Art as Applied to Medicine: Art, Science and Lymph Nodes

Art Anderson MD
Art as Art: -  Melville Covin
High School Art Teacher

Choice: Fine Arts vs Pre-Med?
Art as Art:

Imaginary Oriental Landscape

Circulatory Satire
Art as Art: Study and Reflection

These were drawn for pleasure and when taking a break from my studies.
In 1968 I examined an emaciated patient before her 50 lb ovarian cyst was removed surgically. I drew her standing naked by the bed. This drawing and one I made of the cyst at surgery were kept in her chart. Seven months later she saw Dr. Gaylord Clark for a hand problem. He arranged for me to become a special student in *Art as Applied to Medicine* after seeing my drawings. Dr. Clark, a hand surgeon, is also a medical illustrator who trained at JHU.
Art as Applied to Medicine 1969

Brodel Pen Technique Sampler

Ranice Crosby
Art as Applied to Medicine

Max Brodel created the first American program in medical illustration and invented key drawing techniques.

The medical illustrator's art is both a process and a product; it is a seamless synthesis of human imagination, technical mastery, and creative self-expression.

"Max Brodel's genius was and still is the consummate outpouring of that special combination of scientific research, artistic knowledge, and talent." Ranice Crosby.
Art and Science

Art as Science:

“How Lymph Nodes Work”

~ Scientific Mini-Presentation ~
Lymphocytes Traffic Through Peripheral Lymphatic Tissues

The organs of the immune system are dispersed around the body yet act as a single organ. Its cells recirculate from the blood to tissues and back to the blood via lymph continuously. The traffic is enough to replace the blood lymphocytes 10-48 times every 24 hours.
Lymph Node Structure & Function
LN Uptake of Free Particulates

- Free particles accumulate in the subcapsular sinus, cortical sinuses, and in the medullary lymph sinuses.
- A barrier blocks entry of particles into the diffuse cortex.
Soluble Proteins Enter LN Cortex via Fibroblastic Reticular Cell Conduits

Microparticles do not cross SCS but solutes pass into Cortex via FRC Conduits
Carbon-labeled monocytes were used to track where intracellular antigens go in lymph nodes.
Dendritic Cells In LN Cortex

Inaba et al JExpMed
LN Cortex Function Depends on High Endothelial Venules [HEV]
Lymph Node Vasculature Method

fix
3% Glutaraldehyde
in 0.1M Cacodylate

1cc

axilla

fix

EM

view

wash 1% Osmium

150--200 μM
thick slices

clear

100% DMSO
Lymph Node Vasculature

LN Microvasculature revealed by arterial perfusion with Alcian Blue dye.

SCS

a-v shunts

HEV

a.

hylum
Lymph Node Vasculature

- HEV
- Lobular Vein
- AVC
Art in Service of Science: Vessels Traced by Camera Lucida

Observational Integrity is absolutely essential when art becomes data

C.L. Tracing by Barbara Gould
Lymph Node Vasculature
Lymphocyte Emigration in LN
Initial Contact Via Microvilli
WH Lewis, a JHU Cell biology pioneer, was the first to film lymphocyte migration. Bull. Johns Hopkins Hosp. 48: 29, 1931
Lymphocyte Emigration at HEV

Animation by Art Anderson
Unidirectional Permeability of HEV

Intra-arterial HRP  Intra-lymphatic HRP  IL-1α Fixative
Chemokines Conducted to HEV Wall In FRC Conduit ‘Fiber’

High Endothelial Venule

Carbon dust rendering by Barbara Gould
Lymphocyte Homing Cascade

Tethering

L-Selectin
CD31
Cytokine-R
LFA-1
VLA-4
LFA-1

Glycam
CD31
Glycocalyx
ICAM-1,2
VCAM-1
ICAM-1

Consensus model of T cell adhesion cascade for binding to LN high endothelial venules. See text for description. (Adapted from Anderson AO, Shaw S: Semin Immunol 5:271, 1993.)
Lymphocyte Traffic and Immunity

- Lymphocyte traffic in lymphatic tissues changes during an immune reaction
- Early & late changes relate to cytokines and cell proliferation
- Immune response is disseminated all over the body by 36-72 hrs
In Vivo Movement of T-cells Within Lymph Node Paracortex


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