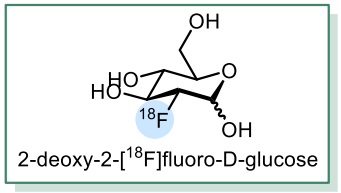
Drug of the Week: Fludeoxyglucose-F18 (FDG)

1. **Positron emission tomography (PET) radiotracer**. Used in 90% PET or PET/CT imaging studies.
2. 4 million studies in 2010 (US), growth was estimated as ~ 10% per year, One study is $1890 (US)
3. Commonly used to monitor or detect locations of high glucose uptake, such as: brain, heart, liver, kidneys and *malignant tumors*. Primarily used in diagnosis of cancers and Alzheimer's disease.



Sem. Nucl. Med. **2011**, *41*, 246

Early 1970s: ^{14}C-labeled deoxyglucose radiography studies

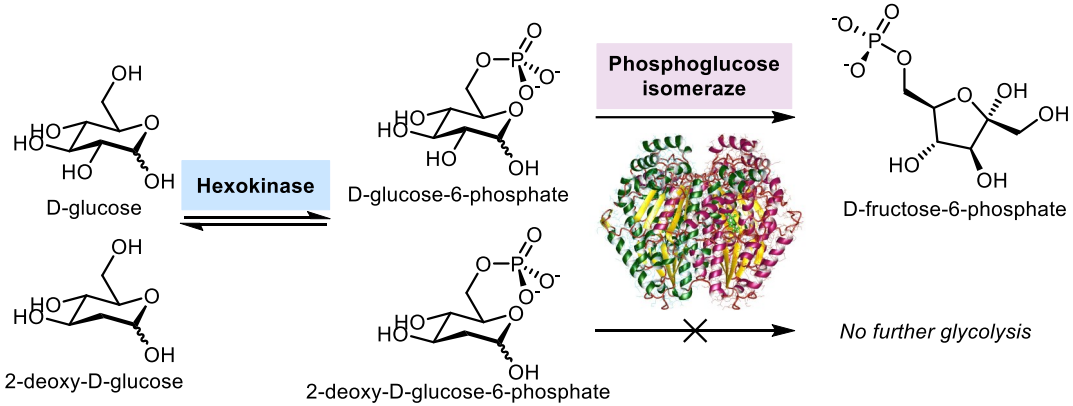
1978: first reported imaging studies using 2-FDG

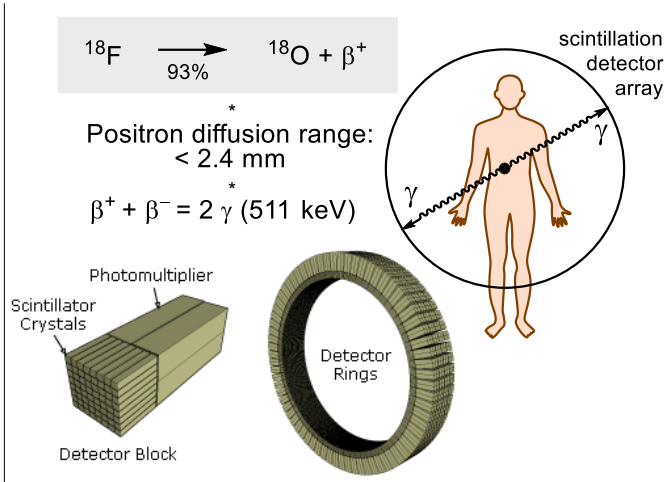
<u>FDA approval of clinical utility:</u>

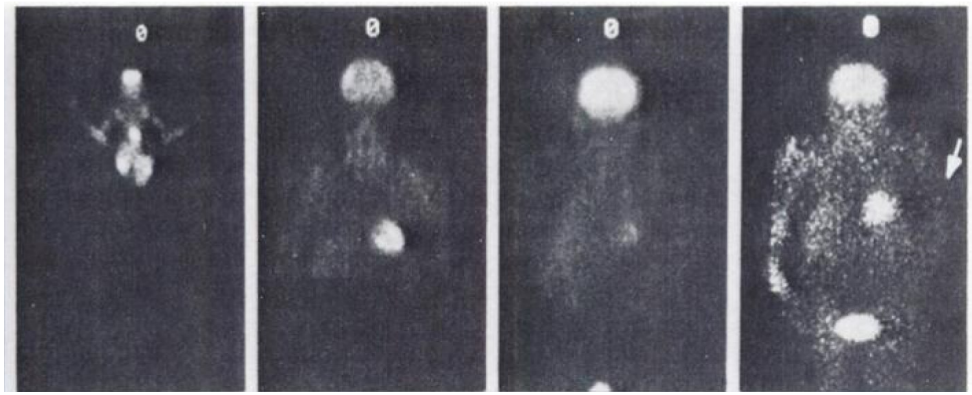
2000: Epiliptic foci in brain, myocardial GM, tumor GM

2005: Alzheimer's disease and frontotemporal dementia

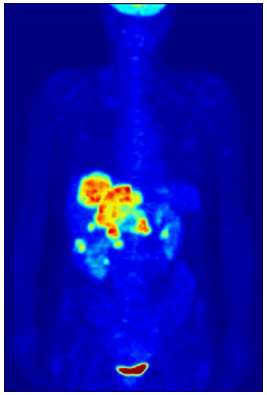
2004, **2005**: FDA approval of NDA



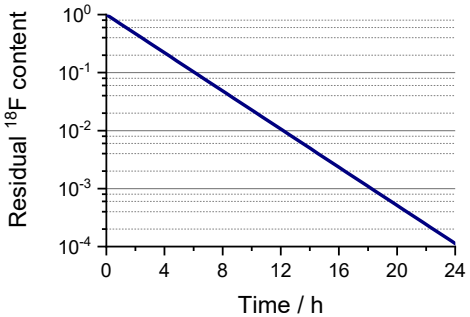




1978: Studies of glucose metabolism *J. Nucl. Med.* **1978**, *19*, 1311



2006: Tumor diagnosis



^{18}F half-life: 109.8 min
Specific activity of FDG: ~ 300 — 3000 MBq

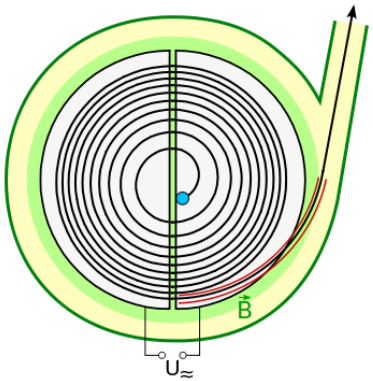
Drug of the Week: Fludeoxyglucose-F18 (FDG)

^{18}F labeled reagents production

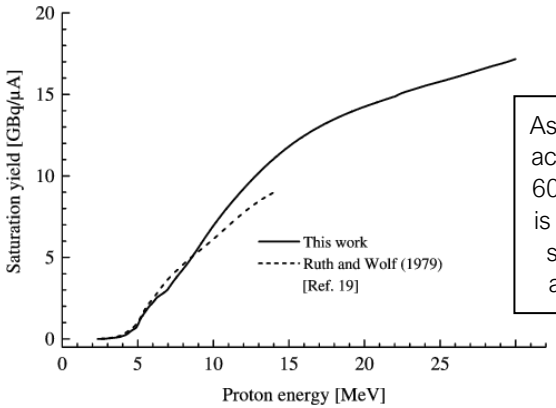
	1	2	3
Radiochemical reaction	$^{18}O(p,n)^{18}F$	$^{20}Ne(d,\alpha)^{18}F$	$^{6}Li(n,\alpha)^{3}H$, $^{16}O(^{3}H,n)^{18}F$
Reagent produced	$K^{18}F$	$(^{18}F)_2$	$H^{18}F$
	Bioconjug. Chem. **2015**, *26*, 1		*Int. J. Appl. Radiat. Isot.* **1980**, *31*, 339

Bombardment of ^{18}O targets with protons

U of Chicago 18 MeV cyclotron



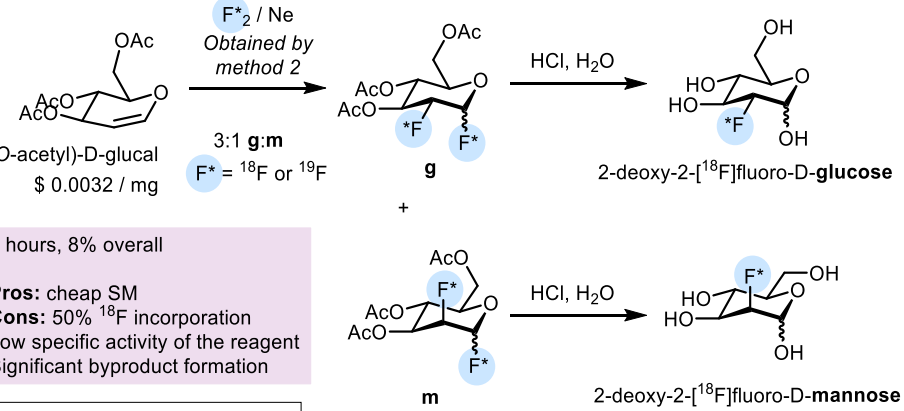
Inside the cyclotron



Radiochim. Acta **2001**, *89*, 357

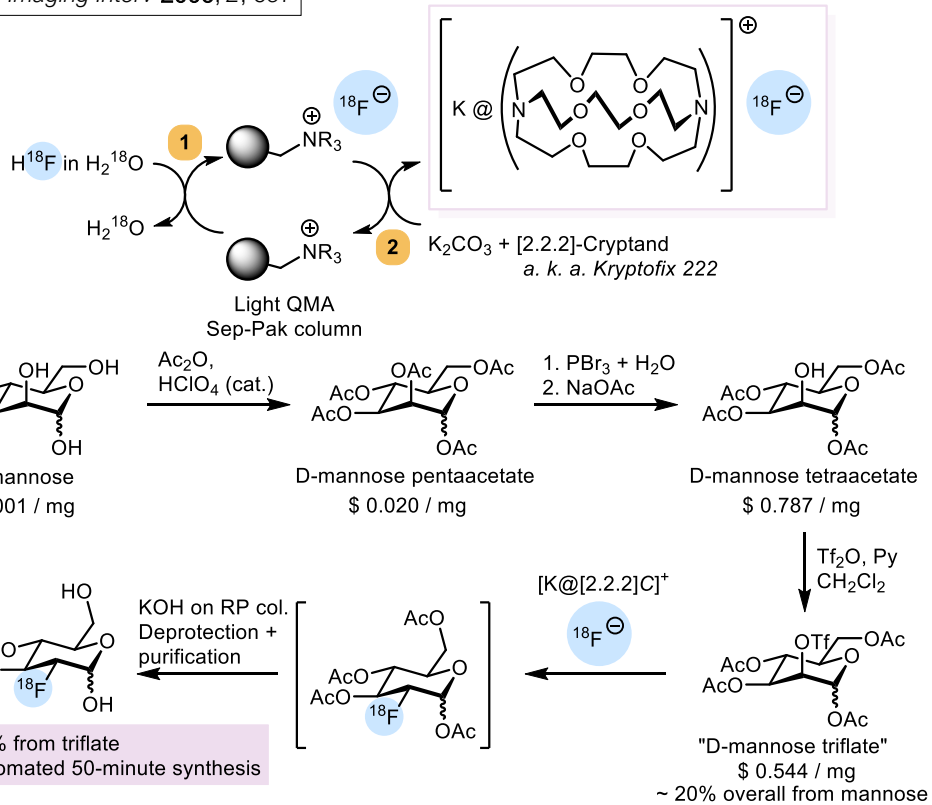
Assuming 10 GBq as the specific activity of ^{18}F-enriched water and 60 % overall reaction yield, there is about 6 hours time period that separates isotopic enrichment and FDG injection into patient

Electrophilic fluorination



2 hours, 8% overall

Pros: cheap SM
Cons: 50% ^{18}F incorporation
Low specific activity of the reagent
Significant byproduct formation

Biomed. Imaging Interv **2006**, *2*, e57

Nucleophilic fluorination