Positron Emission Tomography (PET) at Madison

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Technology
Applications
35 years of PET tracer production at Wisconsin

- EN Tandem
  - Noblesse of Willy, HTR, HHB, PQ
- 11 MeV cyclotron
- NEC tandem
- A. Converse UW - Madison

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- 5FU, $^{15}$O, $^{13}$NH$_3$, $^{18}$F, FDG,..

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- several dozen PET tracers in research use

- FDG goes commercial
Space
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: $[^{11}\text{C}]\text{SCH23390}$, $[^{11}\text{C}]\text{RAC}$, $[^{18}\text{F}]\text{FAL}$, $[^{18}\text{F}]\text{desFAL}$

**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: $^{90}\text{Y}$, $^{76}\text{Br}$, $^{64}\text{Cu}$, $^{34m}\text{Cl}$
Dopamine Release

(a) Image of brain regions labeled as Cd and Pu.

(b) Graph showing time (minutes) on the x-axis and Ci/cc on the y-axis. The graph includes data points and lines labeled as pre and post with a symbol for amph. Legend includes markers for Str and Cb.

(c) Bar chart showing percentage changes in BP for AW25*, AV51, AW21, and AW92.
Dopaminergic Neuromodulation

![Diagram of dopaminergic systems and molecular interactions](image)

The diagram illustrates the flow of dopaminergic molecules between the plasma and tissue compartments, with free and bound states represented by $C_p$, $C_F$, and $C_B$ respectively. The reactions are denoted by the rate constants $k_1$, $k_2$, $k_3$, and $k_4$. The graphs show the activity over time for different conditions, with labels a, b, c, and d indicating specific scenarios.
PET People

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Enthusiasm

Focus

Rigor

“Do the simple experiment first”