Microdistribution and Long-Term Retention of $^{239}Pu(NO_3)_4$ in the Respiratory Tracts of an Acutely Exposed Plutonium Worker and Experimental Beagle Dogs

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We started off looking at the dog data

The Beagle dog study started in 1952 and lasted ~40 years: Cost > $200 million ($2 billion today).

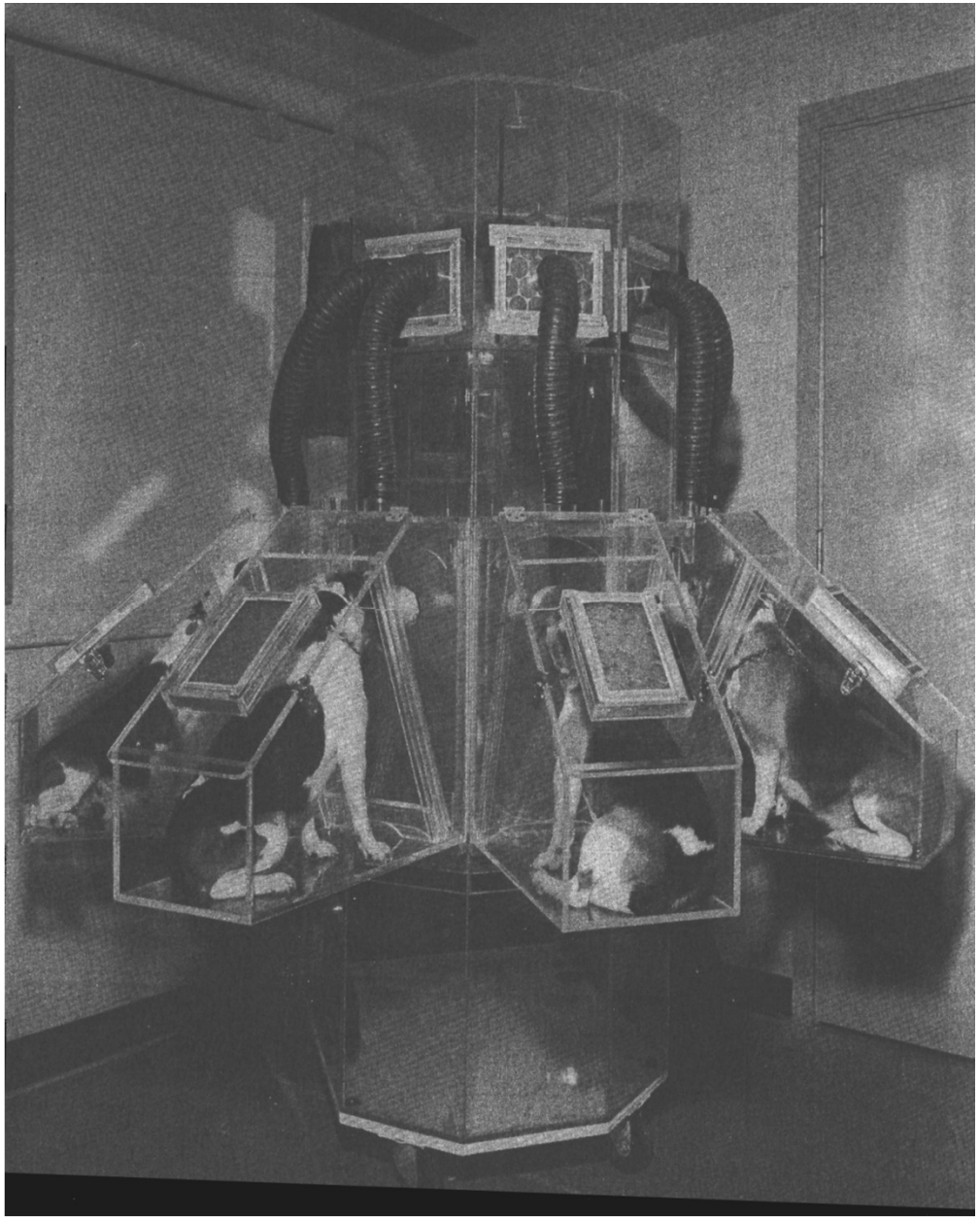
Goal - gain information of health consequences of radionuclides associated with the bomb

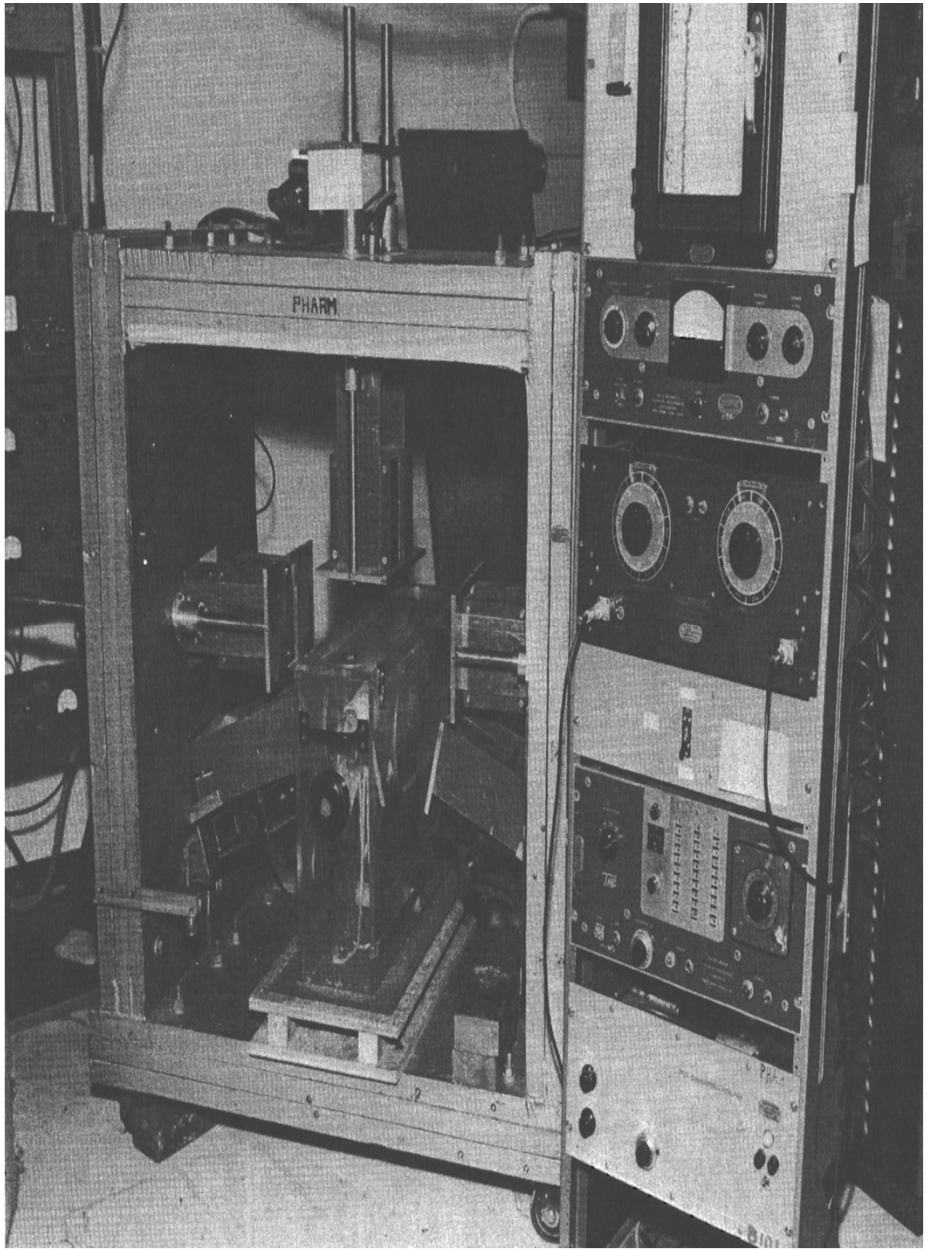
Primarily supported by government agencies worldwide

Involved multiple institutions

Included >9000 Beagles, plus those used in preliminary and ancillary studies, as well as the breeding colonies

Significant amount of data available as well as medical records and tissue samples





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Extremely detailed records for each dogs

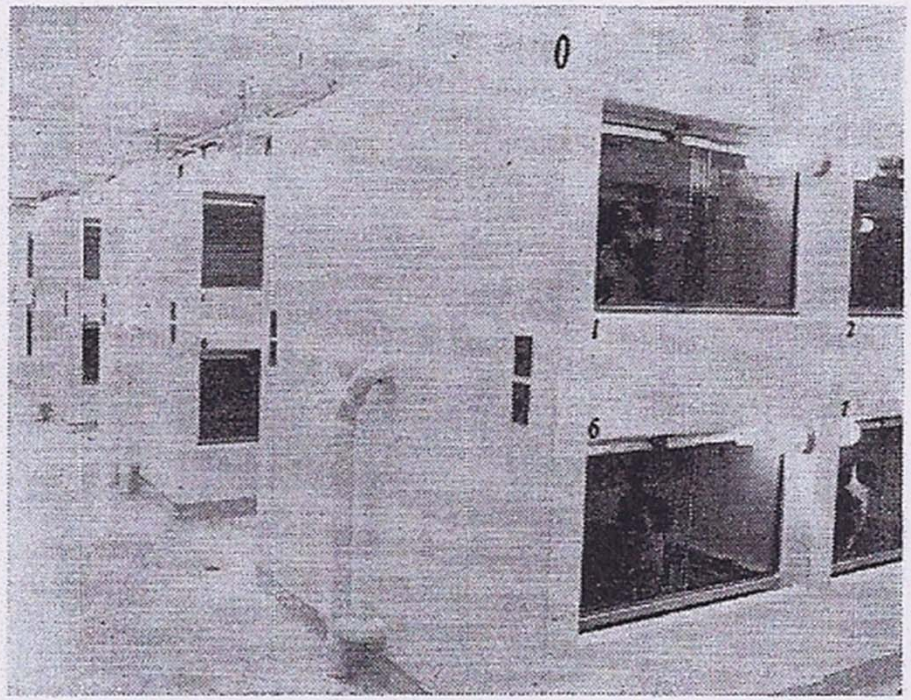


FIG. 2.1—Perspective view of permanently constructed air-conditioned cages. Note excreta drain line (left), *shatterproof sliding glass doors, and cage lights.*

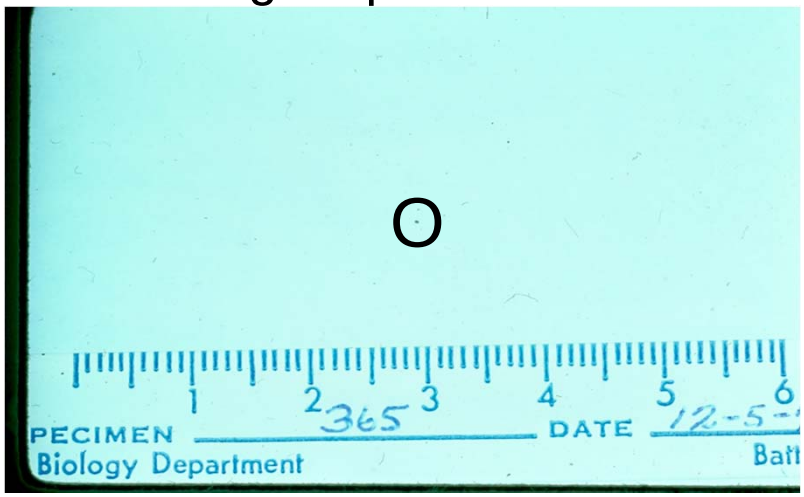
Average number of Beagles	303	
Caretaker hours/day[1]		
Day crew	51.5	
Night crew	6.5	
Total	58.0	
Labor cost @ $2.20/hr	42 cents/day/dog	
Work assignment	(man-hours/day)	
Feed preparation	2.0	(3.4%)
Feeding	4.0	(6.7%)
Cleaning:		
feed pans	1.0	(1.7%)
cages	12.0	(20.7%)
cage room	6.0	(10.3%)
Record keeping	4.0	(6.7%)
Experimental procedures	22.0	(38.0%)
Dog surveillance	4.0	(6.7%)
Clothes change	1.7	(3.0%)
Coffee breaks	1.3	(2.3%)

1. Includes senior animal technicians and animal caretakers.

Dog #365

Right apical #365

Excised tumor #365



Hot particle Pu238

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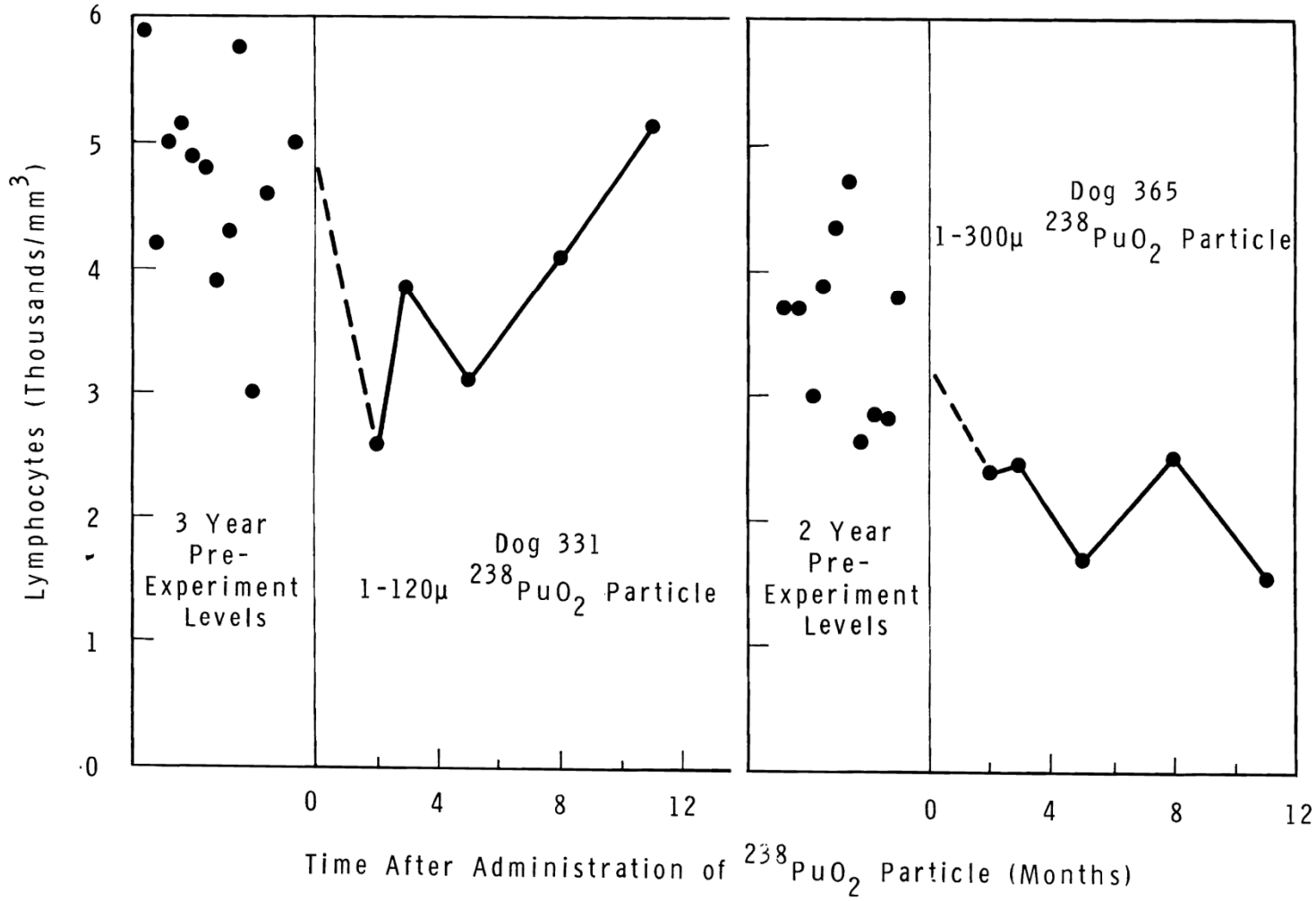
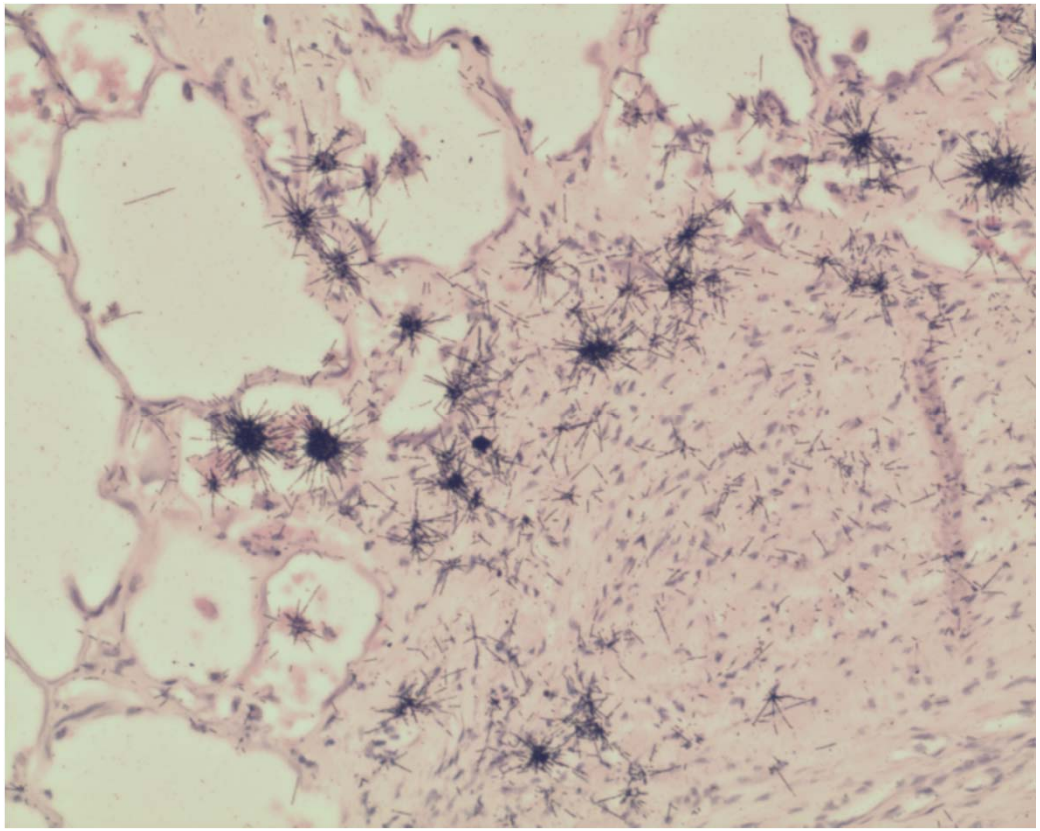
Long term information on lymphocyte counts

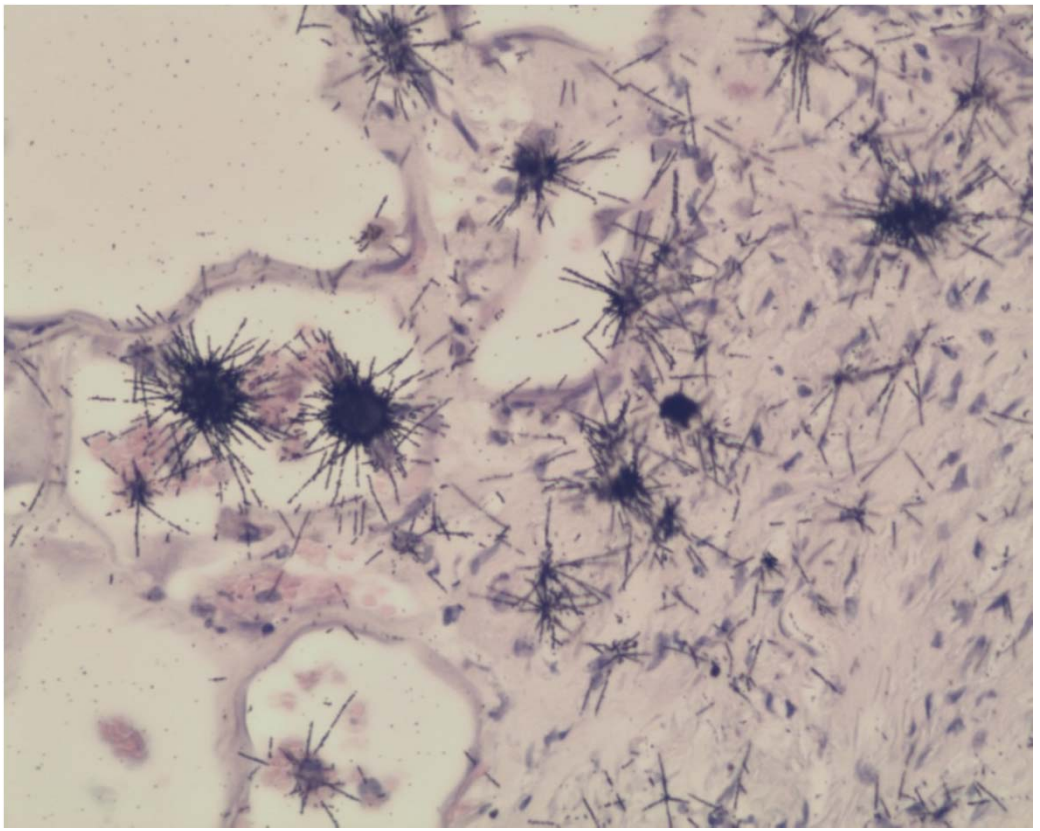


Neg 0672096-8

FIGURE 4.4. Effect of Single $^{238}PuO_2$ Particles in Lungs on Circulating Lymphocyte Levels in Dogs

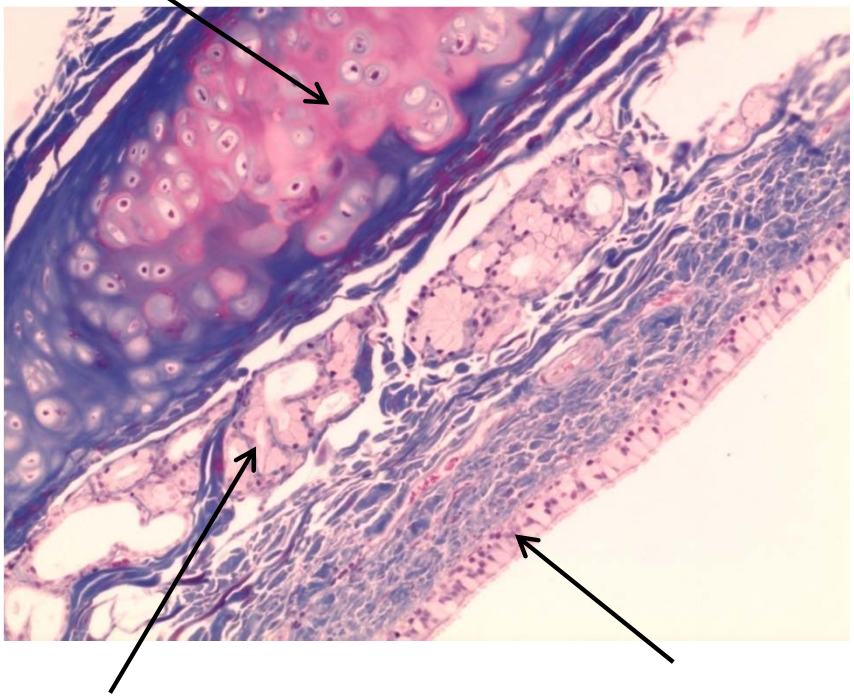
Autoradiographs of paraffin embedded lung tissue from dogs exposed to Pu



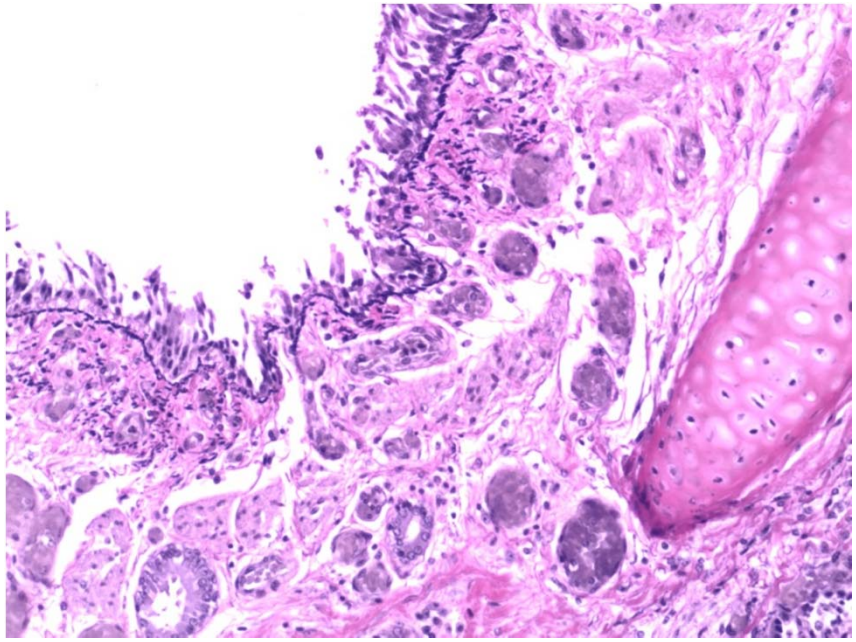


Christopher E. Nielsen, MS, WSU-TriCities

Immunohistochemistry



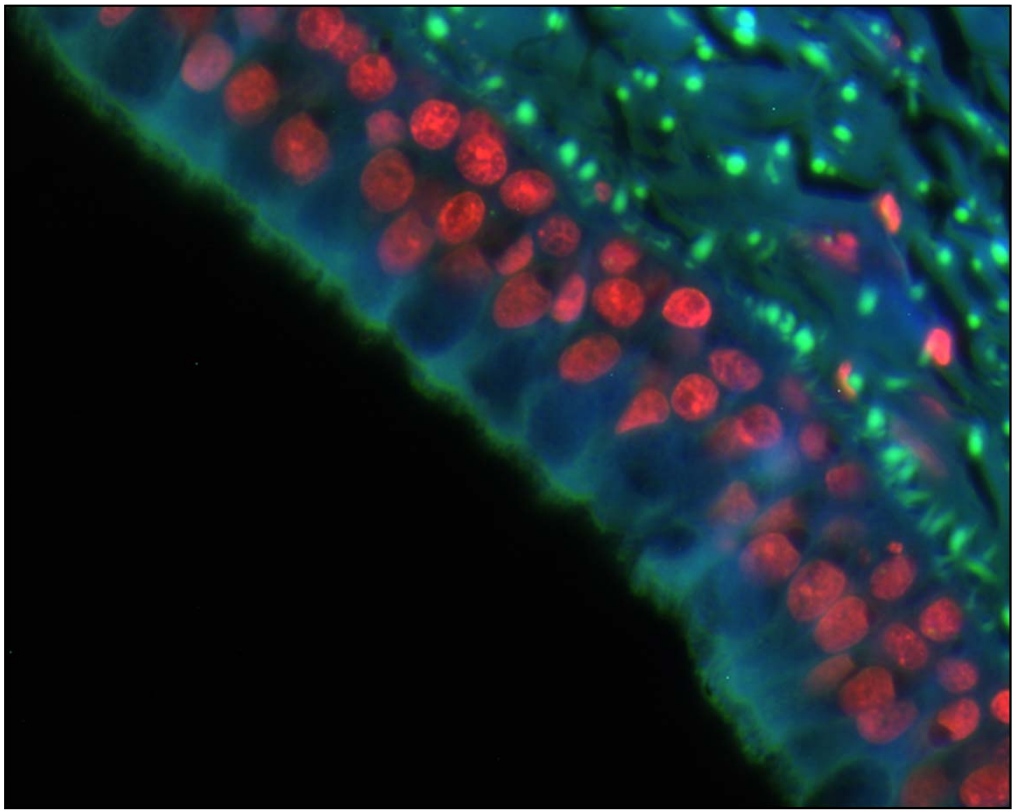
Bronchus section of dog 267 exposed to Pu by inhalation, and stained with Trichrome



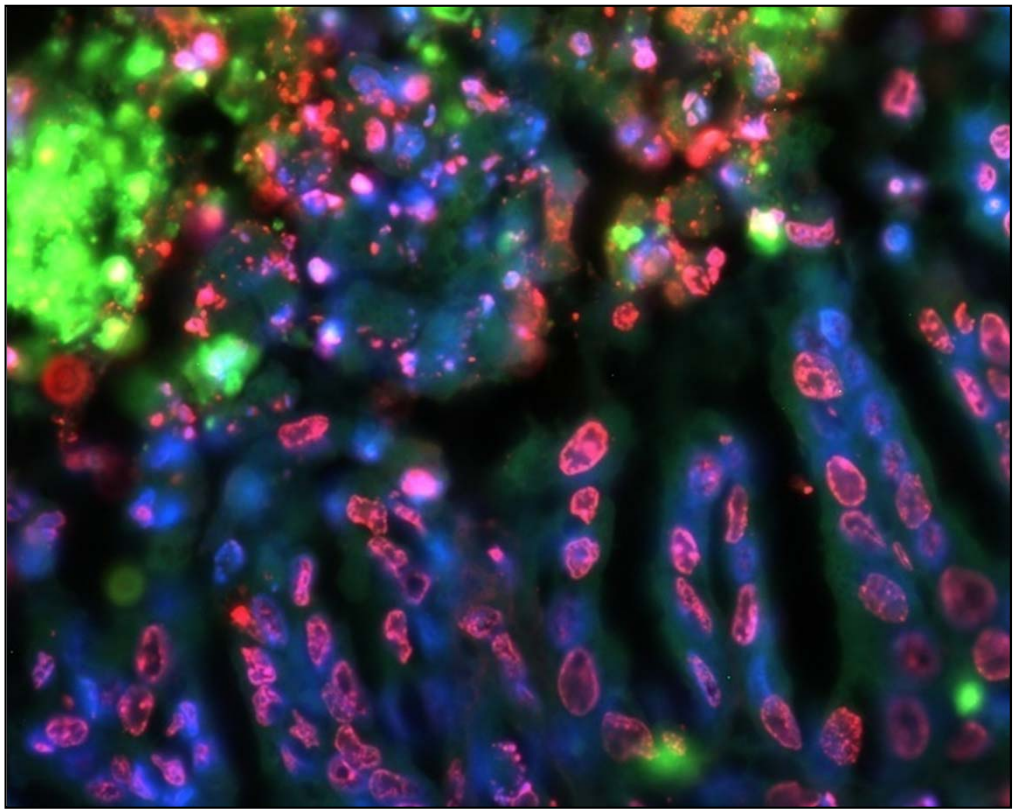
Paraffin section of dog 463 exposed to Pu by inhalation, and stained with Elastin

Xihai Wang, scientist PNNL

Immunohistochemistry Apoptosis



Bronchus section with mucus cells of dog 98 showing apoptosis in the mucus layer



Paraffin embedded section of a lung tumor from dog 463 exposed to Pu showing inflammatory responses and apoptosis. Note the disorganized and organized nuclear structures.

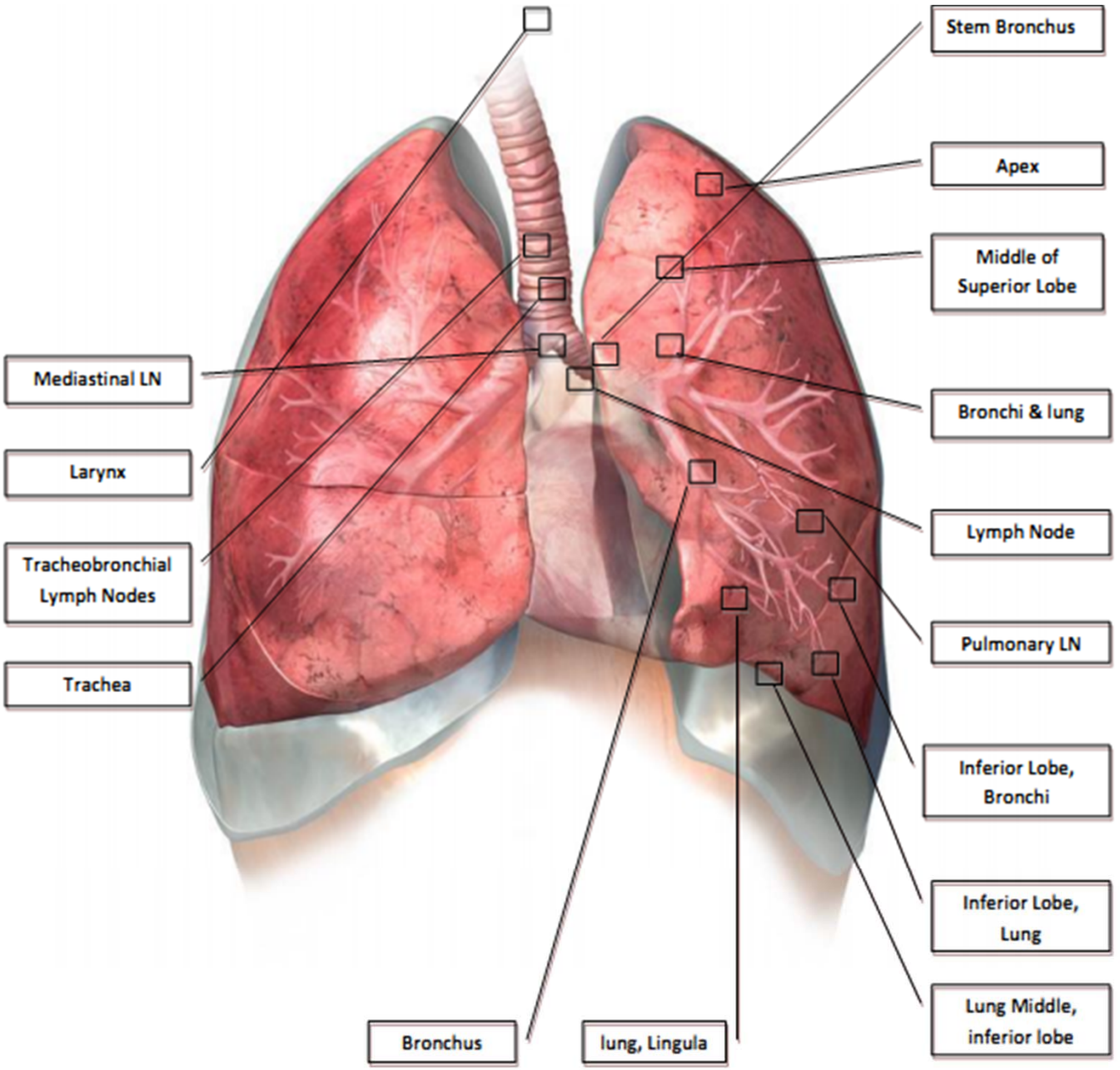
Xihai Wang, scientist PNNL

Case 0269: Intake

- Operator at Hanford
  - Inhaled 58,000 Bq of a $^{239}Pu(NO_3)_4$ aerosol mist
- Died 38 yrs post intake from carcinomatosis secondary to prostate cancer
- Intermittent Ca-EDTA treatment
- Smoker

Maximum permissible body burden – 1480 Bq (40nCi)

Location of tissue samples: Human Case 269



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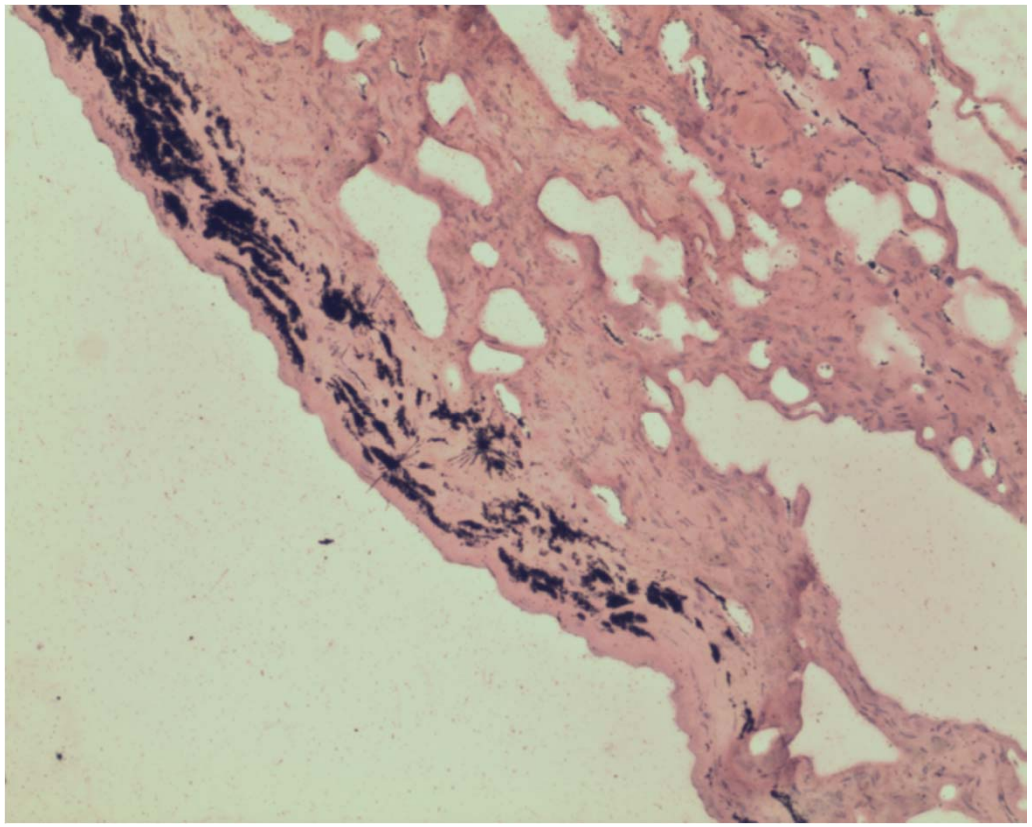
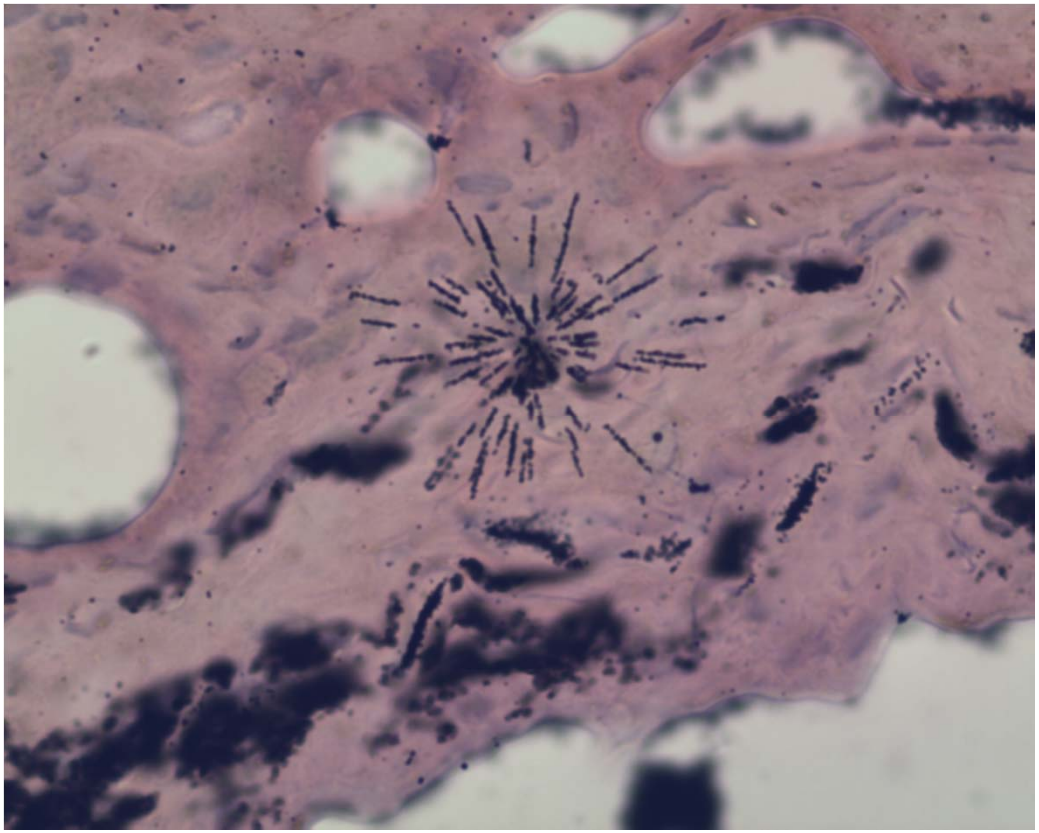
Pleura Includes: Associated connective tissue; Pleural lymphatics. Fibrosis in pleura





Human Case 269; ^{239}Pu deposited along the pleura and in the sub-pleural regions of this section

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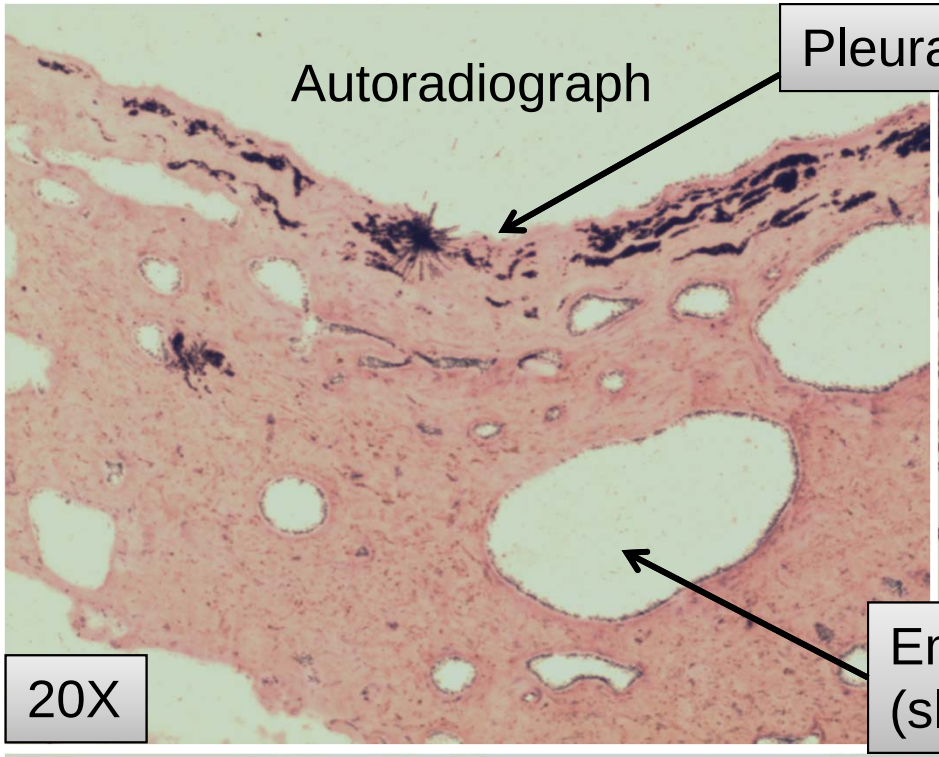

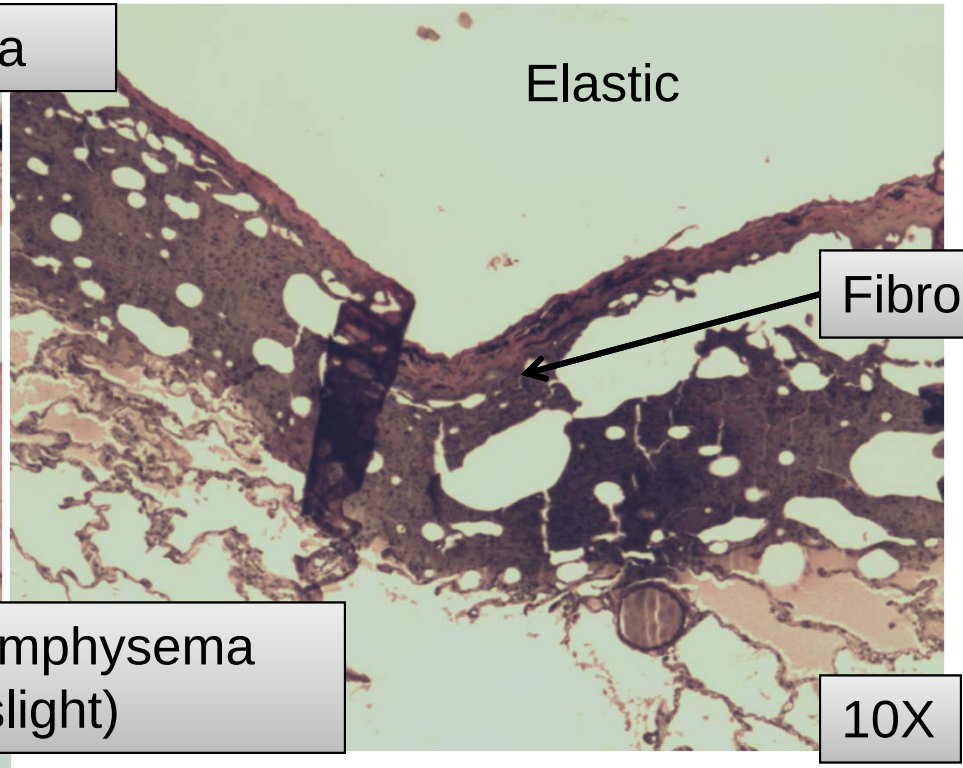

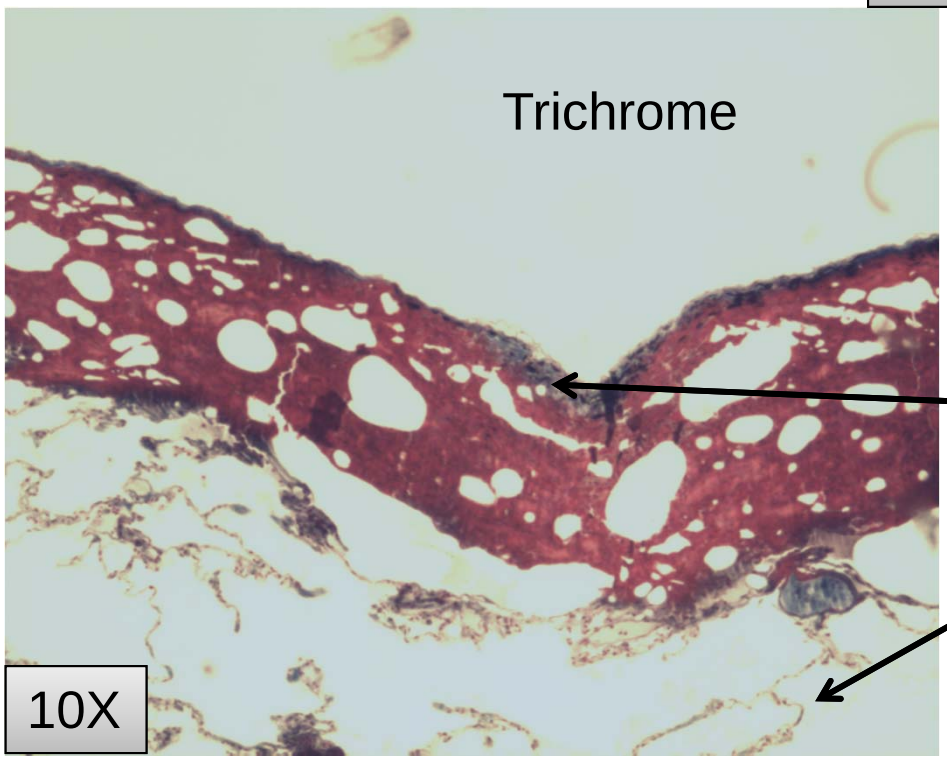

Human Case 269 - 58 kBq

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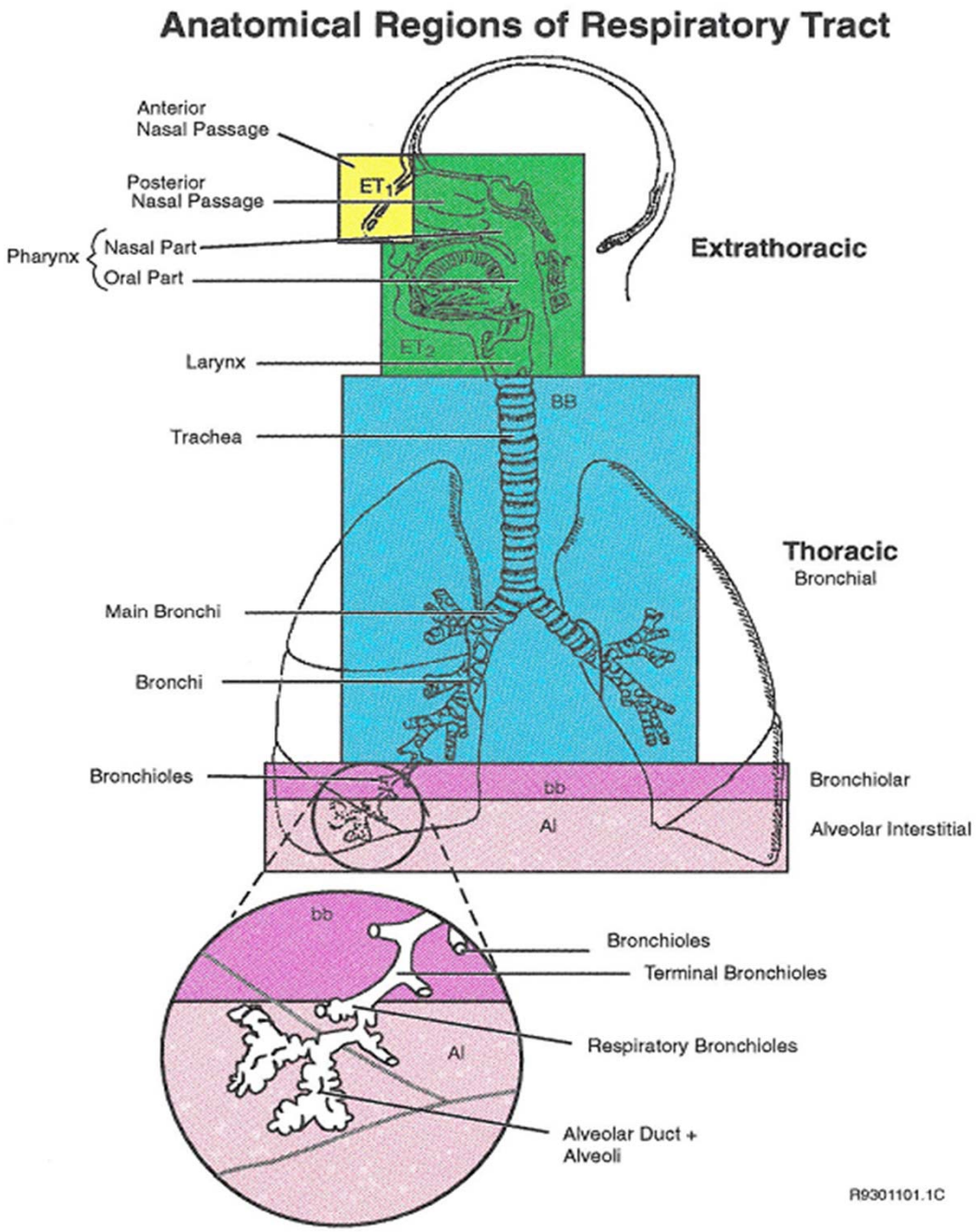

Future Directions:

i.e., Chris's PhD project

A productive collaboration between PNNL and USTUR

Analysis of Pu deposition along the respiratory tract.

In collaboration with the SOLO program in Europe.

Implications for the models of Pu clearance and subsequent risk. ICRP model??

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Cancer Research, in press

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Christopher E. Nielsen, Dulaney A. Wilson, Antone L. Brooks, Stacey McCord, Gerald E. Dagle, Anthony C James, Sergei Y. Tolmachev, Brian D. Thrall and William F. Morgan

Monday morning USTUR meetings: Bill Bair and Tony Brooks et al., …what an experience!

Comments and Questions

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