CT SCANNING; THEORY AND PRACTICE

L. Shepp

This talk is about CAT scanning now used in every hospital in the developed world to find tumors, blood leaks and clots and other brain lesions. The driving technology is mathematics. See the paper:

``Computerized Tomography: The New Medical X-Ray Technology,'' (with JB Kruskal) Amer. Math. Monthly 85, (1978), 420-439.

1. The philosophy of inverse problems.
2. Why X-rays give rise to line integrals and the Radon transform.
3. The use of mathematical phantoms.

EMISSION TOMOGRAPHY; THEORY AND PRACTICE

L. Shepp

This talk is about SPECT and PET used in many University hospitals to study how the brain functions - when one speaks Farsi which part of the brain is active and is it the same part as when one speaks English? How can one make measurements to answer this question? See the paper:

``Maximum Likelihood Reconstruction for Emission Tomography,'' (with Y. Vardi) IEEE Trans. on Medical Imaging 1, (1982), 113-122.

1. The philosophy of nuclear medicine or "tracers".
2. Why emission physics gives rise to Poisson statistical modelling.
3. The limitations of this modality.

FUNCTIONAL MAGNETIC RESONANCE IMAGING; THEORY AND PRACTICE

L. Shepp

This talk points to a way around the main limitation of emission tomography to study brain function - which is the poor time resolution. See the paper:

``Fast Functional Magnetic Resonance Imaging via Prolate Wavelets''
(with Cun-Hui Zhang), Applied and Computational Harmonic Analysis,
9, (2000), 99-119.

1. The physics of magnetic resonance and Fourier transforms.
2. The philosophy of imaging brain function; wavelet filters.
3. Experimental data and results.