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Diffusion MRI Data for Neurosurgical Planning
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... from DT-MRI Tractography

... to white matter anatomy

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2000 – NIH Reporter

Drs. Ron Kikinis (left) and Ferenc Jolesz work on developing clinical applications for image processing and computer graphics. To accomplish this, they collaborate with physicists, computer scientists, medical researchers, and neurosurgeons. (Photo courtesy of the Surgical Planning Laboratory, Brigham and Women’s Hospital, Boston)
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2003 First Computer Scientist in PNL

Sylvain Bouix, Ph.D.
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Shape

Major Fiber Bundles in the Brain

Subject-Specific Profiles of Injury – Similar to Precision Medicine Approach

Sylvain Bouix, Ph.D.
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2004-2015 NA-MIC is a national research center supported by grant U54 EB005149 from the NIBIB NIH HHS Roadmap for Medical Research Program.

Multi-institutional, interdisciplinary team of computer scientists, software engineers, and medical investigators who develop computational tools for the analysis and visualization of medical image data. The purpose of the Center is to provide the infrastructure and environment for the development of computational algorithms and open-source technologies, and then oversee the training and dissemination of these tools to the medical research community.

2004-2007 Driving Biological Problem: Schizophrenia (Shenton)
2007-2010 Velocardiofacial Syndrome (Kubicki)
2010-2015 Atrial Fibrillation, Head & Neck, Lupus, Traumatic Brain Injury, Prostate Cancer, Autism
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2005
Move to 1249 Boylston Street

Gate B Fenway Park
**INTRuST Progress Flowchart 2008-2016**

**Total Cases on CNDA (n=438)**

- Scan Downloaded from CNDA: 100% (438/438)
- Case folder organized on network: 100% (438/438)
- Quality Control (n=384 passes): 88% (384/384)

**T1W**
- Realign
- Mask: 100% (384/384)
  - Semi-Automated Mask
  - Manually edit

**SWI**
- Register Tensor masks to SWI space: 100% (383/383)
- Generate high-contrast image: 100% (383/383)
- Microbleed identification: 100% (383/383)

**DWI**
- Motion and eddy current correction: 100% (384/384)
- Mask: 100% (384/384)

**FreeSeg (GM, WM, CSF)**
- 100% (384/384)

**FreeSurfer: Cortical Segmentation & Thickness**
- 100% (384/384)

**Semi-automated segmentation of amyg/hipp**
- 100% (384/384)

**Whole Brain Tractography**
- 100% (384/384)

**ROI Tract Analysis**
- Generate tracts: CC, AF, UF, IOFF, SLF
- Extract diffusion measures: FA, AD, RD, trace
- Tract volume measurement
- 100% (384/384)

**Free Water Analysis**
- 100% (384/384)

**Register Tensor masks to SWI space**
- 100% (383/383)

**ROI Tract Analysis**
- 100% (384/384)
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2008-Present

NFL Study of Repetitive Head Trauma: Soccer Sub-Concussive Head Trauma

Ross Zafonte         Bob Stern            Inga Koerte           Alex Lin          Sylvain Bouix      Yogesh Rathi     Ofer Pasternak   Mike Coleman

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NFL Study of Repetitive Head Trauma: Soccer Sub-Concussive Head Trauma

Ann McKee

2008-Present
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Thank you for your attention!

http:// pnl.bwh.harvard.edu