

Positron Emission Tomography (PET) at Madison

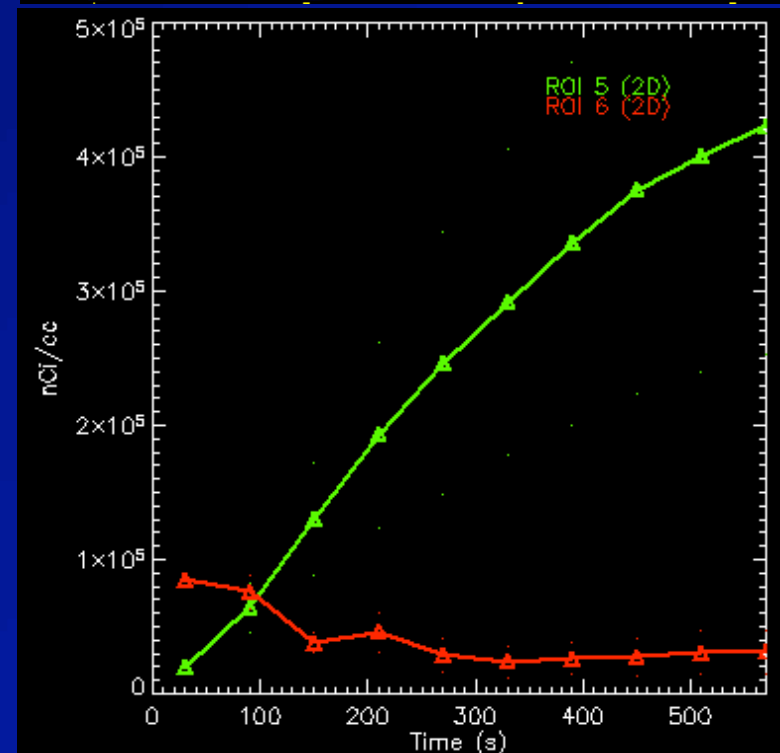
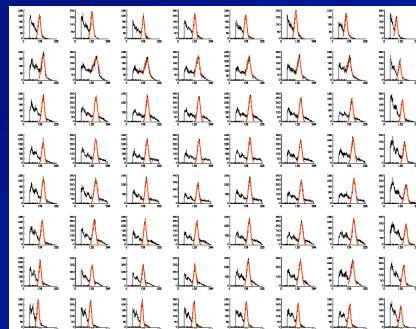
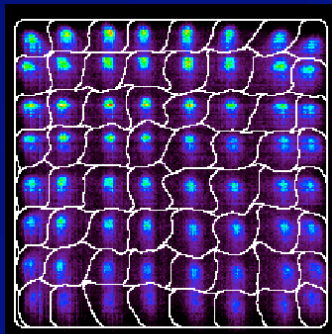
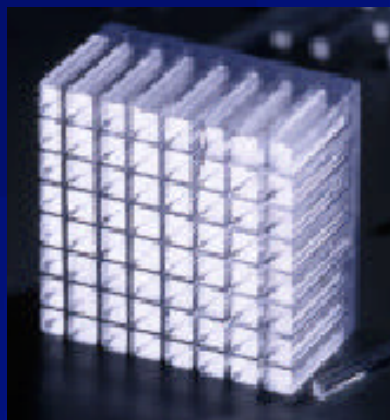
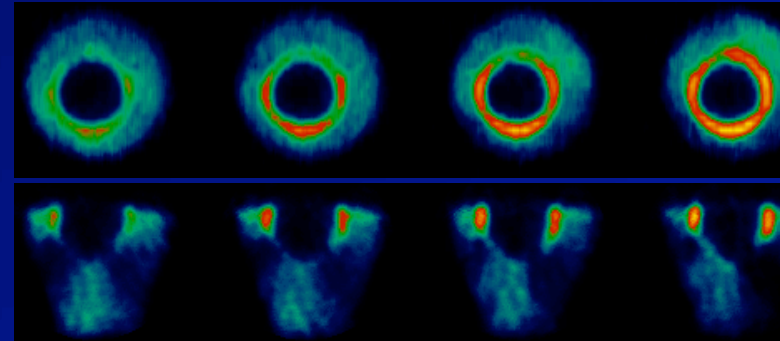
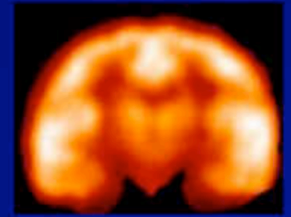
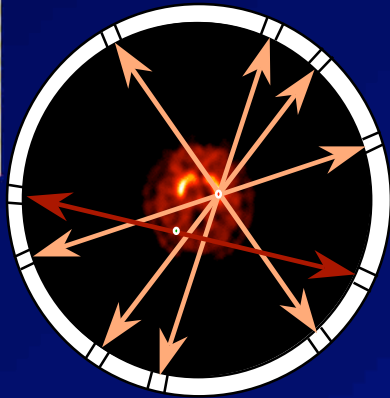
Alexander K. Converse¹, Andrew D. Roberts²,
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¹University of Wisconsin - Madison

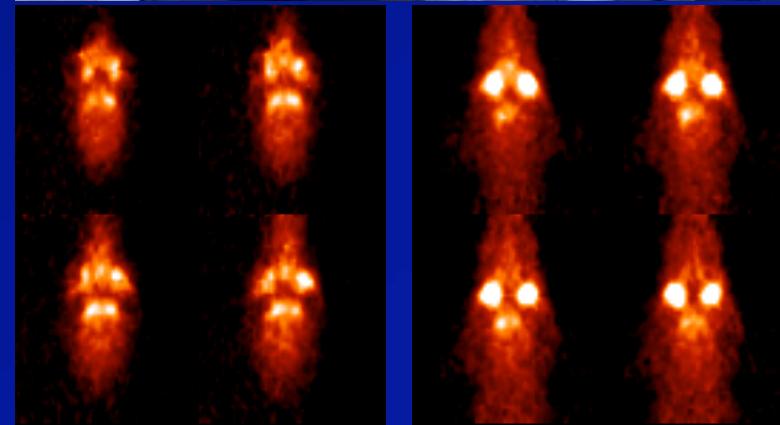
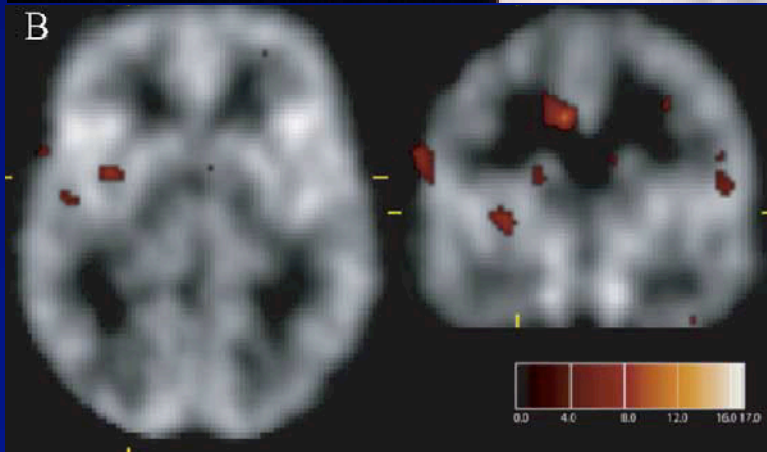
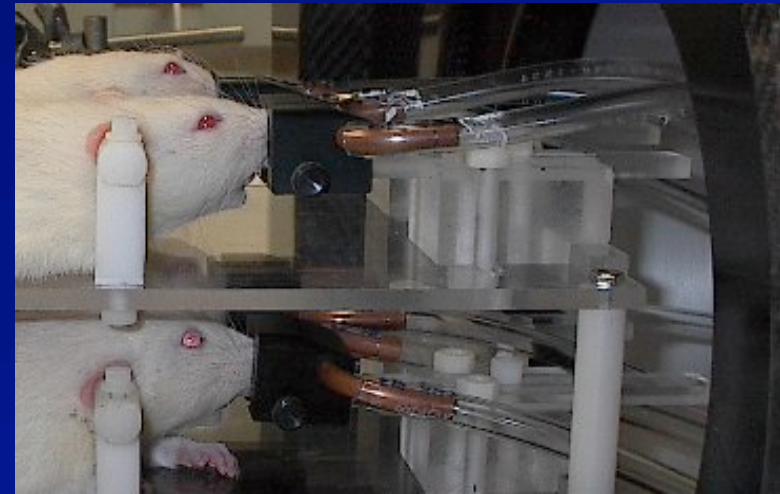
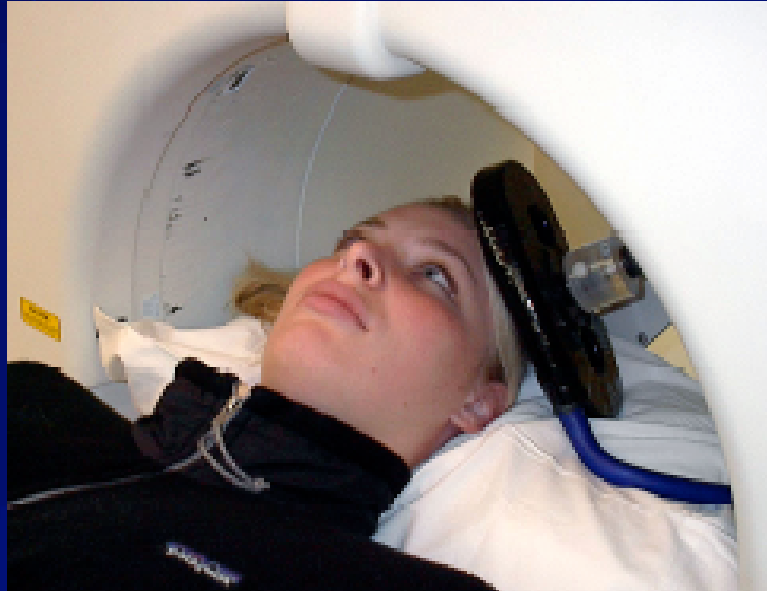
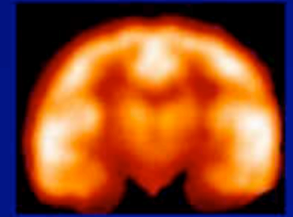
²University of Manchester

Willy Fest, Madison, 10 June 2005

Technology

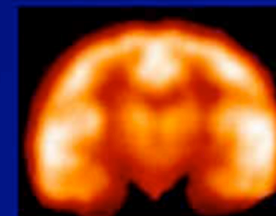


Applications

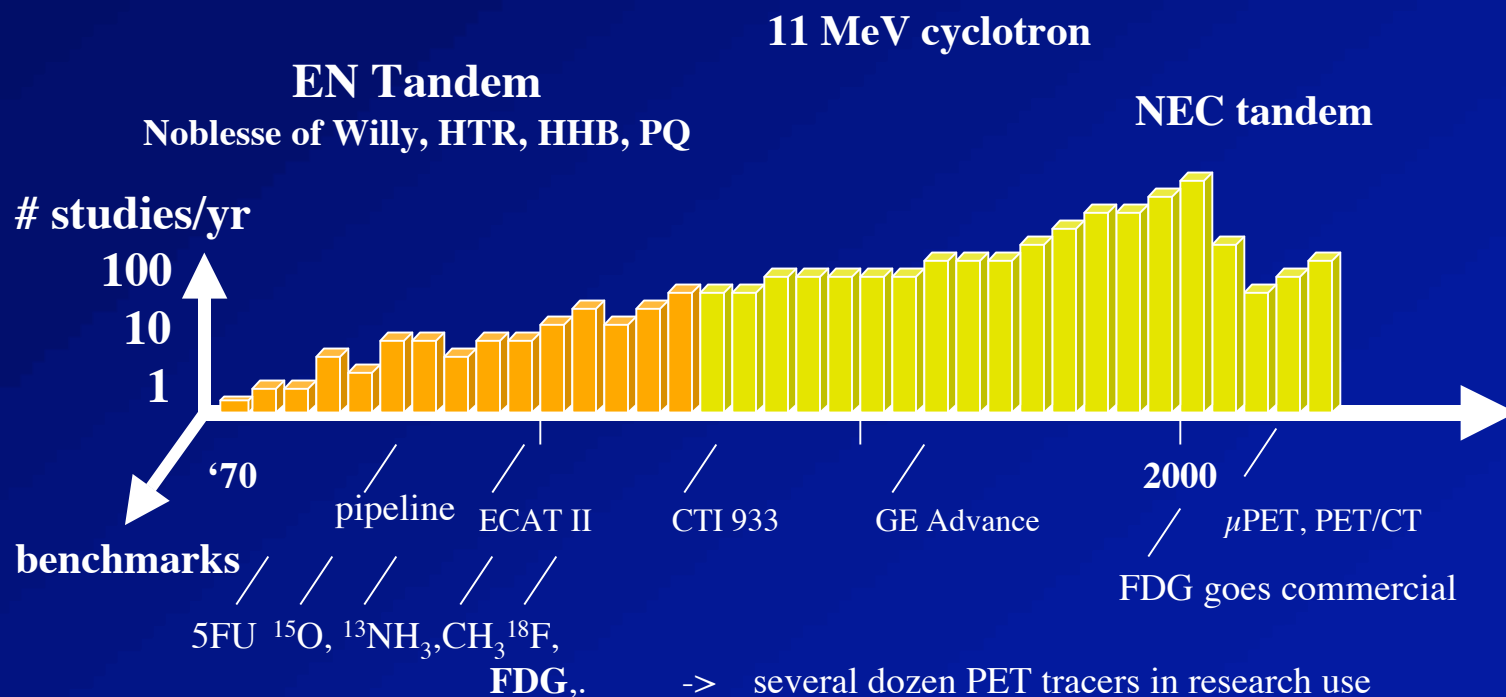




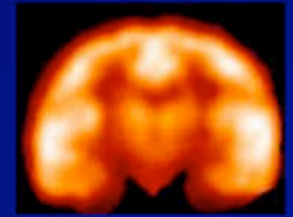
Time



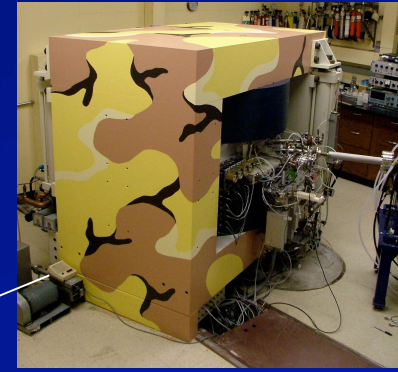
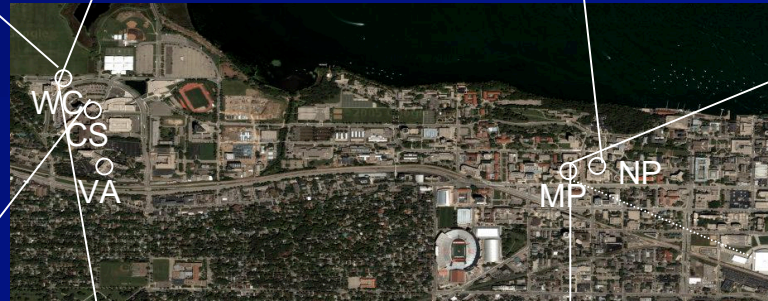
35 years of PET tracer production at Wisconsin



Space



8 uL



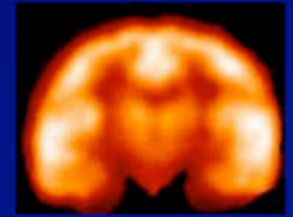
100 uL



5000 uL



Tracers



Basics

Blood flow	$[^{15}\text{O}]\text{H}_2\text{O}$, $[^{17}\text{F}]\text{CH}_3\text{F}$
Blood volume	$[^{11}\text{C}]\text{CO}$
Oxygen extraction	$[^{15}\text{O}]\text{O}_2$
Glucose metabolism	$[^{18}\text{F}]\text{FDG}$
pH	$[^{11}\text{C}]\text{CO}_2$
Bone	$[^{18}\text{F}]\text{F}^-$

Dopamine

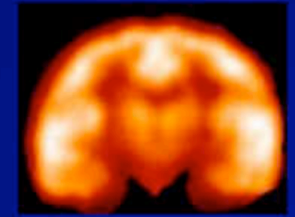
Synthesis	$[^{18}\text{F}]\text{FDOPA}$, $[^{18}\text{F}]\text{FMT}$
Transporters	$[^{11}\text{C}]\text{MP}$, $[^{11}\text{C}]\text{DTBZ}$
Receptors D1 D2	$[^{11}\text{C}]\text{SCH23390}$, $[^{11}\text{C}]\text{RAC}$, $[^{18}\text{F}]\text{FAL}$, $[^{18}\text{F}]\text{desFAL}$

Serotonin

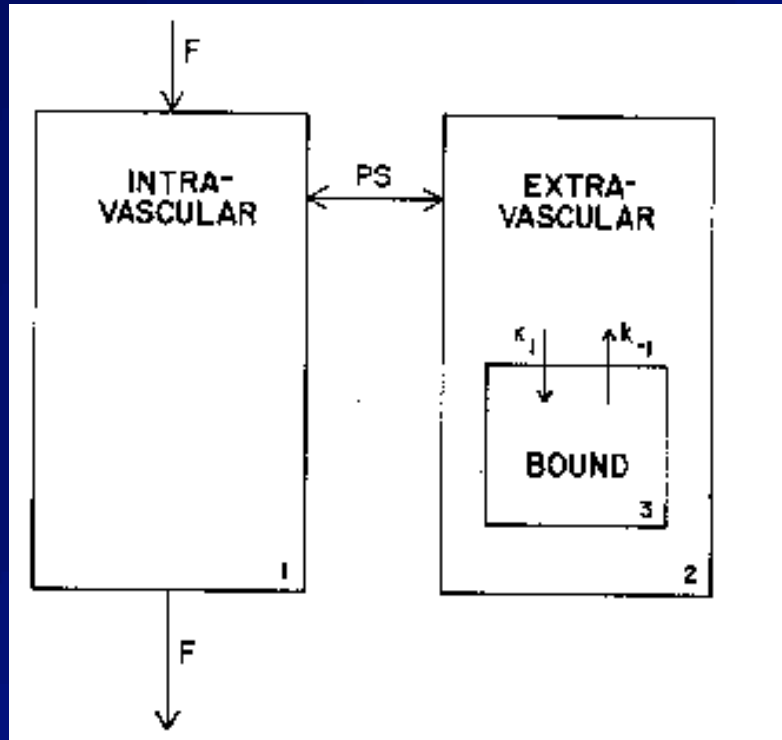
Transporter	$[^{18}\text{F}]\text{ADAM}$
Receptors 1A	$[^{18}\text{F}]\text{MPPF}$

More...

Tumors	$[^{18}\text{F}]\text{Iressa}$, $[^{124}\text{I}]\text{NM404}$, $[^{62}\text{Cu}]\text{ATSM}$, $[^{18}\text{F}]\text{FLT}$
Microglial activation	$[^{11}\text{C}]\text{PK11195}$
Anesthesia	$[^{18}\text{F}]\text{halothane}$
Phantoms	^{90}Y , ^{76}Br , ^{64}Cu , $^{34\text{m}}\text{Cl}$

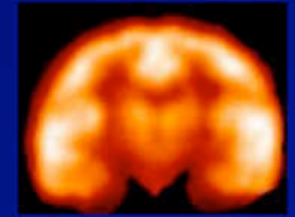


Tracer Kinetics

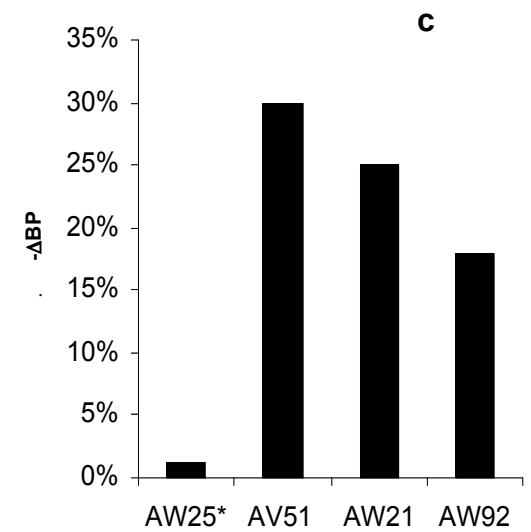
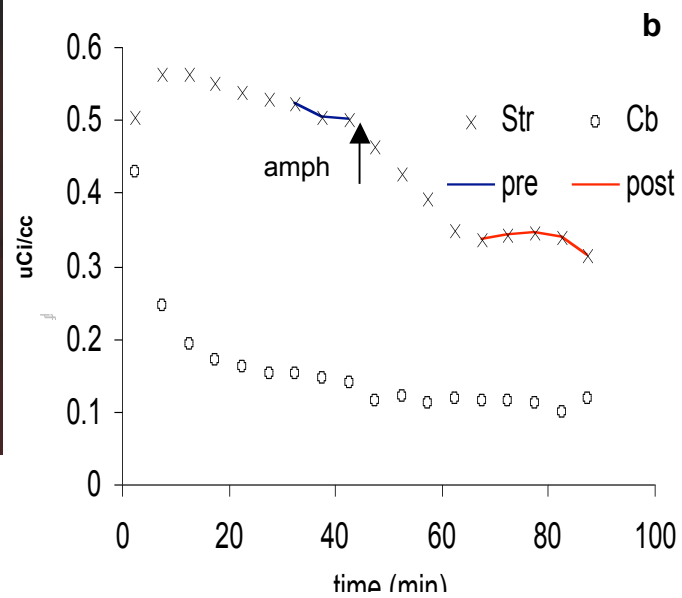
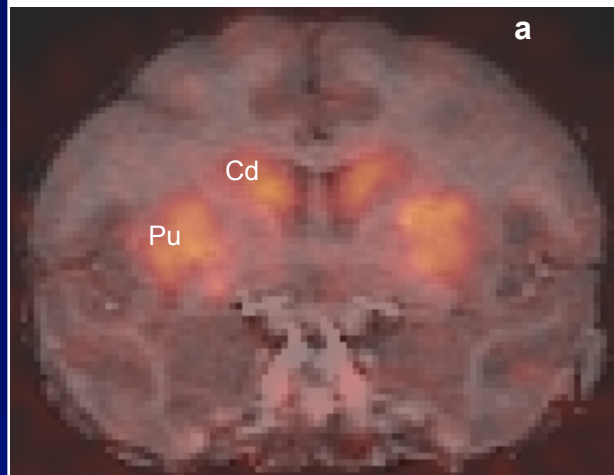


$$\begin{aligned}
 \Phi_{1in} &= F \cdot C_A + PS \cdot f_2 \cdot C_2 \\
 \Phi_{1out} &= F \cdot C_1 + PS \cdot f_1 \cdot C_1 \\
 \Phi_{2in} &= PS \cdot f_1 \cdot C_1 + k_{-1} \cdot C_3 \cdot V_2 \\
 \Phi_{2out} &= PS \cdot f_2 \cdot C_2 + k_1 \cdot C_2 \cdot f_2 \cdot (B_{max} - C_3) \cdot V_2 \\
 \Phi_{3in} &= k_1 \cdot C_2 \cdot f_2 \cdot (B_{max} - C_3) \cdot V_2 \\
 \Phi_{3out} &= k_{-1} \cdot C_3 \cdot V_2
 \end{aligned}$$

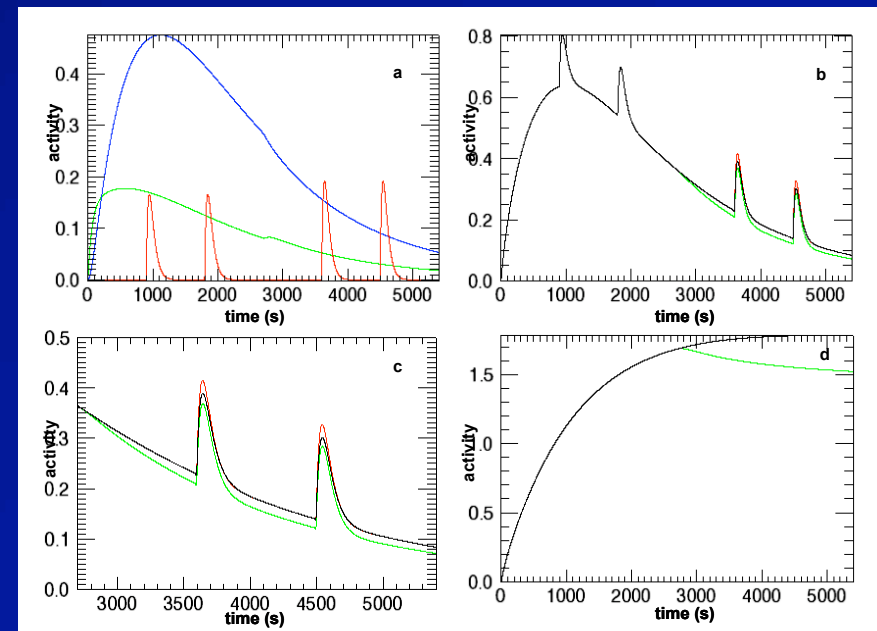
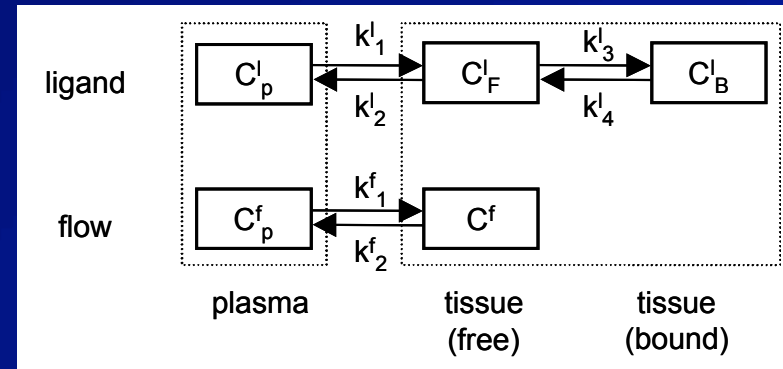
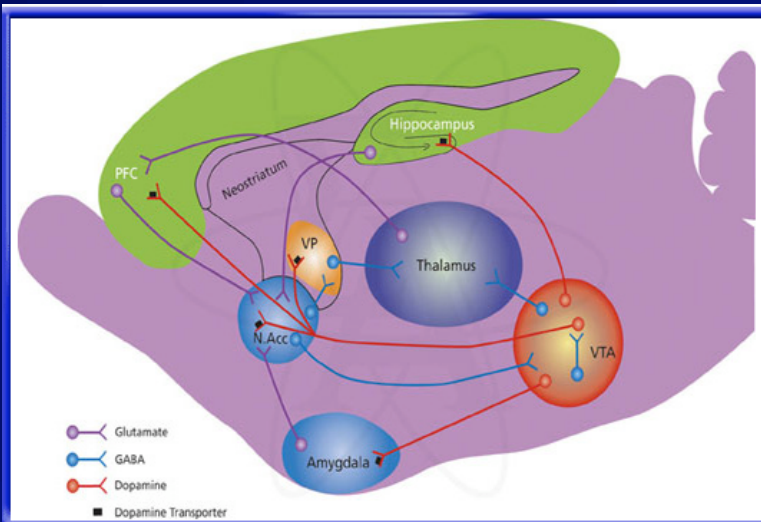
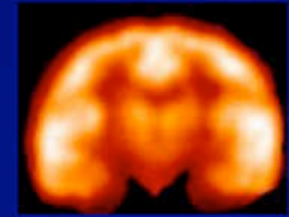
Mintun MA, Raichle ME, Kilbourn MR, Wooten GF, Welch MJ (1984) A quantitative model for the in vivo assessment of drug binding sites with positron emission tomography. *Annals of Neurology* 15:217-227



Dopamine Release

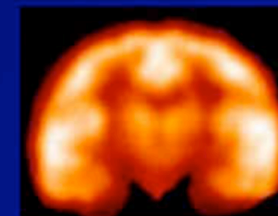


Dopaminergic Neuromodulation





PET People



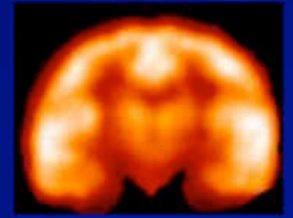
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Willy

Enthusiasm

Focus

Rigor

“Do the simple experiment first”