



# ISOTOPES

*uses, demand, and supply*

*at* **NIST**

**Rob Dimeo**, Director  
NIST Center for Neutron Research

**NIST**  
National Institute of  
Standards and Technology  
U.S. Department of Commerce

*“ “We believe that there is romance in precision measurement, and that ability to extend the absolute accuracy of measurement by one decimal place frequently demands as much in ingenuity, perseverance, and analytical competence as does the discovery of a new principle or effect in science. ” ”*



Allen V. Astin  
May 1, 1953

# NIST

*...promoting U.S. innovation and industrial competitiveness by advancing*

# *measurement*

*science*

*standards*

*technology*

*...in ways that enhance economic security and improve our quality of life.*



**CENTER FOR NANOSCALE  
SCIENCE AND TECHNOLOGY**

**NIST CENTER FOR  
NEUTRON RESEARCH**

**MATERIAL MEASUREMENT  
LABORATORY**

**PHYSICAL MEASUREMENT  
LABORATORY**

**ENGINEERING LABORATORY**

**INFORMATION TECHNOLOGY  
LABORATORY**

# NIST Products & Services

Measurement research **2200** pubs/year

Standard Reference Data **100** types  
**6000** units sold/year  
**226** million data downloads/year

Standard Reference Materials **1300** products available  
**30000** units sold/year

Calibration Tests **18000** tests/year

Laboratory Accreditation **800** accreditations of testing and calibration laboratories

# NIST's projected isotope demand

From DoE's "endangered species" list

Am-241	Pm-147
Am-243	Pu-236
Cs-137	Pu-242
Cu-64	Pu-244
Ho-166	Re-186
Ir-192	Sn-117m
Kr-85	Th-230
Lu-177	Th-232
Np-237	U-232
Pa-233	W-188



# Li-ion battery



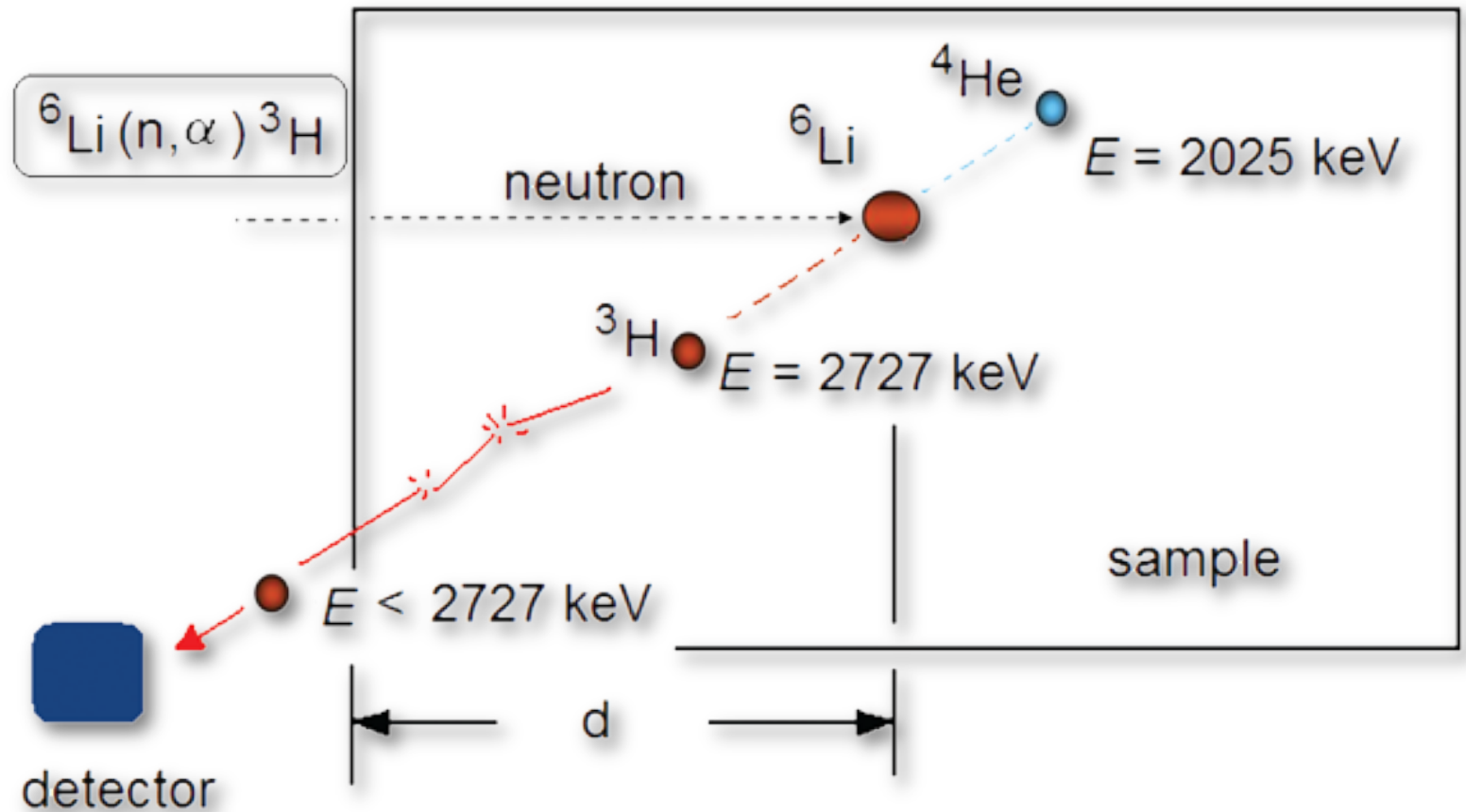
1

significant loss  
of storage capacity

2, 3, ...

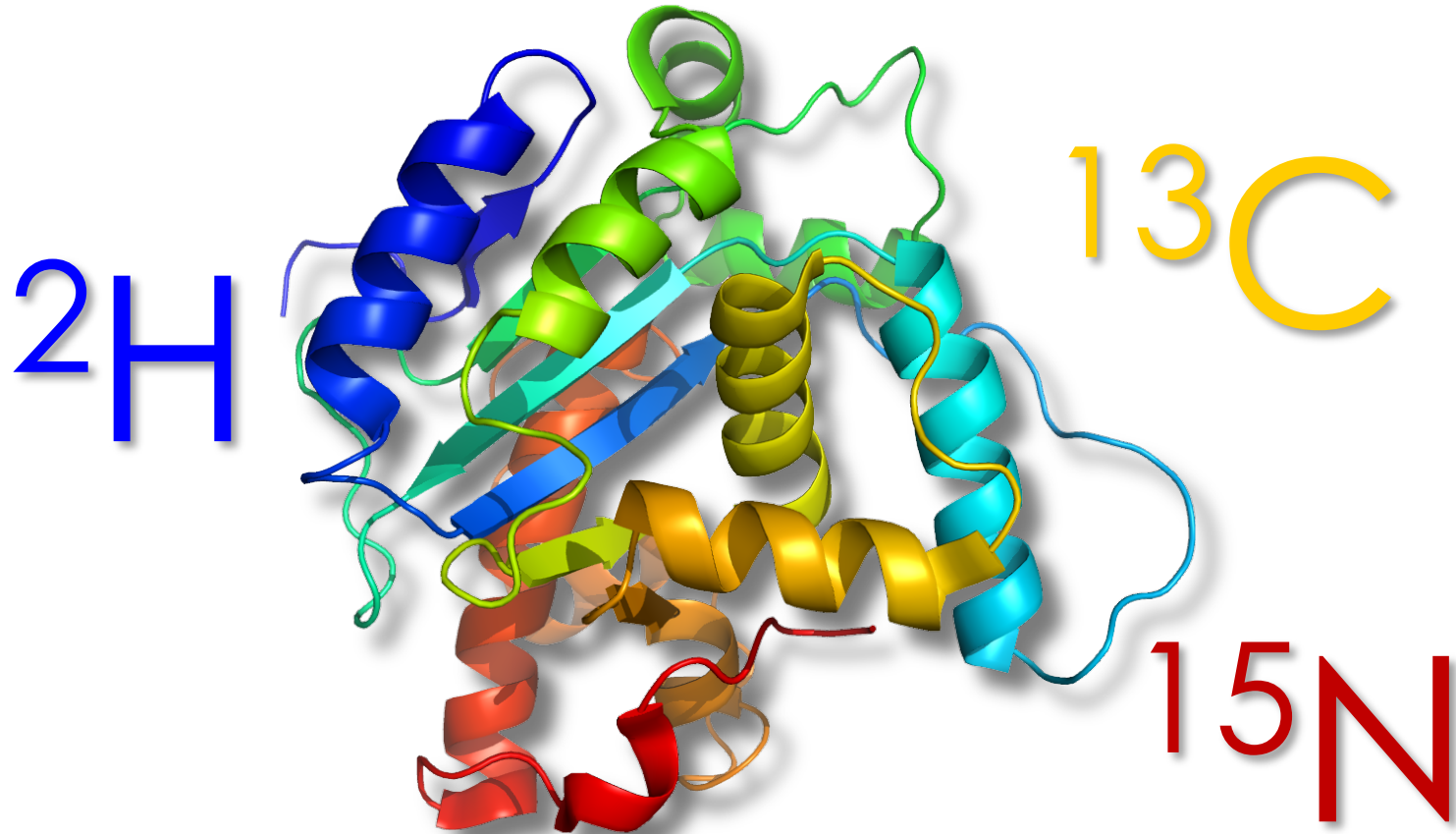
incremental loss  
of storage capacity

# Li-ion battery: following the ${}^6\text{Li}$ using NDP



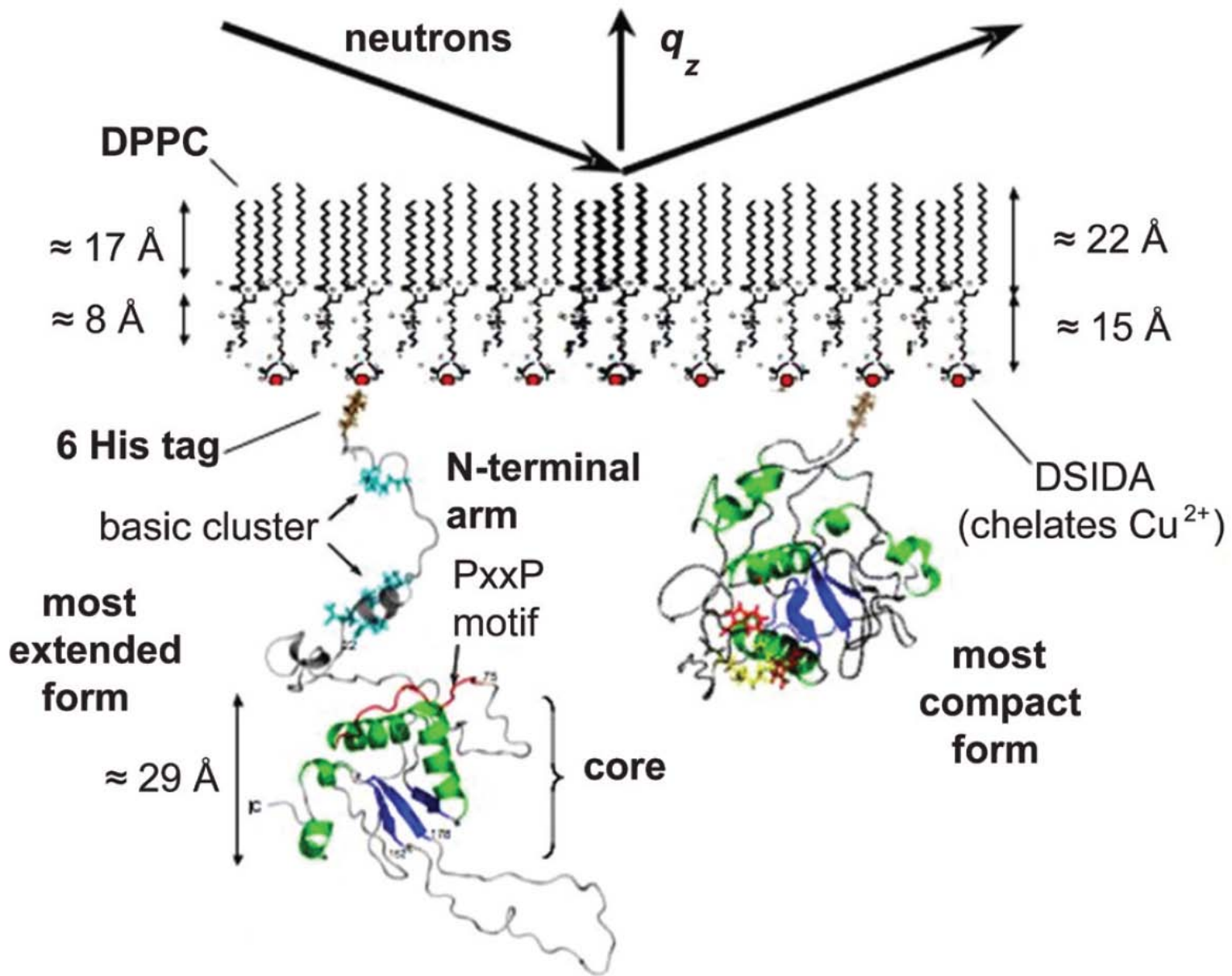


# Biomolecular Labeling Laboratory



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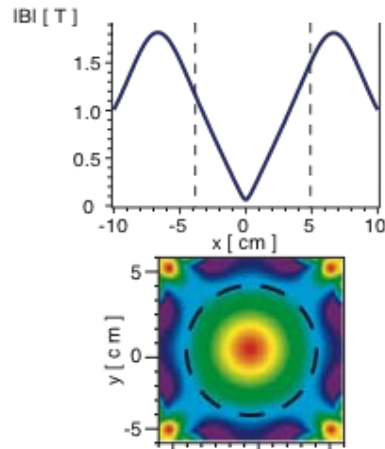
Neutron reflectometry study of the conformation of HIV Nef bound to lipid membranes



# Ultra Cold Neutron Experiment

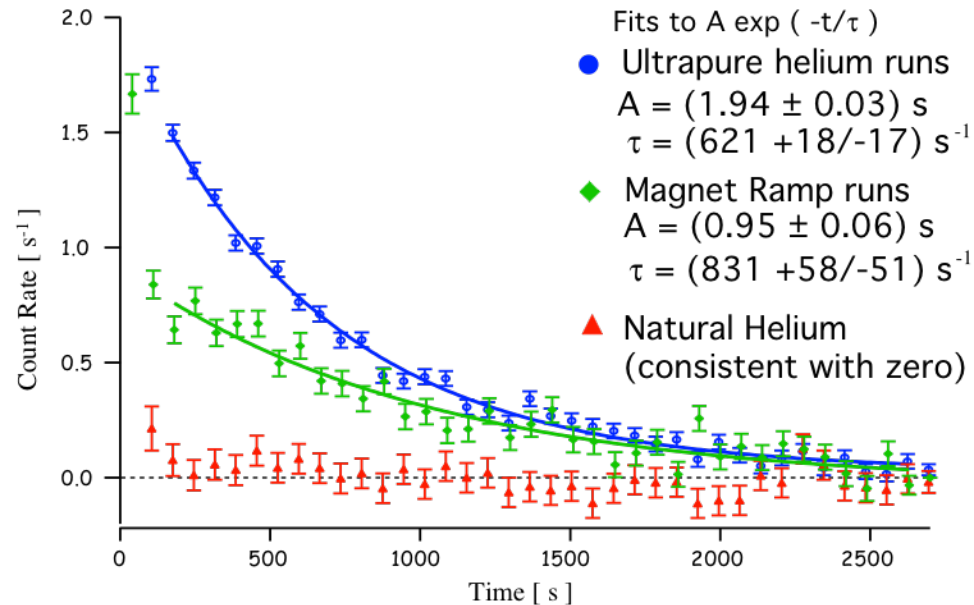
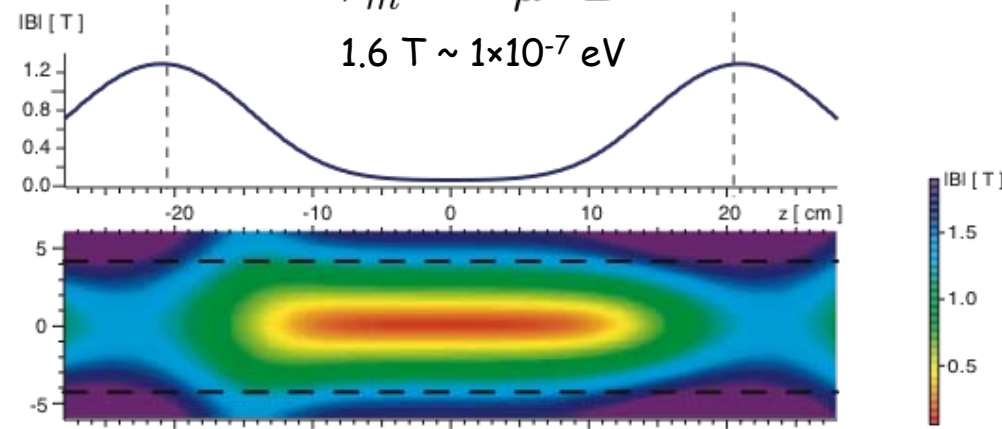


Radial Confinement

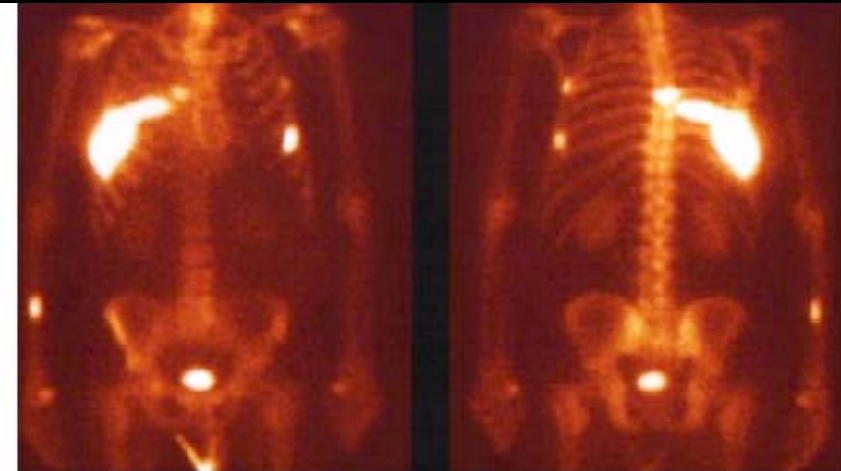


Axial Confinement

$$V_m = -\vec{\mu} \cdot \vec{B}$$
$$1.6 \text{ T} \sim 1 \times 10^{-7} \text{ eV}$$



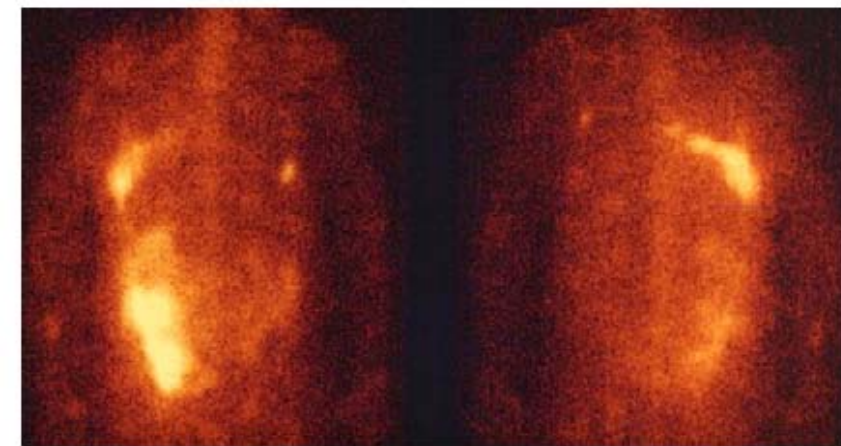
# Standardization of Ra-223



$^{99m}\text{Tc}$ -MDP

Bone-seeking skeletal metastases treatment

$\alpha$ -emitter, targeted toxicity



FDA required dosage standardization prior to clinical trials

Anterior

Posterior

*Figure 4. Scintigraphic images demonstrating accumulation of  $^{223}\text{Ra}$  in skeletal lesions in accordance with  $^{99m}\text{Tc}$ -MDP uptake. Radium image taken 24 hrs post injection, hence radium excreted and in transit in the large bowel is evident in the lower left image. (Image quality is dependent on dose administered: 750 MBq  $^{99m}\text{Tc}$ -MDP vs. 12 MBq  $^{223}\text{Ra}$ )*

*Thank You*