

Faculdade de Medicina de Ribeirão Preto

FMRP – USP

RCG 381 – Noções Básicas de Diagnóstico
por Imagem

**Medicina Nuclear:
Instrumental e Formação
da Imagem**

Prof. Dr. Lauro Wichert Ana

Introdução

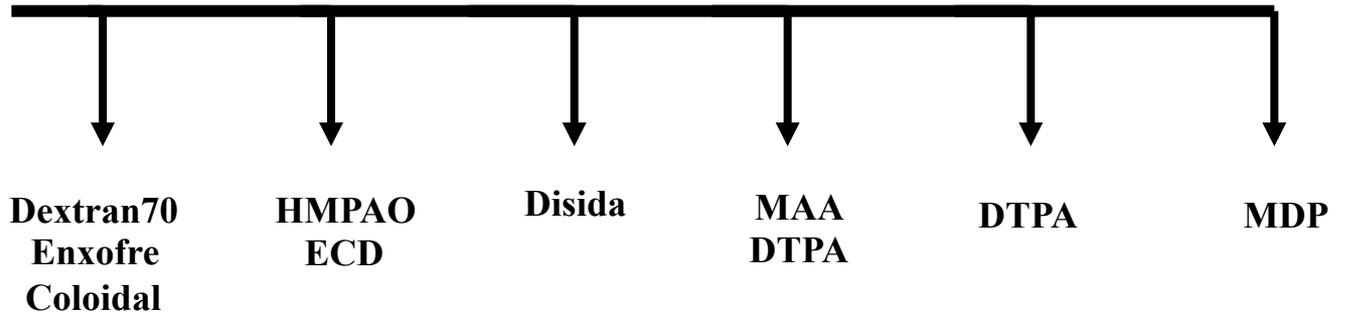
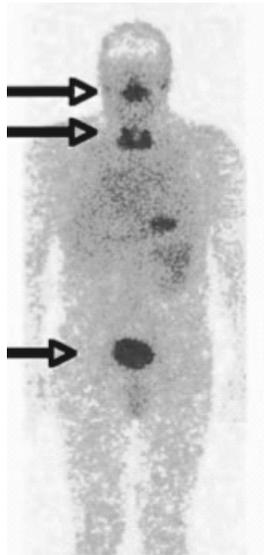
- O que é Medicina Nuclear?
- Quais são as 3 finalidades principais?
- Qual a matéria prima da MN?
- O que a MN nos diz sobre o o corpo humano?
- Existem Limitações?

Tecnécio-99m

Radionuclídeo + Fármaco



Puro



Dextran70
Enxofre
Coloidal

HMPAO
ECD

Disida

MAA
DTPA

DTPA

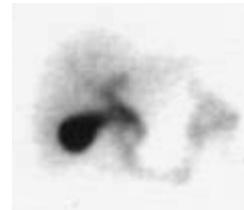
MDP



Linfo-
Cintilografia



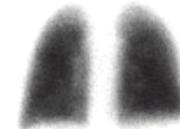
SPECT
Cerebral



Função
Hepato
Biliar



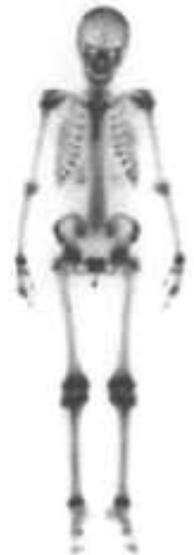
Ventilação



Perfusão



Função
Renal



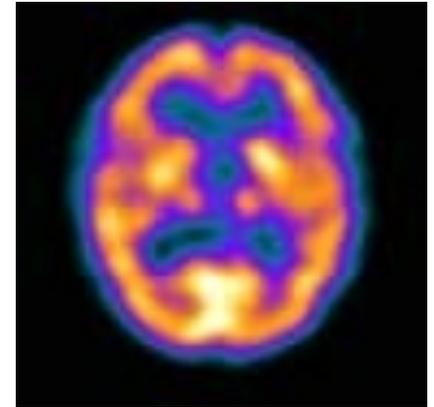
Metab.
Ósseo

Qual é a mensagem?

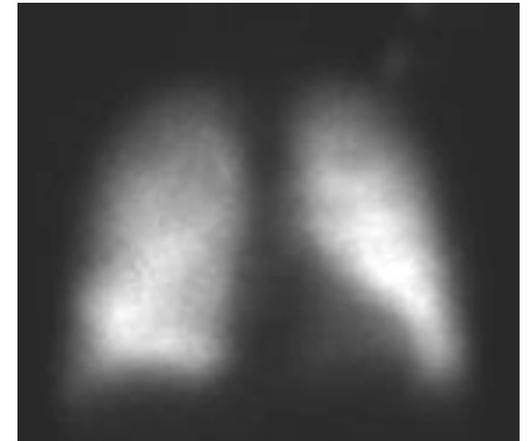
Medicina Nuclear

■ Vias de Administração:

■ *Injeção*
Intravenosa



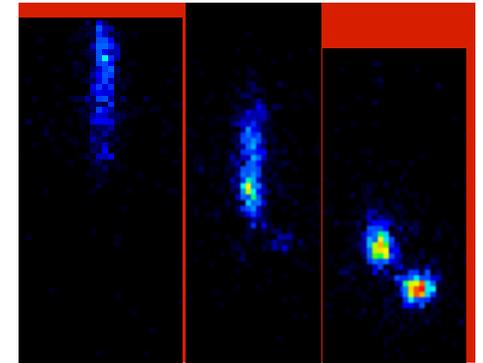
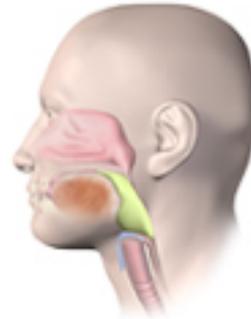
■ *Inalação*



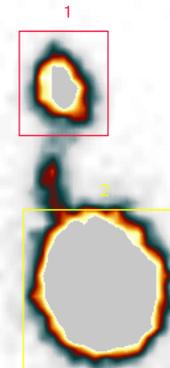
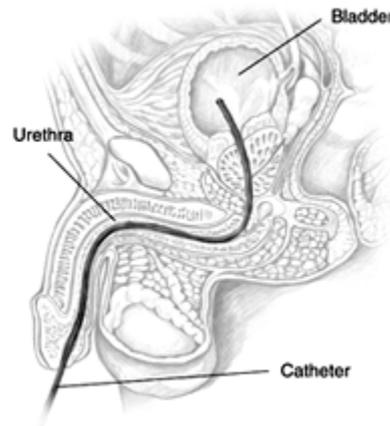
Medicina Nuclear

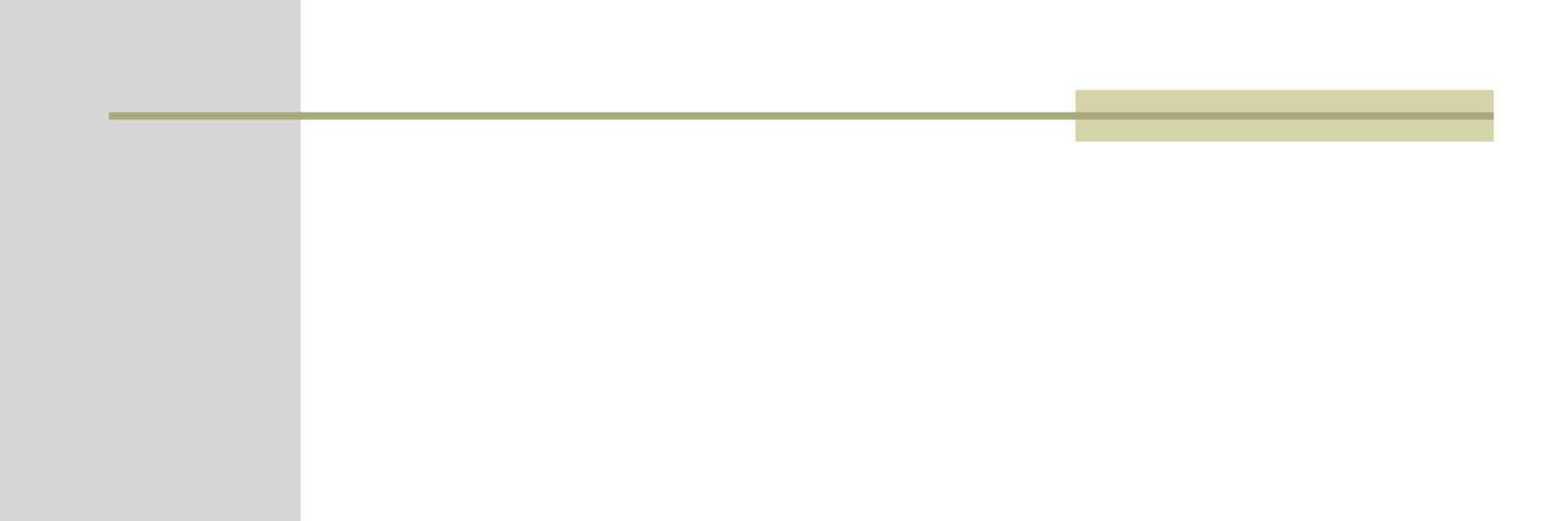
■ Vias de Administração:

■ *Deglutição*

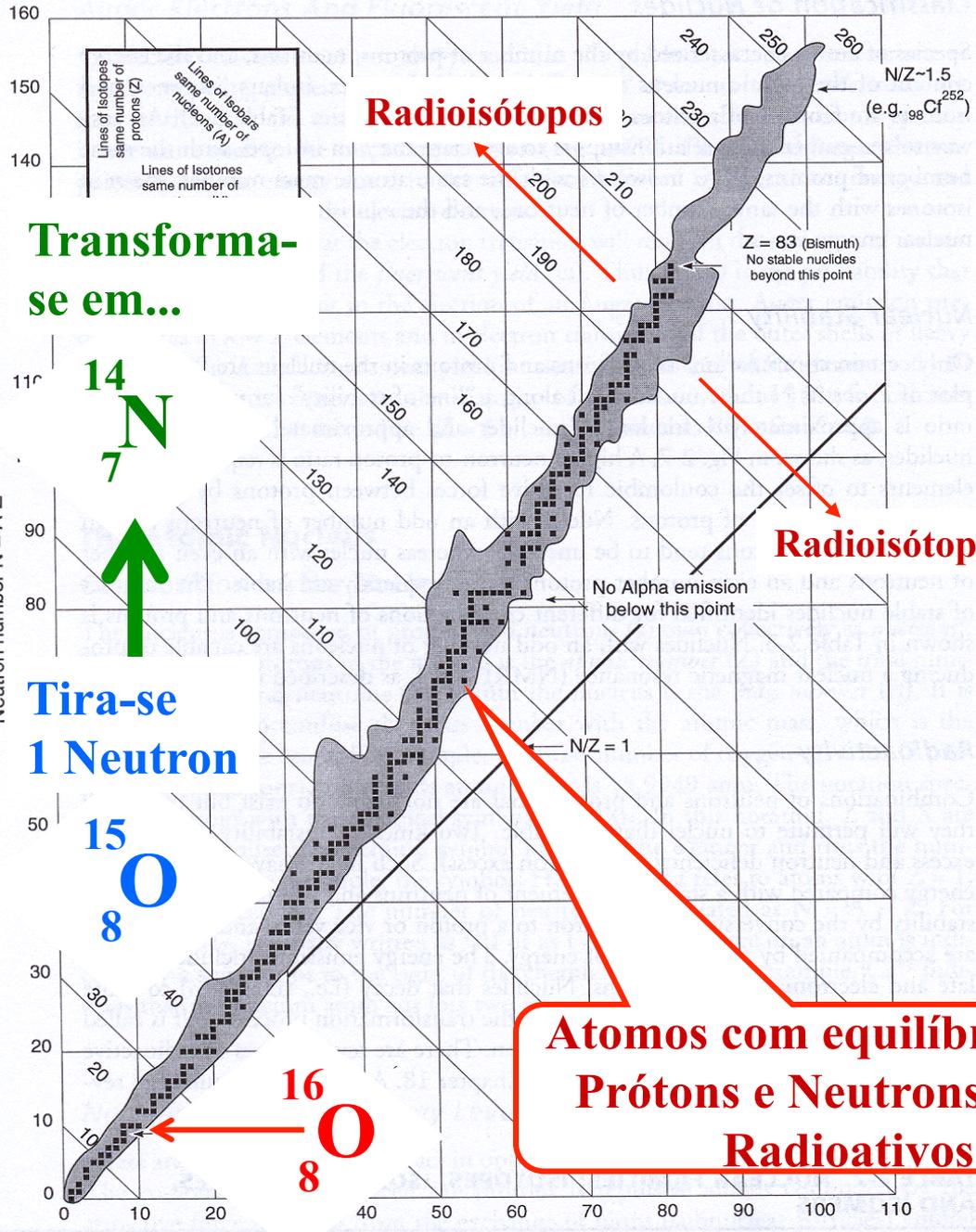


■ *Sondagem*





Quais são as Bases Físicas da Medicina Nuclear



Transforma-se em...



Tira-se 1 Neutron



Neutrons

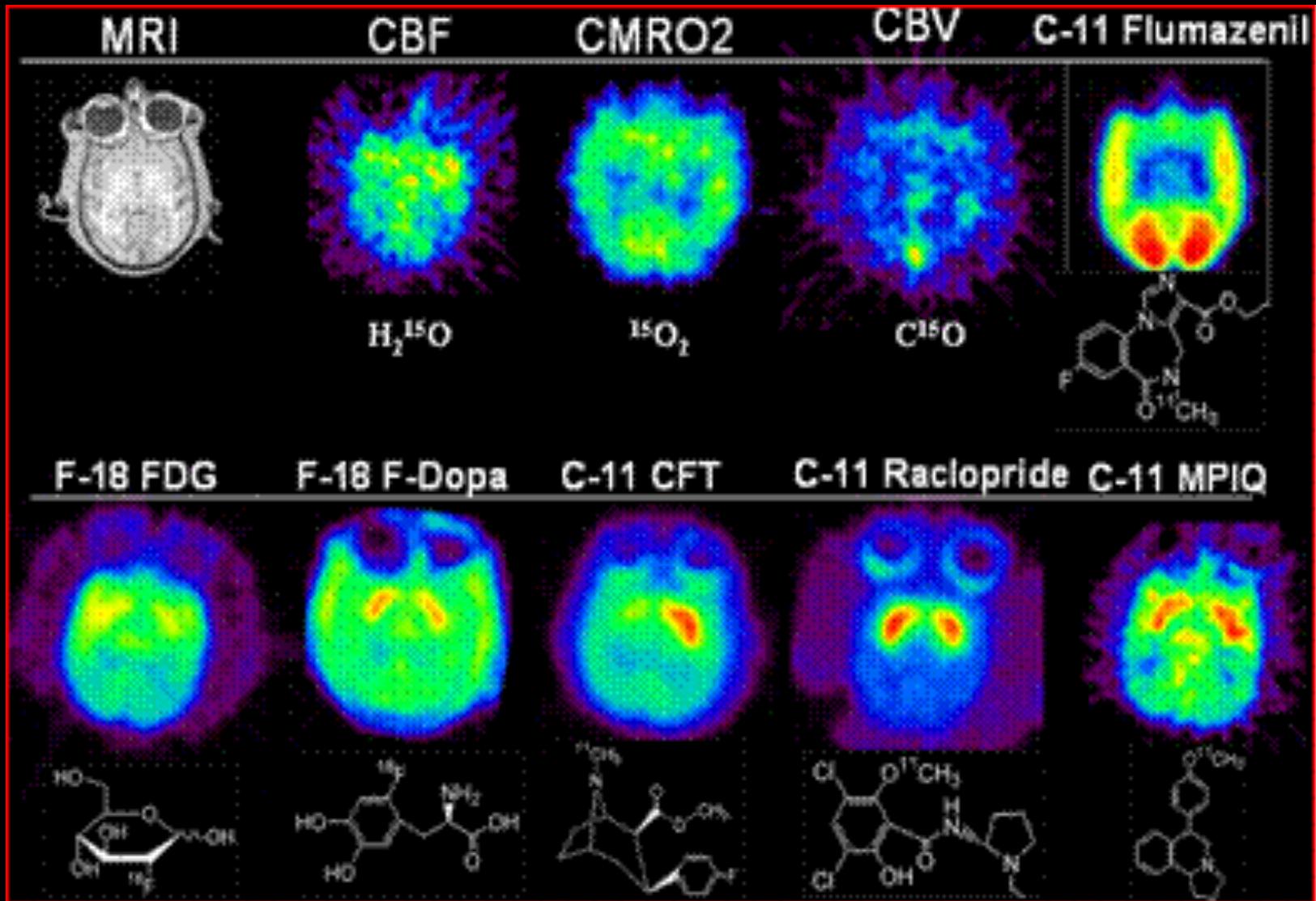


Proton number Z



Prótons

Aplicações em Neurociências



Radiação

- Quando um átomo encontra-se instável (excitado), o que ele faz para alcançar a sua estabilidade nuclear?

Emite Radiação

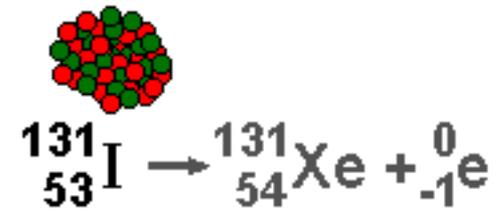
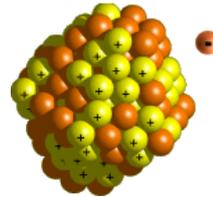
DECAIMENTO RADIOATIVO

Definições

- **Radiação:** É a emissão e propagação de partículas ou ondas originadas sejam de substâncias radioativas, fontes de ondas eletromagnéticas ou sonoras e que viajam através do espaço e da matéria.
- **Radioatividade:** É a propriedade de determinados elementos químicos de produzir radiação.

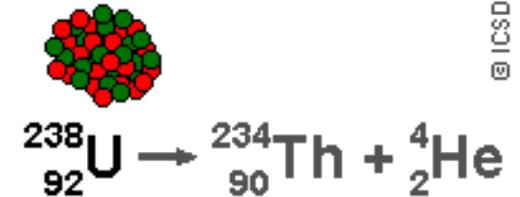
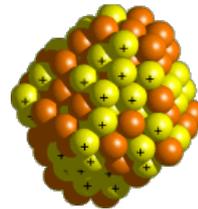
Decaimento Radioativo

- Decaimento Beta
(Transição Isobárica)



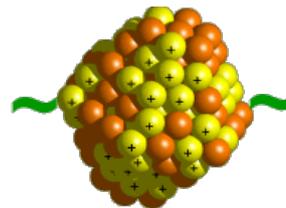
© ICSD

- Decaimento Alfa

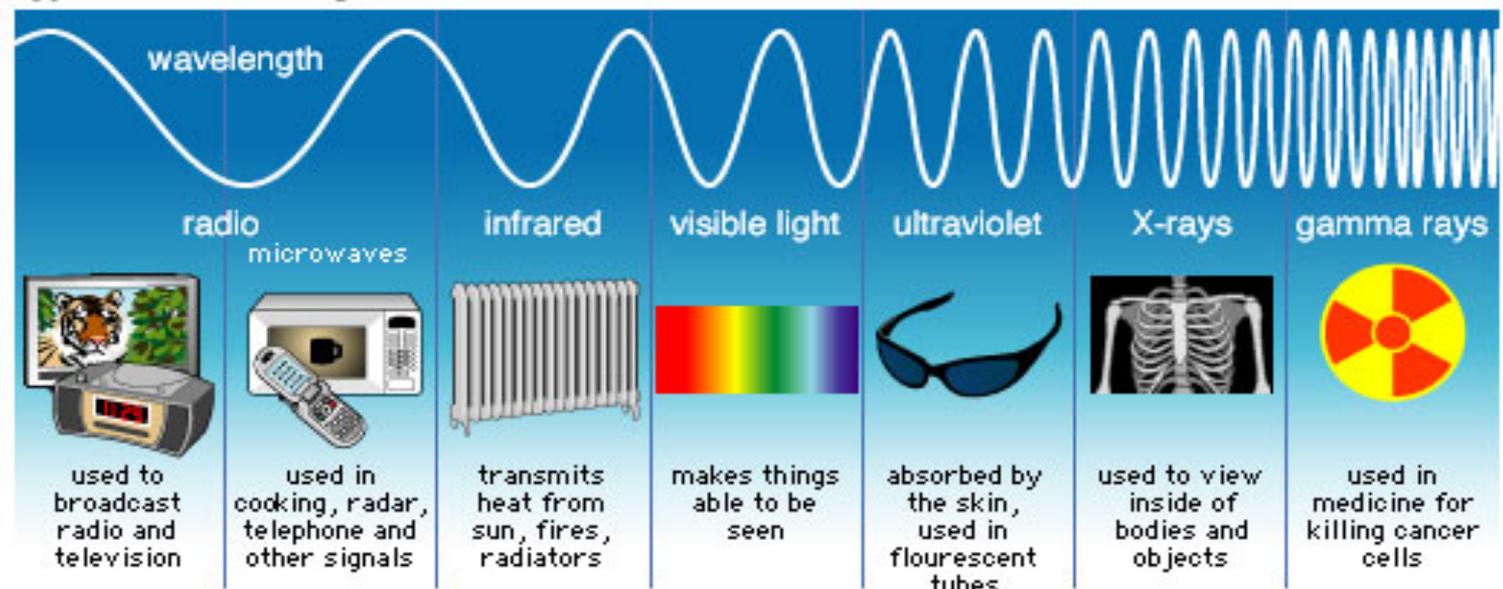


© ICSD

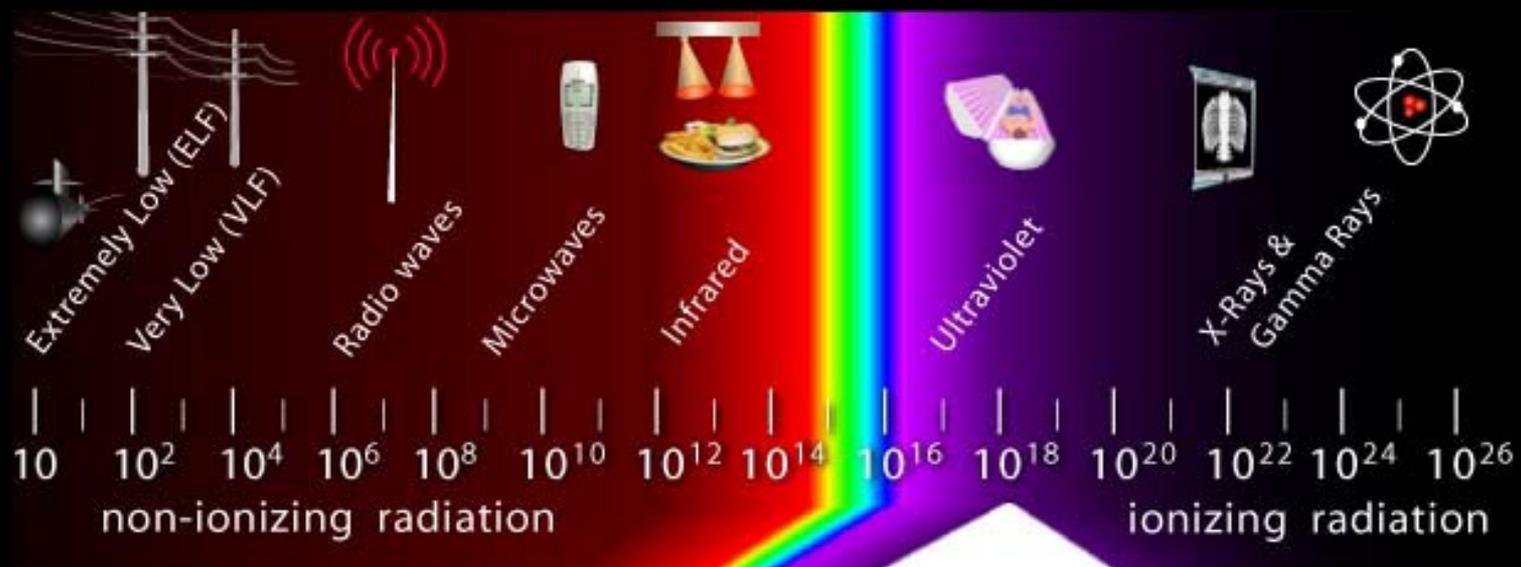
- Decaimento Gama
(Transição Isobárica)



Types of Electromagnetic Radiation



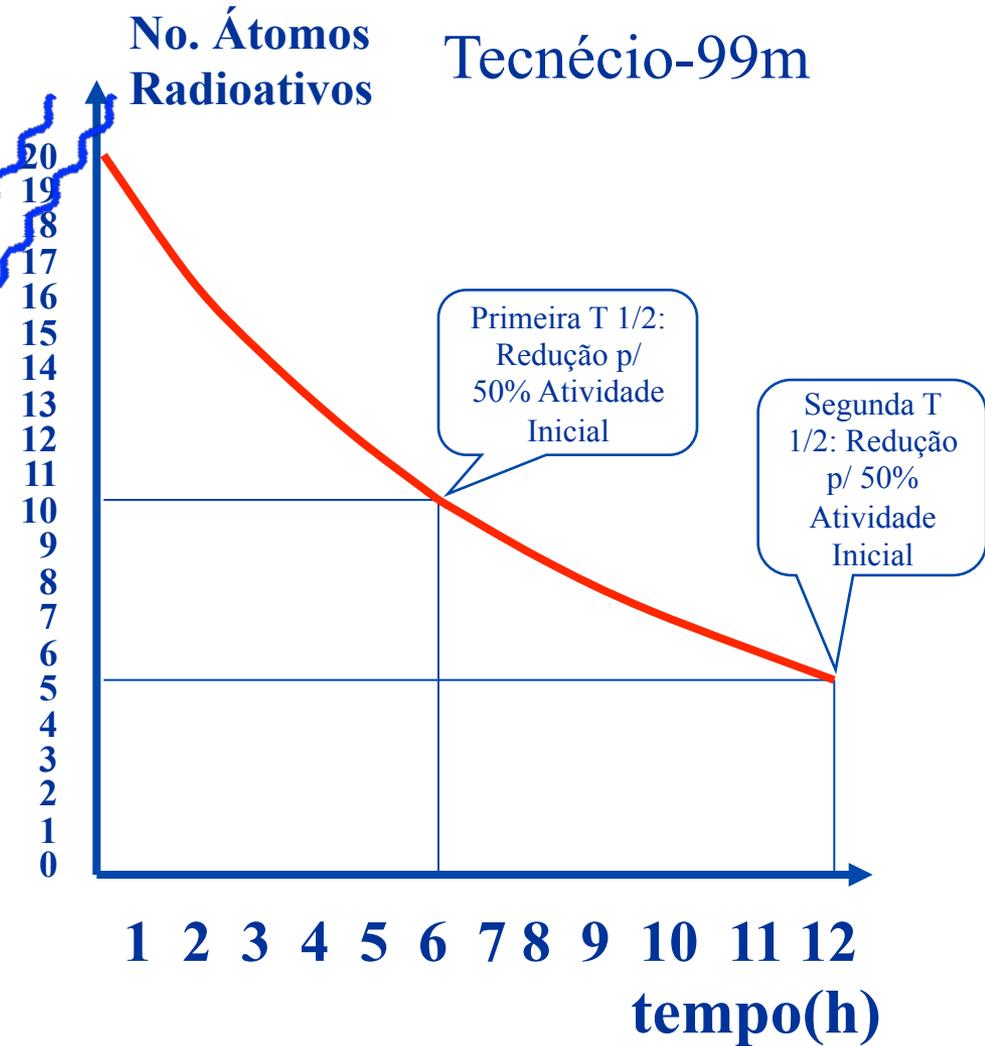
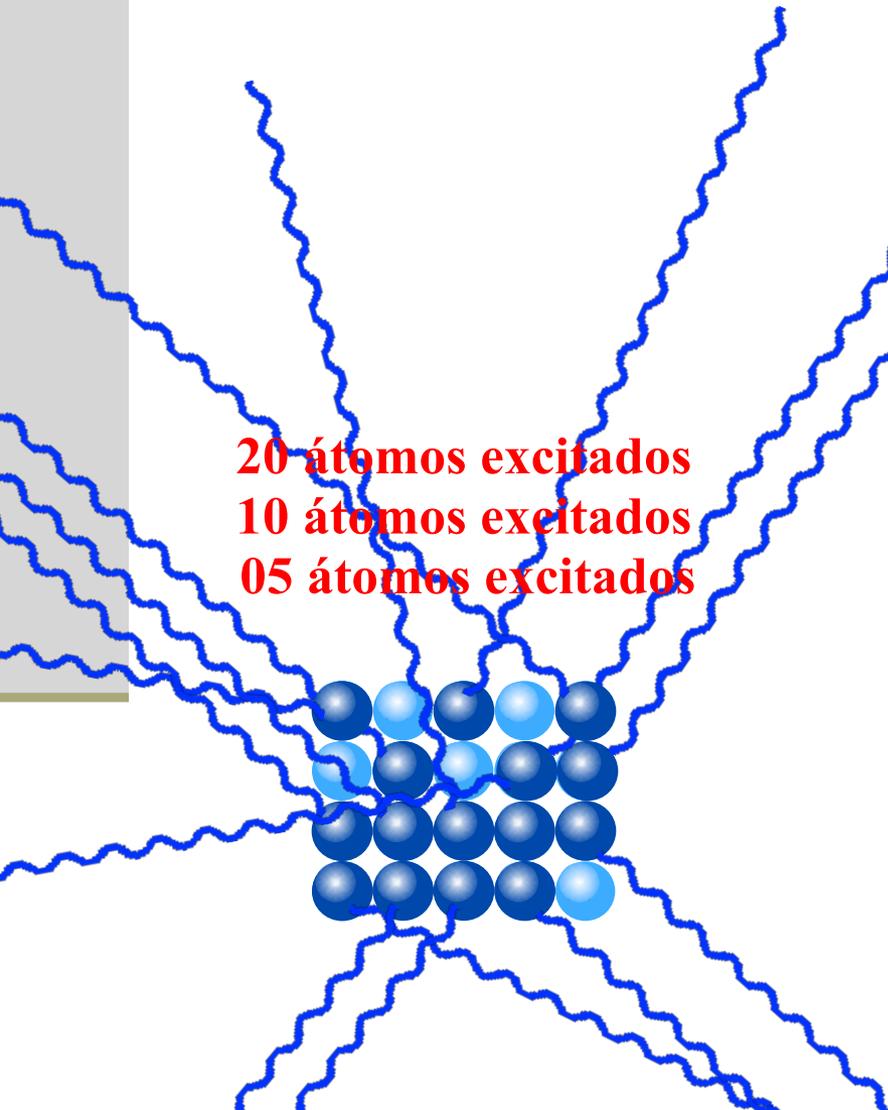
© 2006 Encyclopædia Britannica, Inc.



Não Ionizante

Ionizante

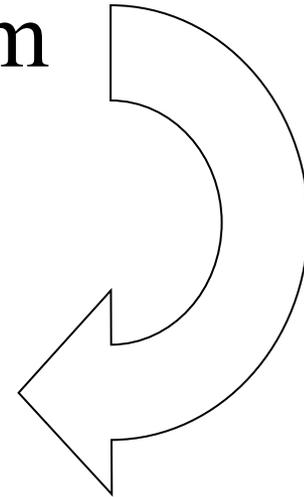
Decaimento Radioativo



Aplicações Médicas

- Partículas Alfa e Beta = Terapêutica
- Radiação Gama = Imagem

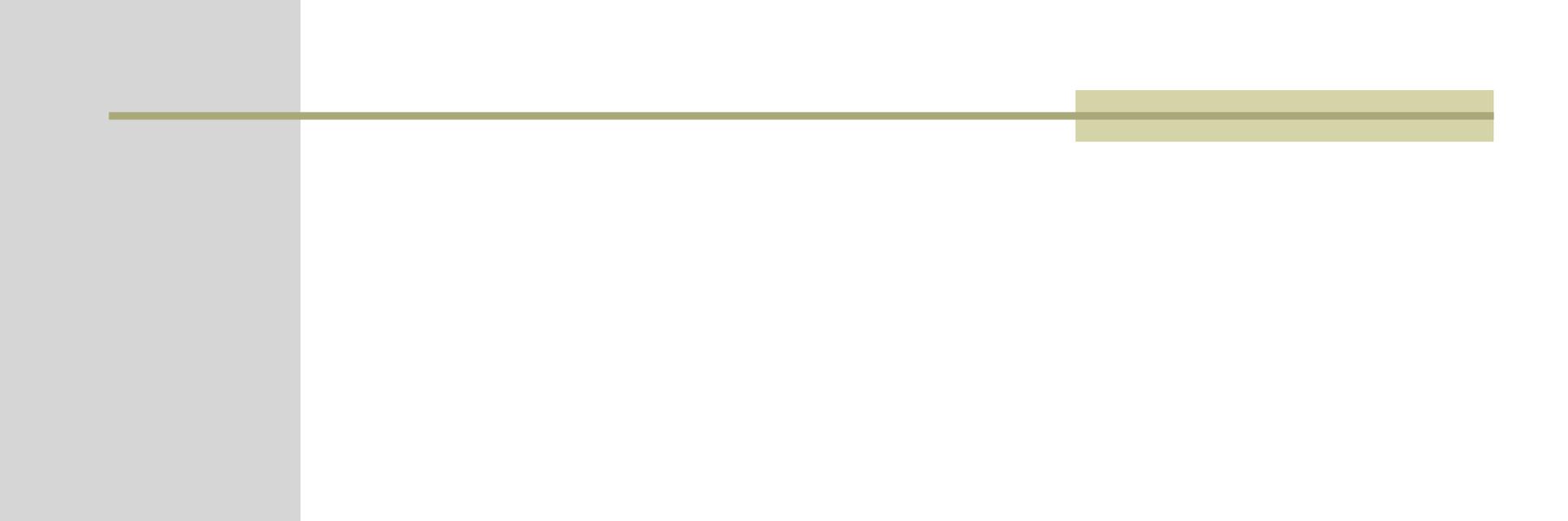
Tecnécio-99m
Iodo-131
Tálio-201
Gálio-67
Samário-153
Flúor-18



Radiação

- Mas como detectar a radiação gama?

**Através de Detectores de
Radiação**

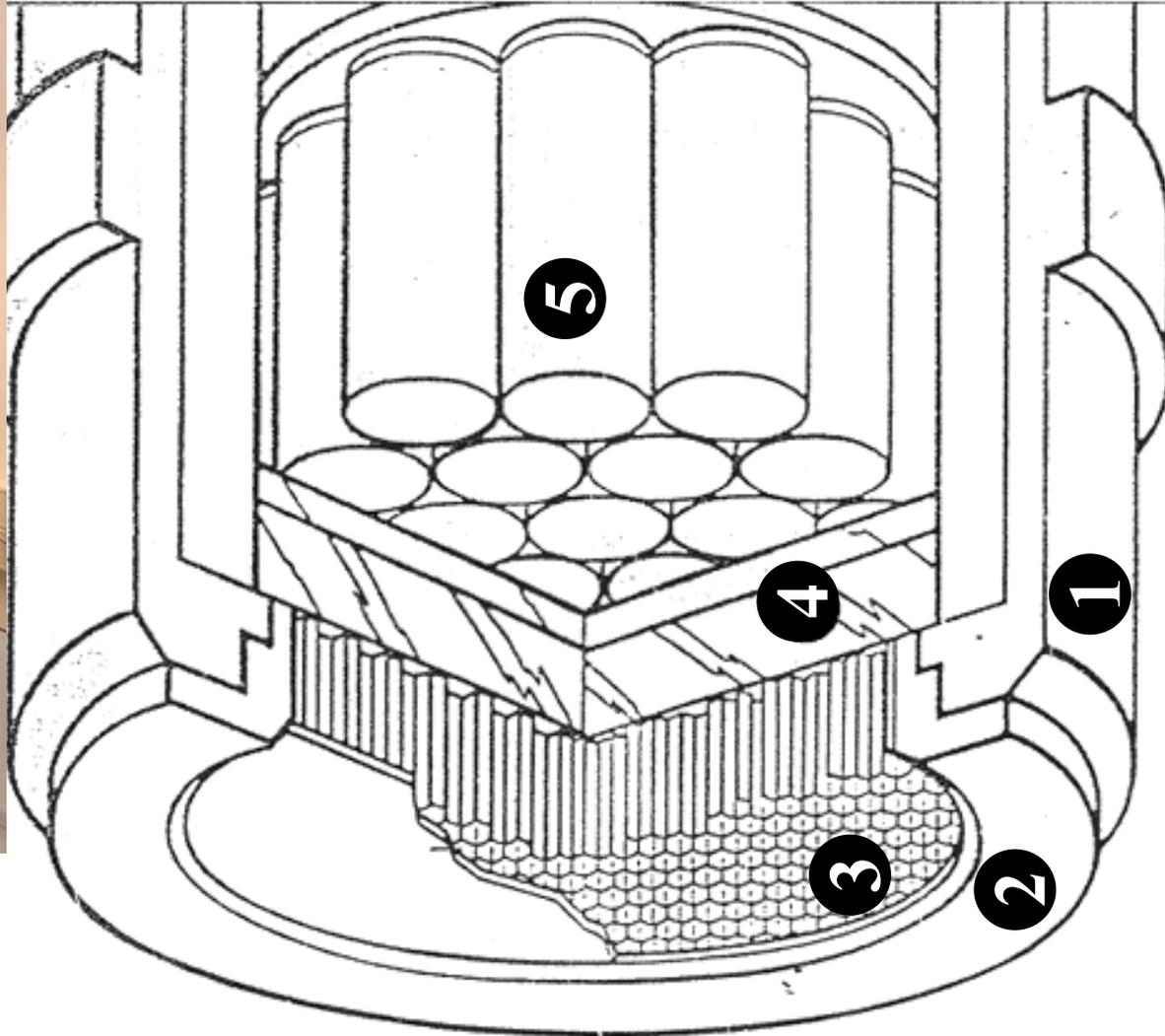


Gama Câmeras e Formação da Imagem

Gama-Câmara



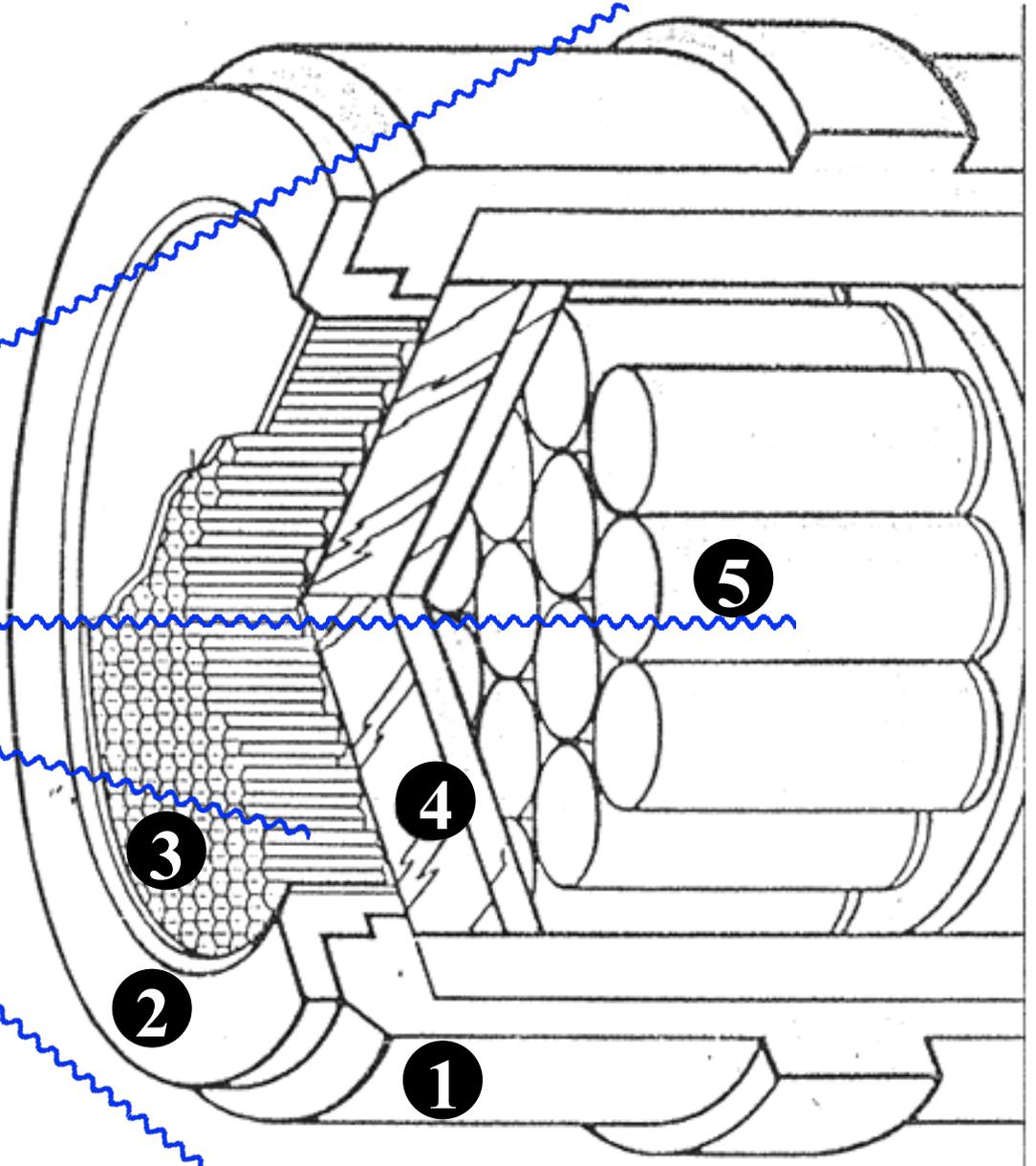
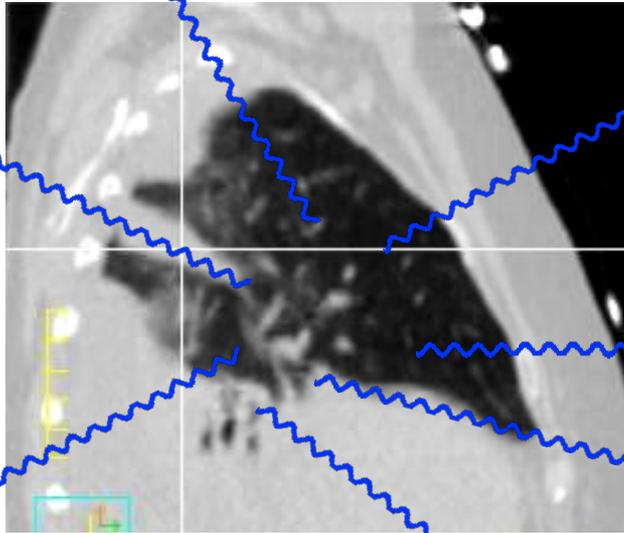
Detector



1. Invólucro
2. Blindagem
3. Colimador
4. Cristal NaI(Tl)
5. Fotomultiplicadora

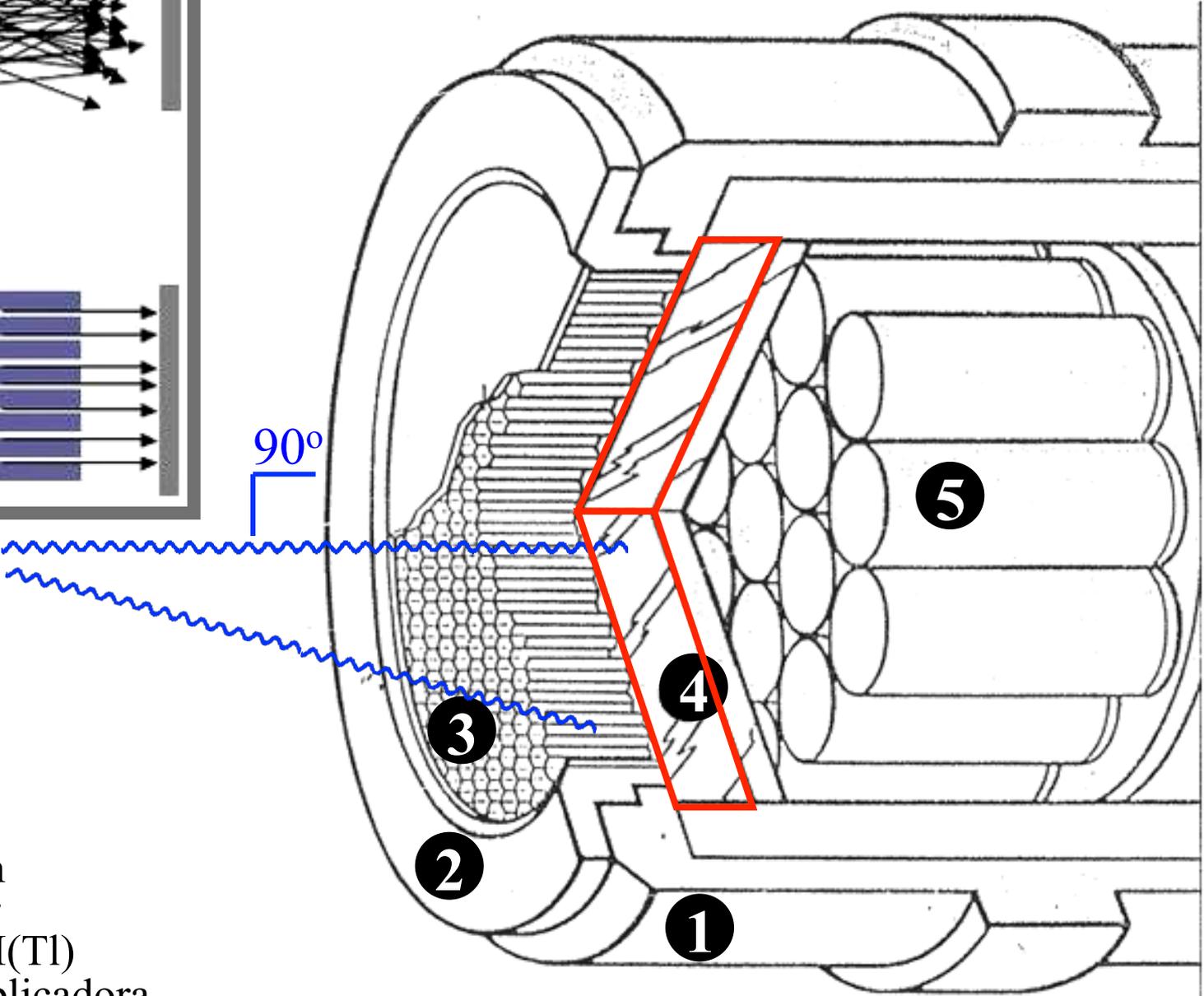
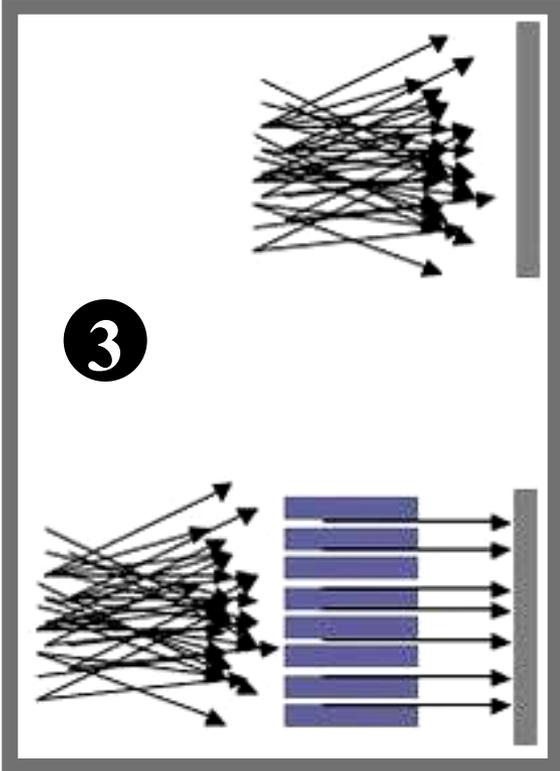
Órgão Alvo

Detector



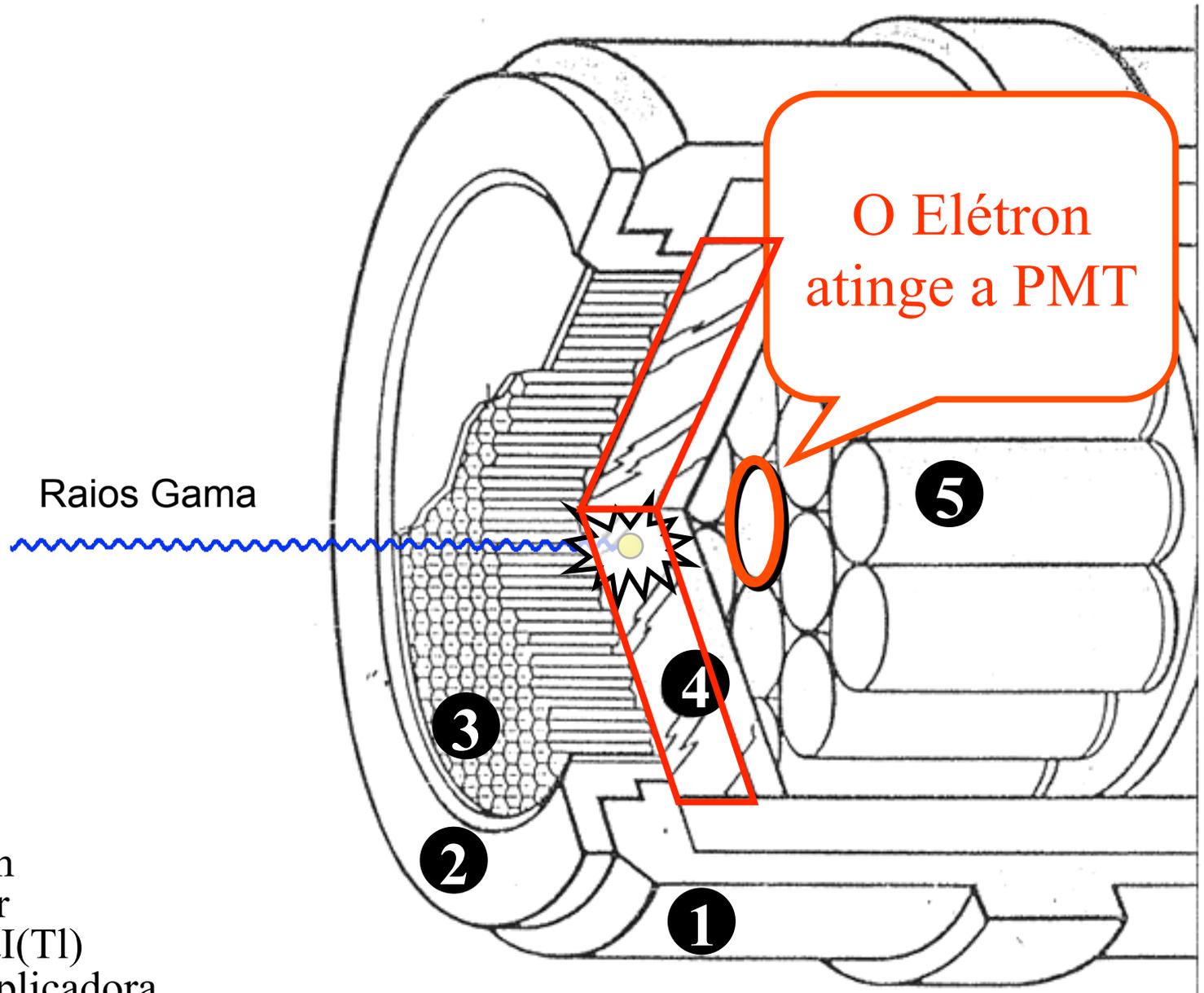
1. Invólucro
2. Blindagem
3. Colimador
4. Cristal NaI(Tl)
5. Fotomultiplicadora

Detector



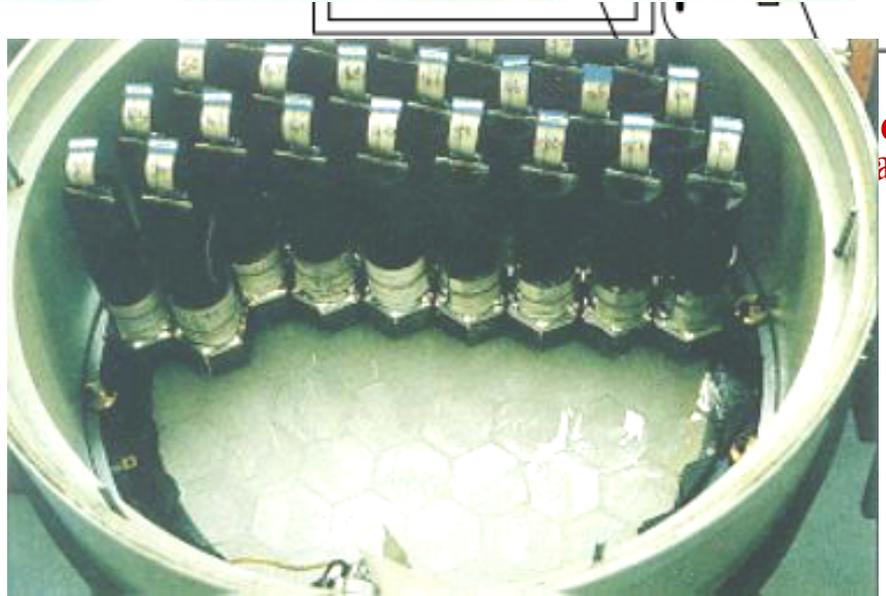
- 1. Invólucro
- 2. Blindagem
- 3. Colimador
- 4. Cristal NaI(Tl)
- 5. Fotomultiplicadora

Detector

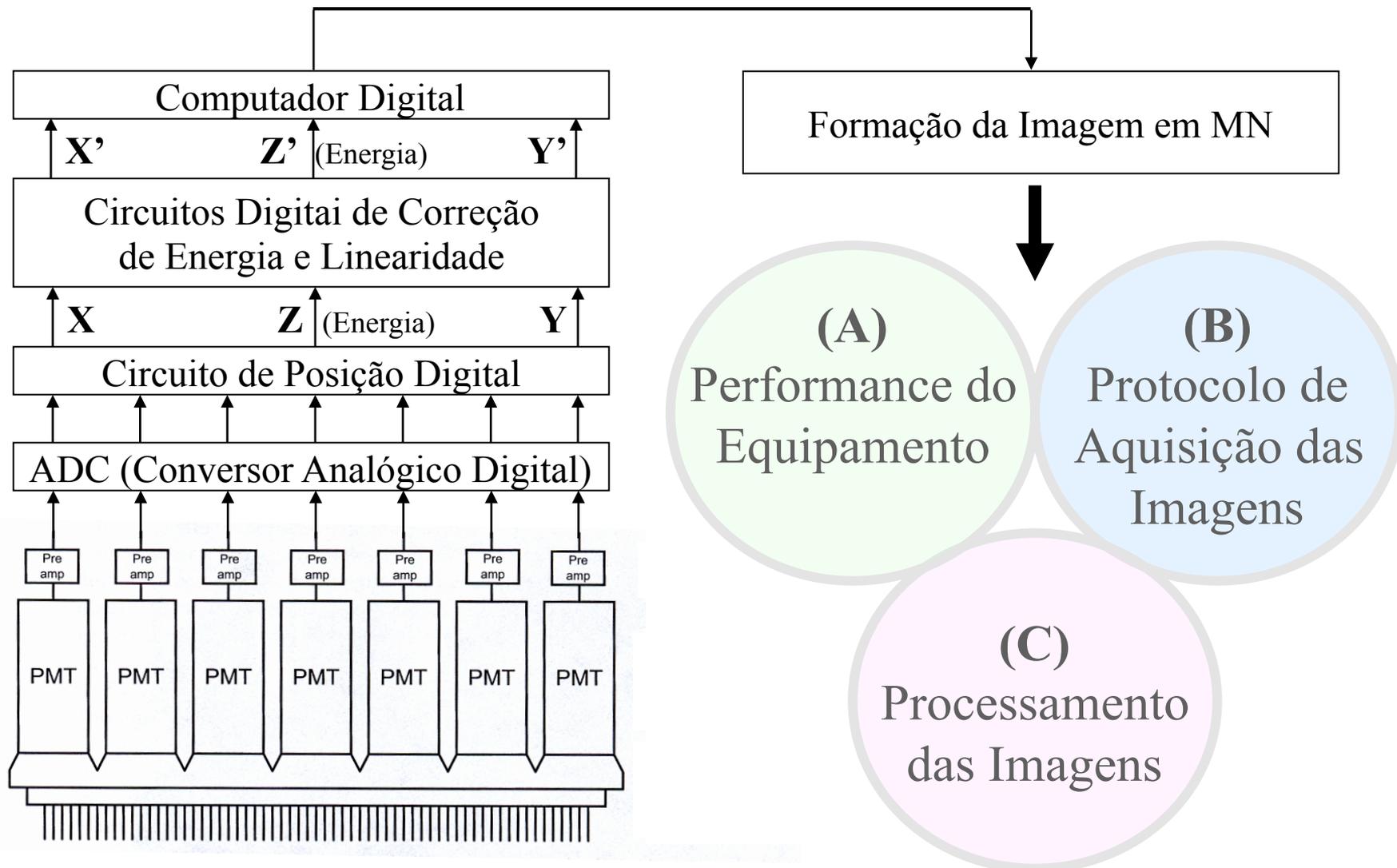


1. Invólucro
2. Blindagem
3. Colimador
4. Cristal NaI(Tl)
5. Fotomultiplicadora

Fotomultiplicadoras (PMT)

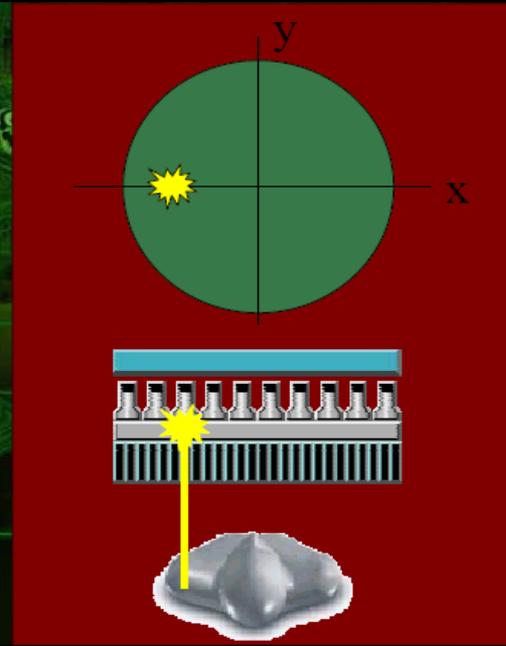


Dos Raios Gama à Imagem em MN



Protocolo de Aquisição

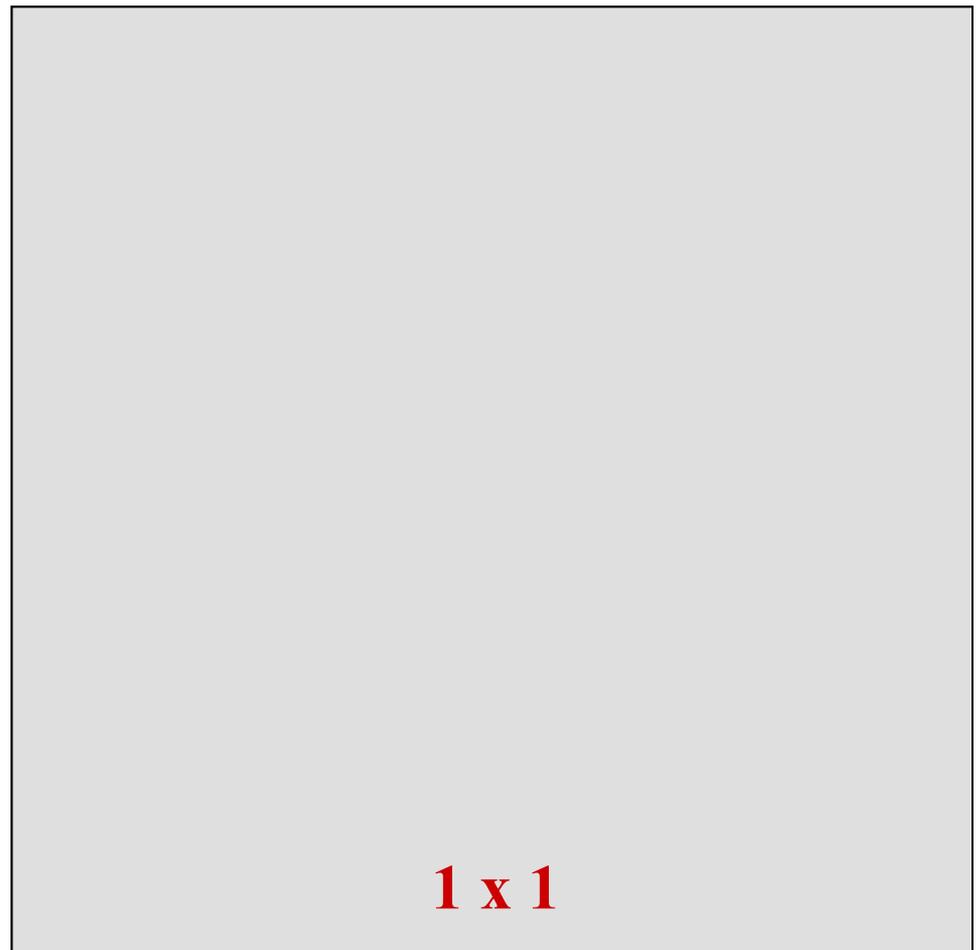
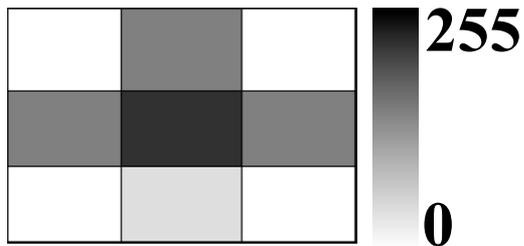
0	0	0
1	0	0
0	0	0



Matriz de
Aquisição
3 x 3

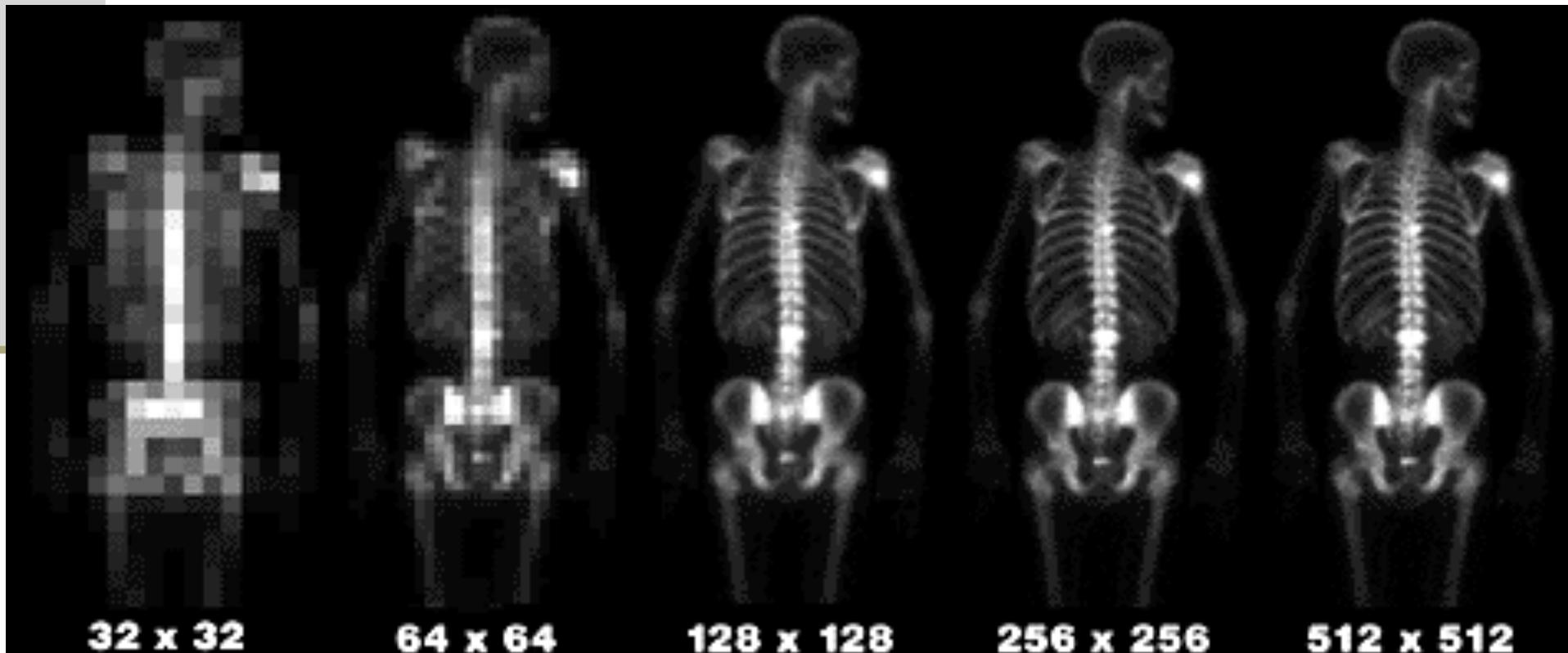
Protocolo de Aquisição

■ Matrizes de Aquisição



Método de Imagem em MN

■ Matrizes de Aquisição



Método de Imagem em MN

- Distância do órgão-alvo até o detector.



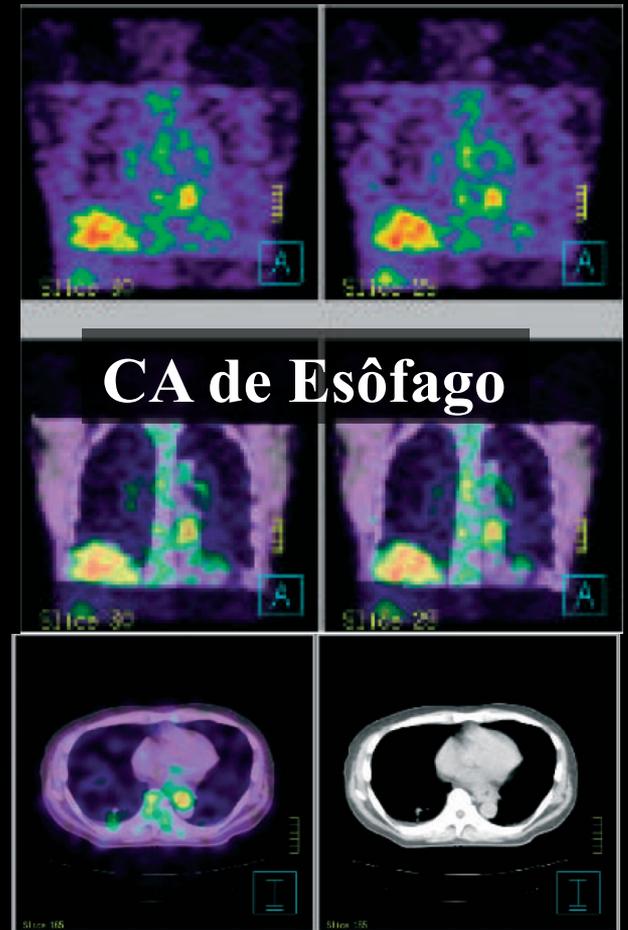
5 cm



15 cm

Detectores de Radiação

■ Gama-Câmaras: SPECT / CT

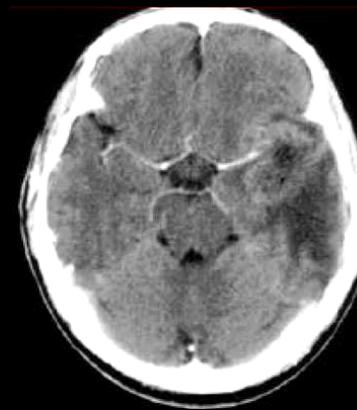


Detectores de Radiação

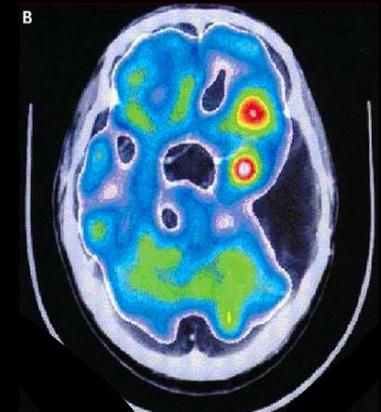
■ PET / CT Glioblastoma de Grau Intermediário

Paciente previamente tratado com Neurocirurgia, Quimioterapia e Radioterapia.

Apresenta aumento da [radiofármaco] nas margens da área tratada.



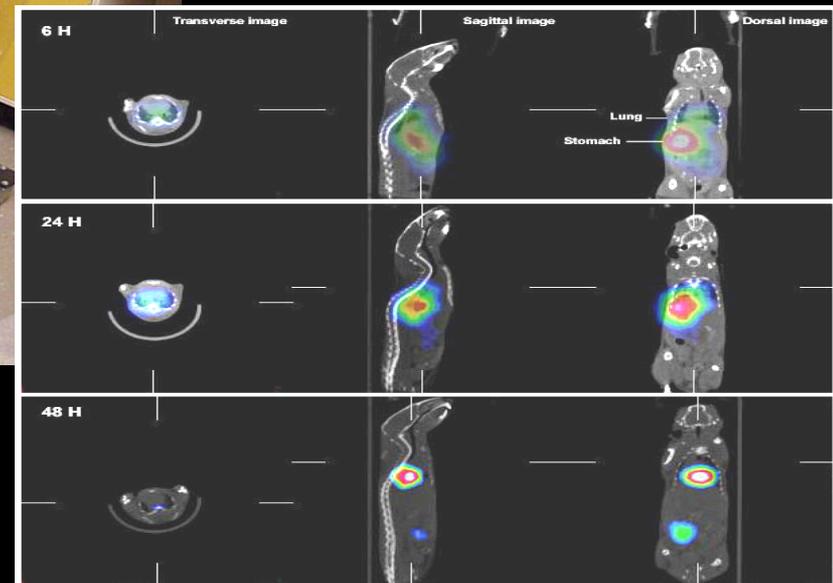
CT, Contraste



PET, F-18 FDG

Detectores de Radiação

■ MicroSPECT/CT



Medicina Nuclear: Indicações e Exemplos Clínicos

Estudos Fisiológicos em...

- **Pneumologia**

Estudos Fisiológicos

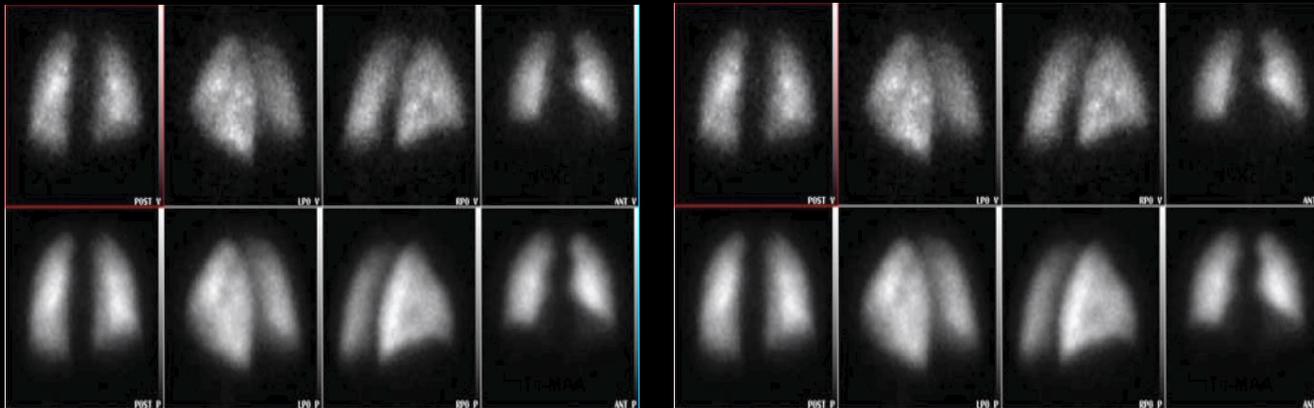
- Qual função está sendo estudada?

^{99m}Tc - DTPA
Ventilação (V)

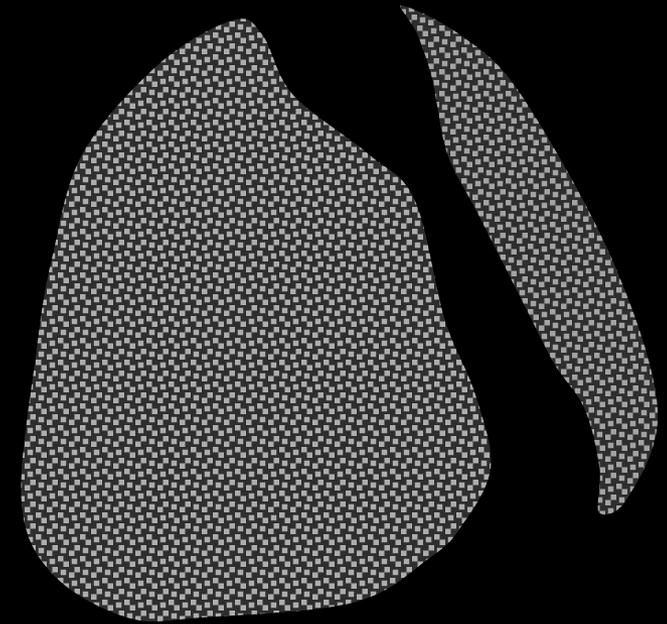
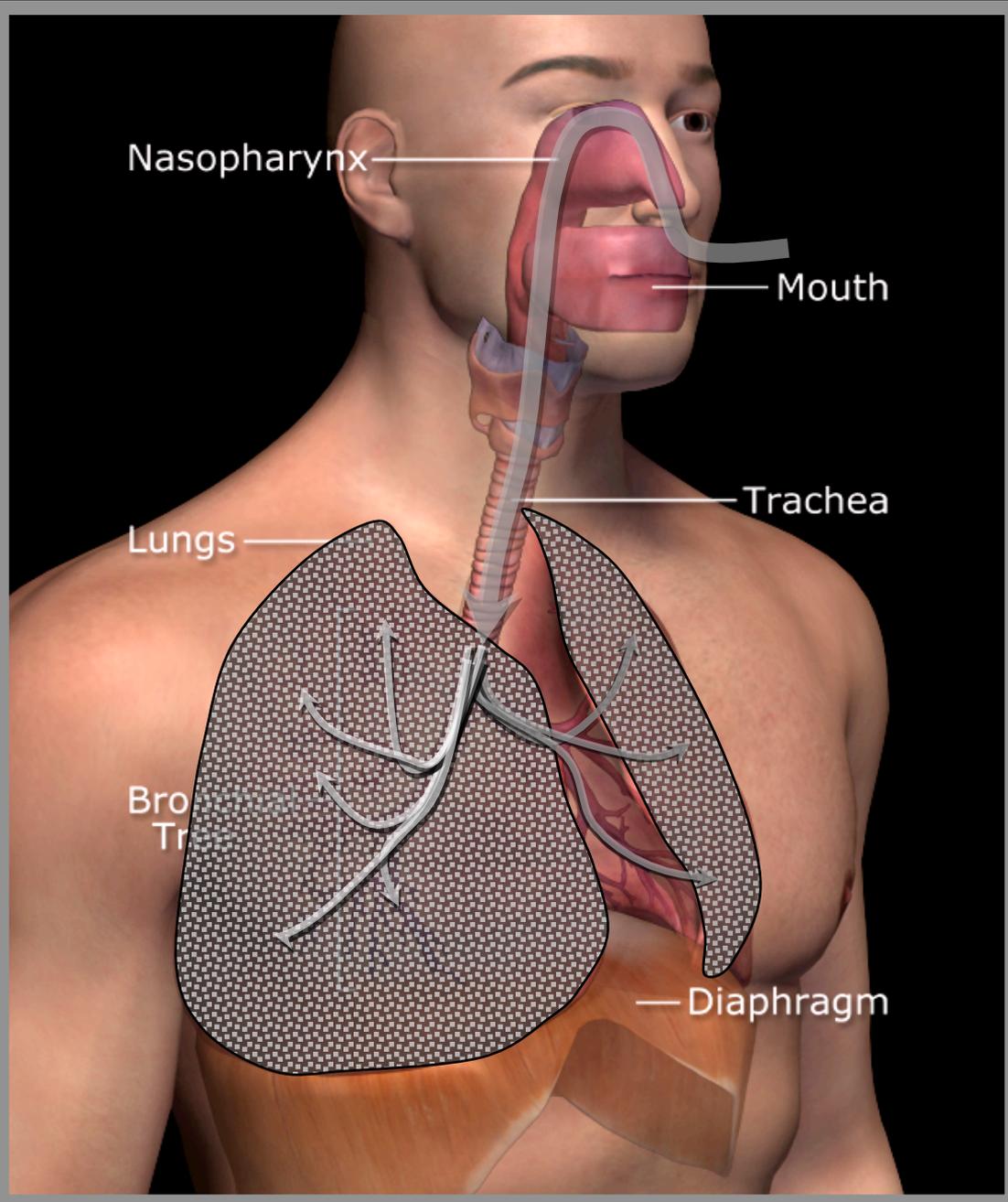
^{99m}Tc - MAA
Perfusão (Q)

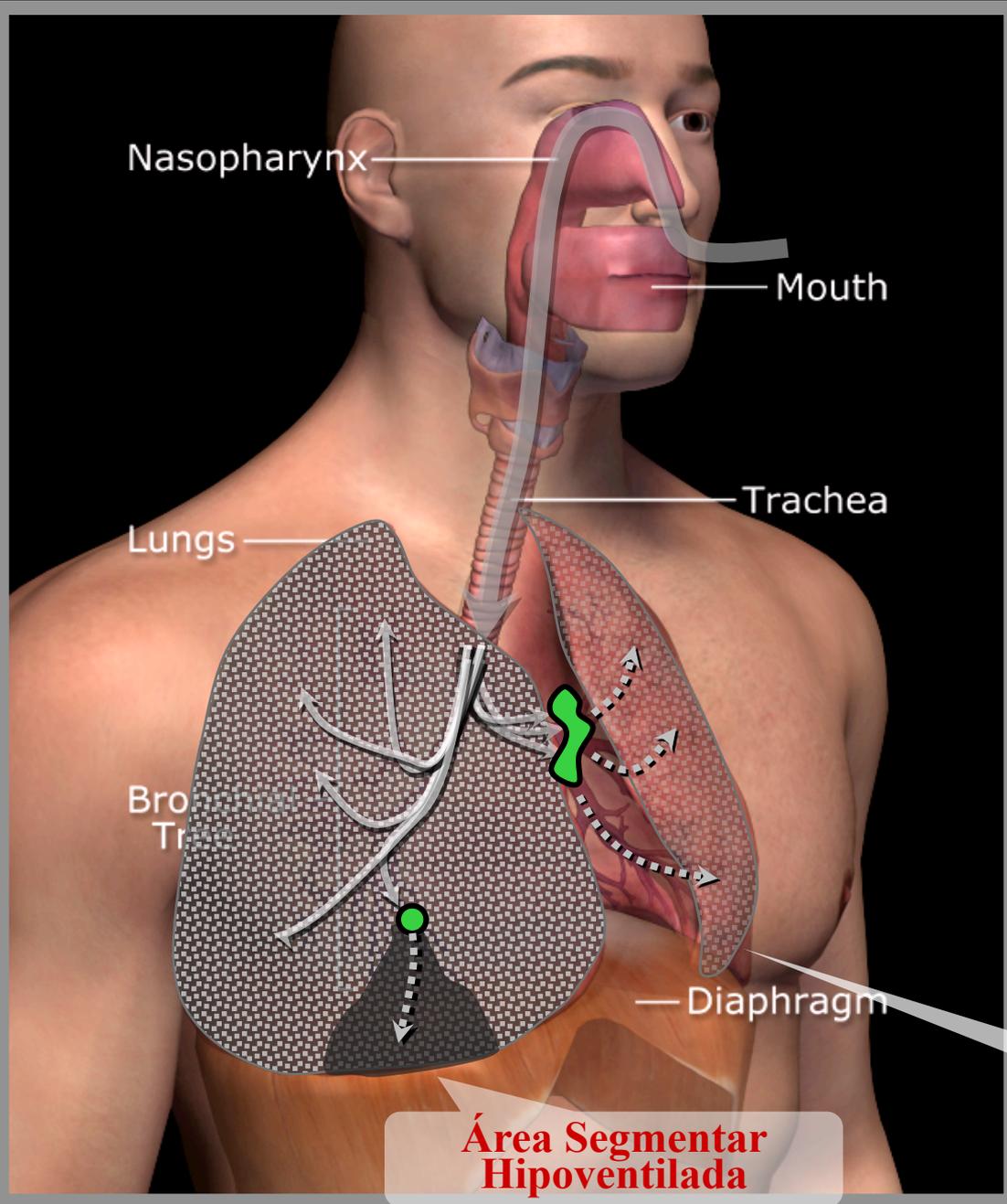


Inalação

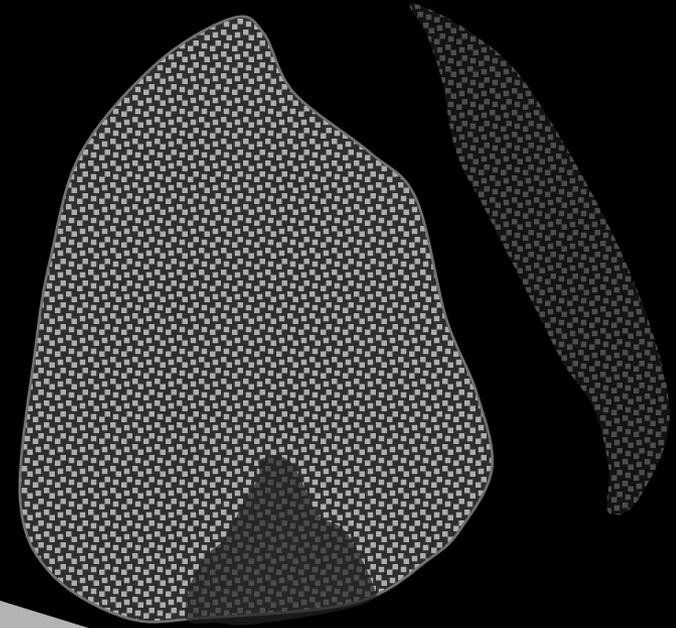


VENTILAÇÃO Pulmonar Normal

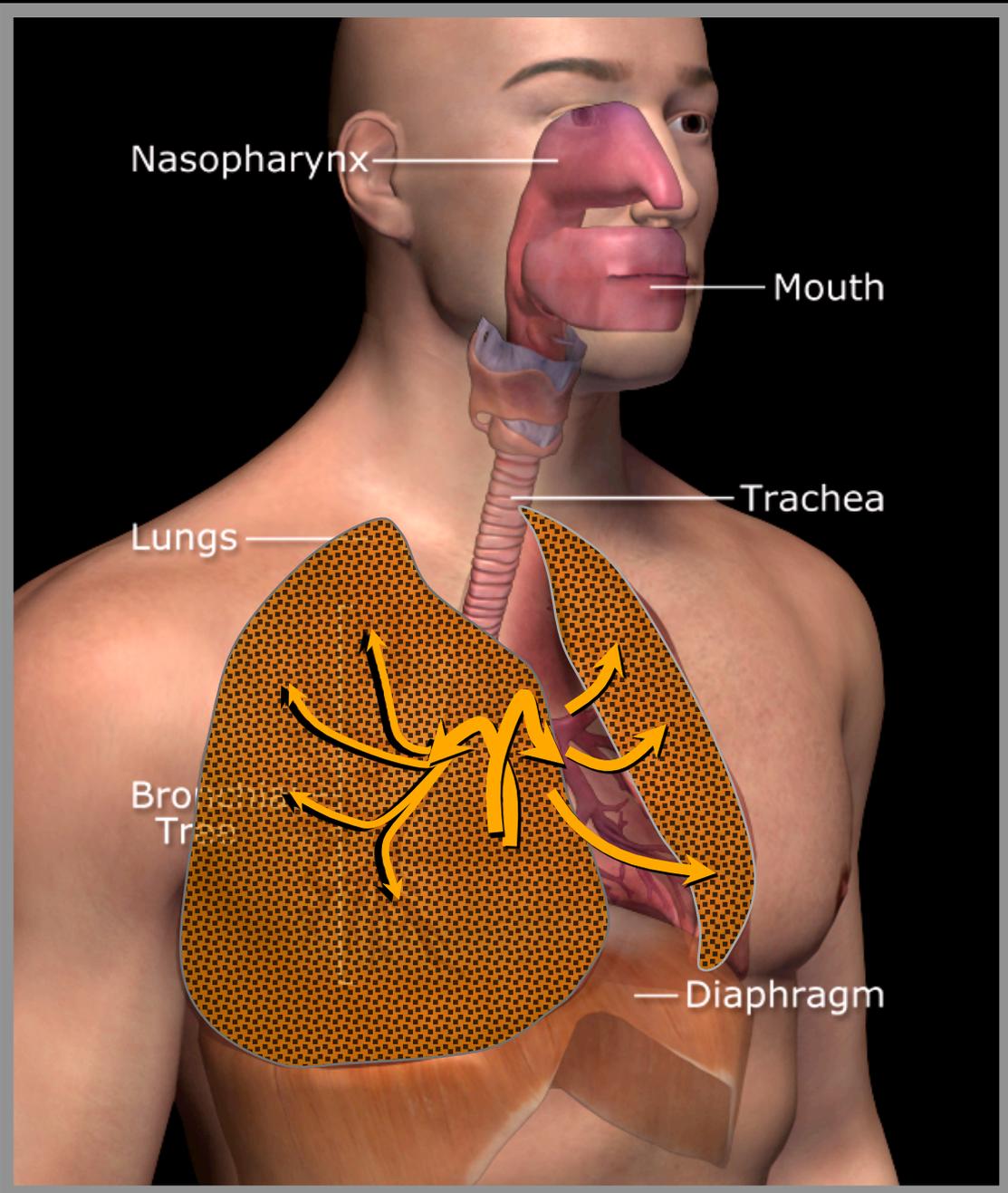




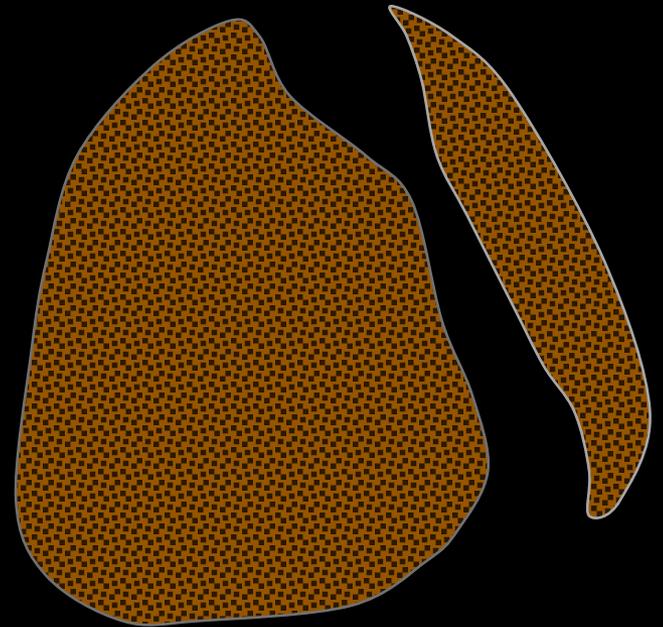
VENTILAÇÃO
Defeito
Segmentar P.D.
+
Defeito em
todo P.E.



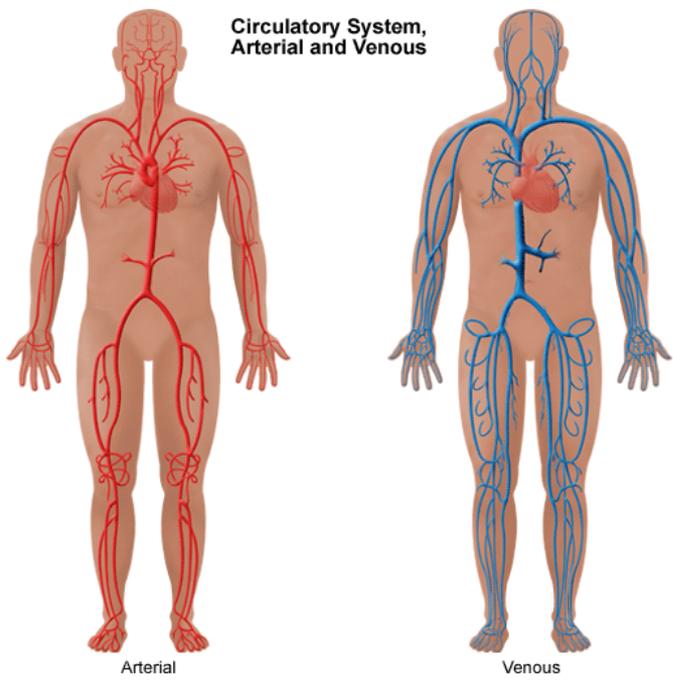
**Todo o Pulmão E
Hipoventilado**



PERFUSÃO Pulmonar Normal



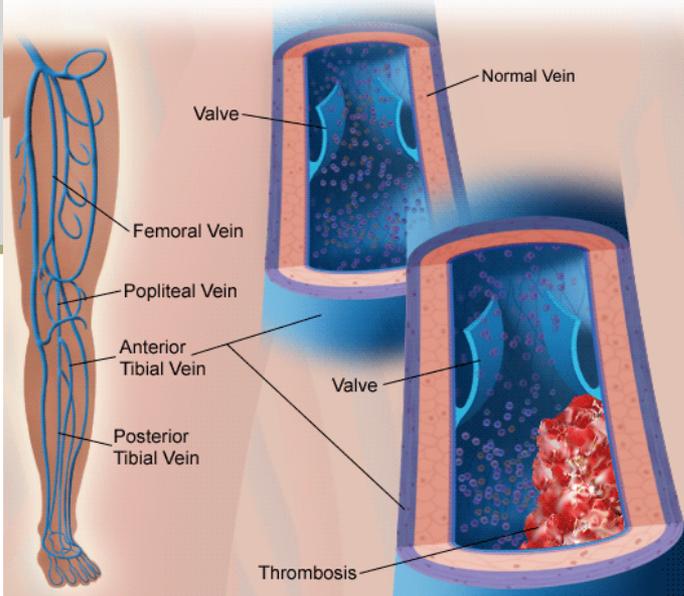
**Circulatory System,
Arterial and Venous**



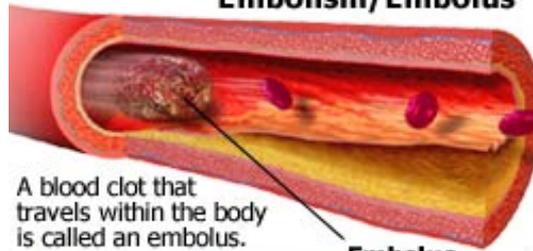
Arterial

Venous

Deep Vein Thrombosis (DVT) of the Leg

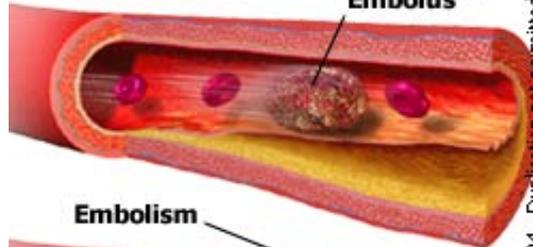


Embolism/Embolus

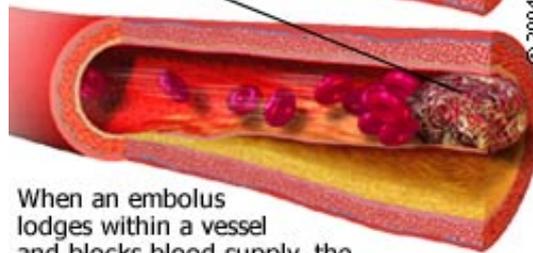


A blood clot that travels within the body is called an embolus.

Embolus



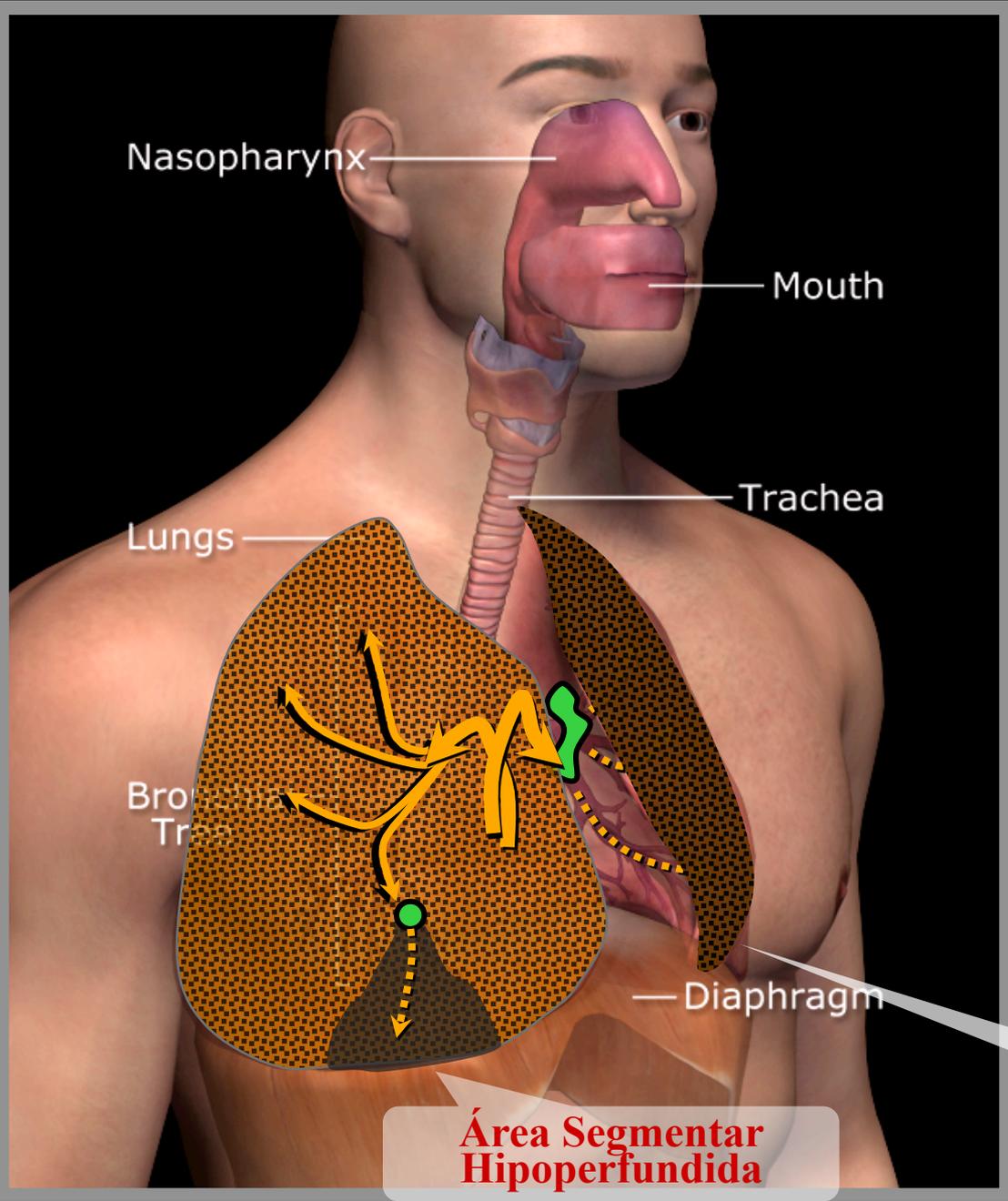
Embolism



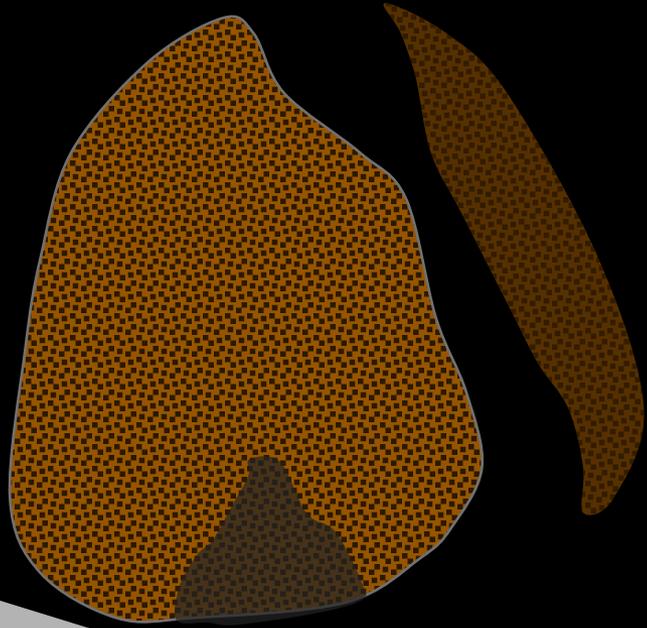
When an embolus lodges within a vessel and blocks blood supply, the condition is called an embolism.

© 2004 - Duplication not permitted





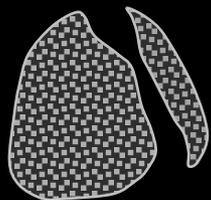
PERFUSÃO
Defeito Segmentar P.D.
+
Defeito em todo P.E.



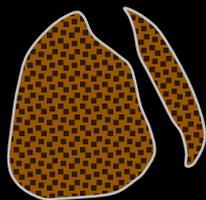
Cintilografia V/Q Pulmonar

Vent

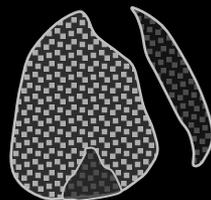
Perf



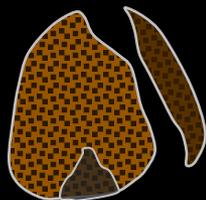
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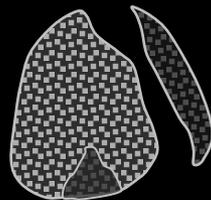
= Diagnóstico: **Aparentemente Normal**



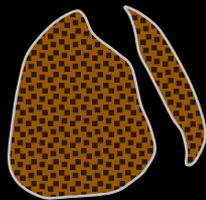
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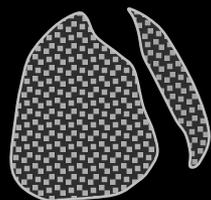
= **Defeito Concordante**: Infartos Prévios, Pneumonia Consolidada. Não TEP.



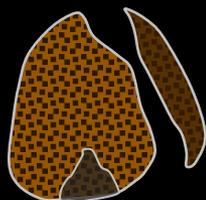
+



= **Defeito Não-Concordante**: Afeta mais a Ventilação. Pneumonias iniciais.



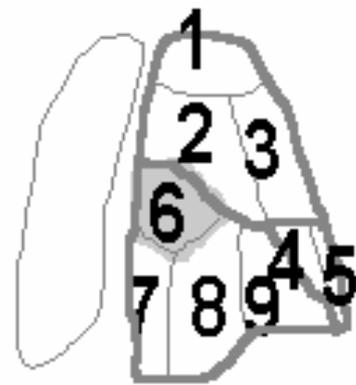
+



= **Defeito Não-Concordante**: Afeta mais a Perfusão → TEP.

Q

V



RPO



LPO

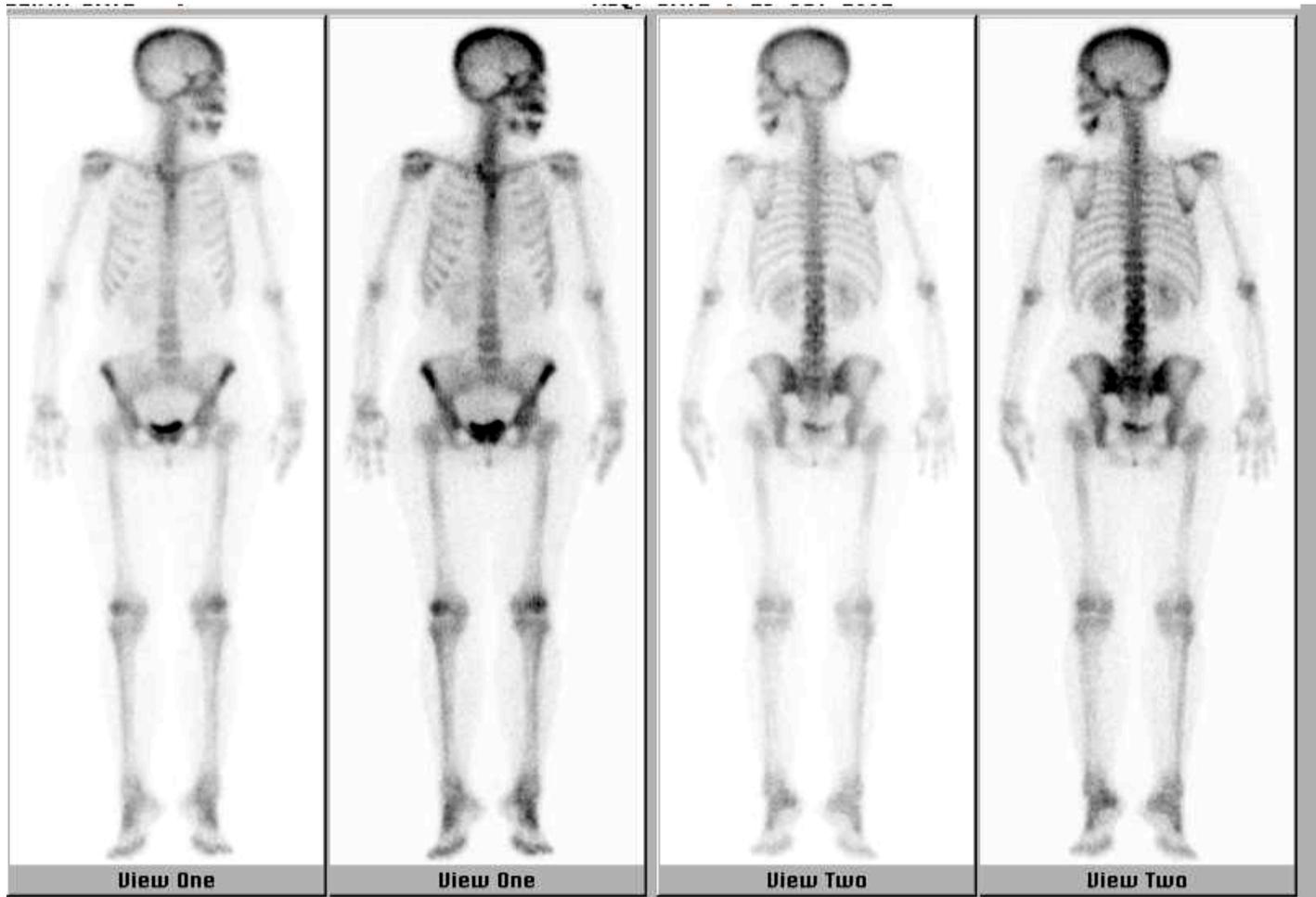
Estudos Fisiológicos em...

- Pneumologia
- **Oncologia e Ortopedia**

Estudos Fisiológicos

^{99m}Tc -MDP

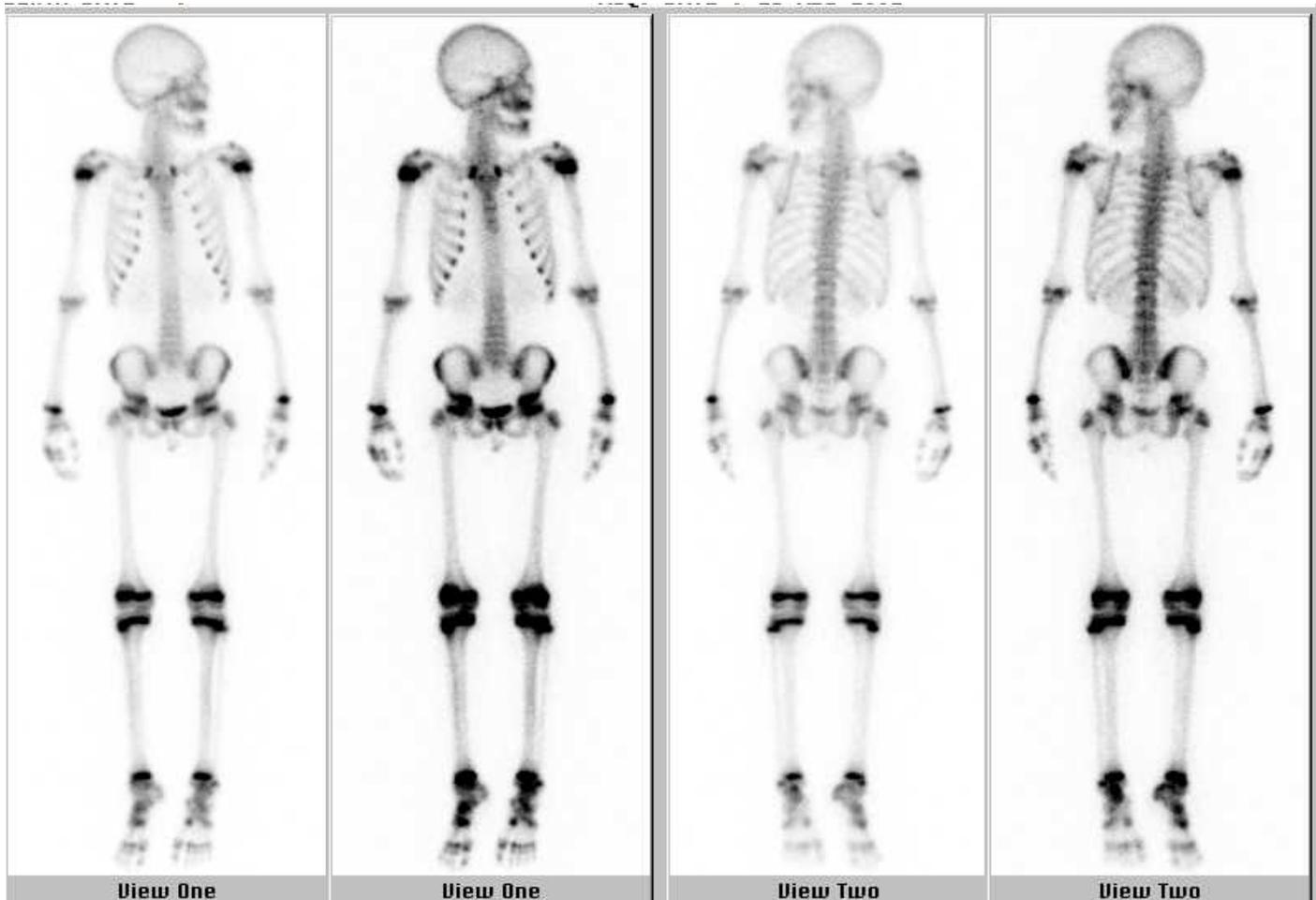
- Qual função está sendo estudada?



Estudos Fisiológicos

^{99m}Tc -MDP

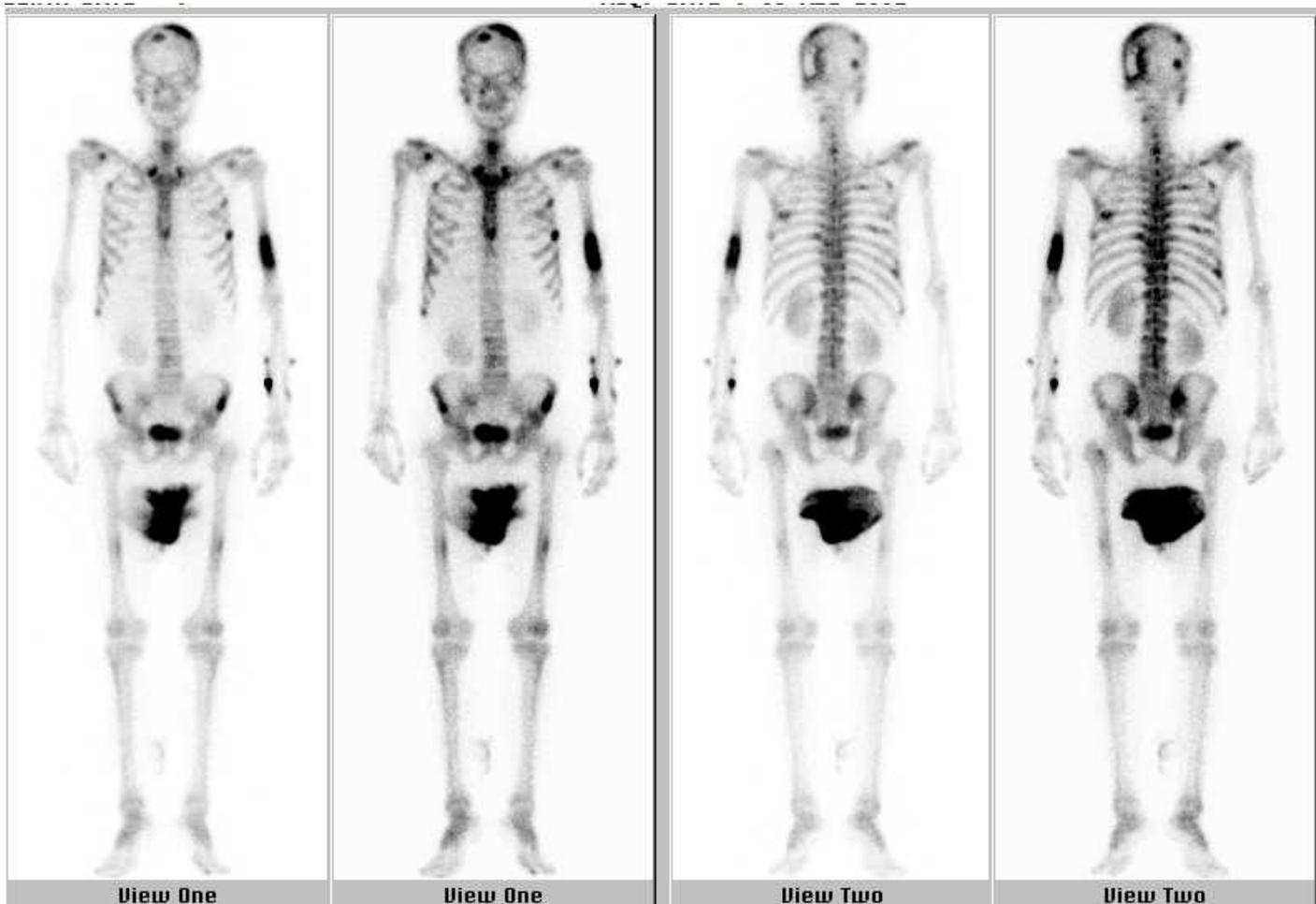
- Qual função está sendo estudada?



Estudos Fisiológicos

^{99m}Tc -MDP

- Qual a anormalidade observada?

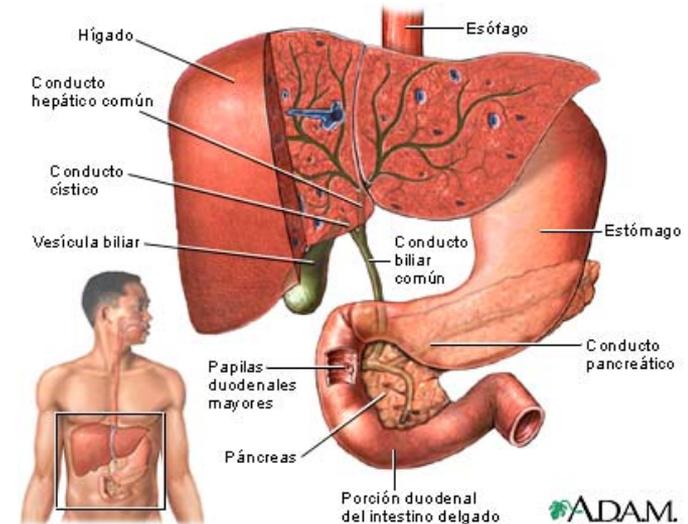
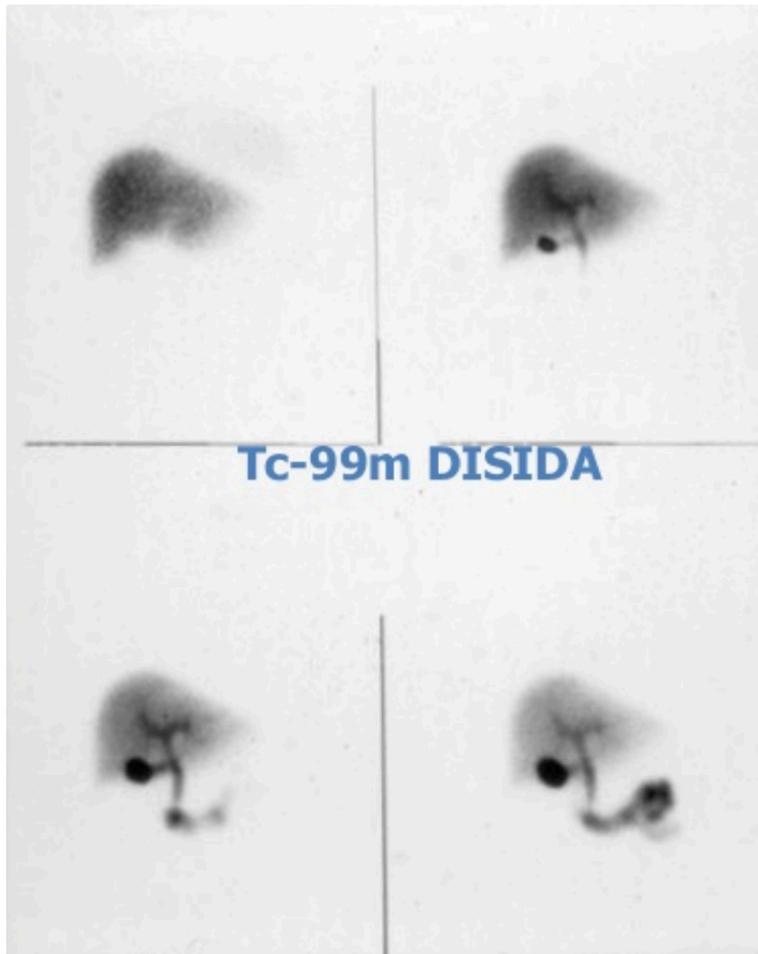


Estudos Fisiológicos em...

- Pneumologia
- Oncologia e Ortopedia
- **Gastroenterologia**

Estudos Fisiológicos ^{99m}Tc -DISIDA

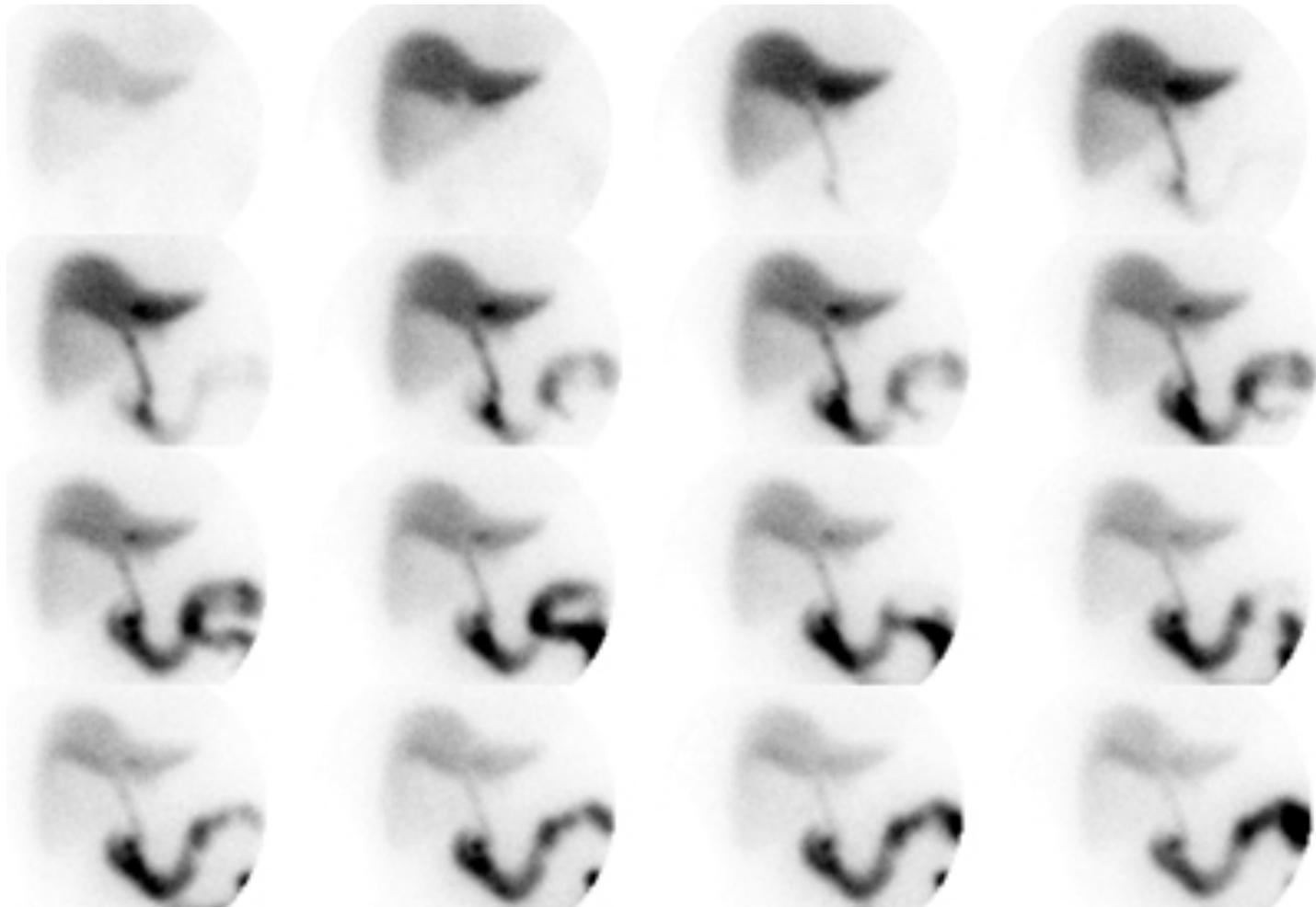
- Qual função está sendo estudada?



- Função Hepato-Biliar
- Função da Vesícula Biliar
- Patência das Vias Biliares

Estudos Fisiológicos ^{99m}Tc-DISIDA

- Qual a anormalidade observada?



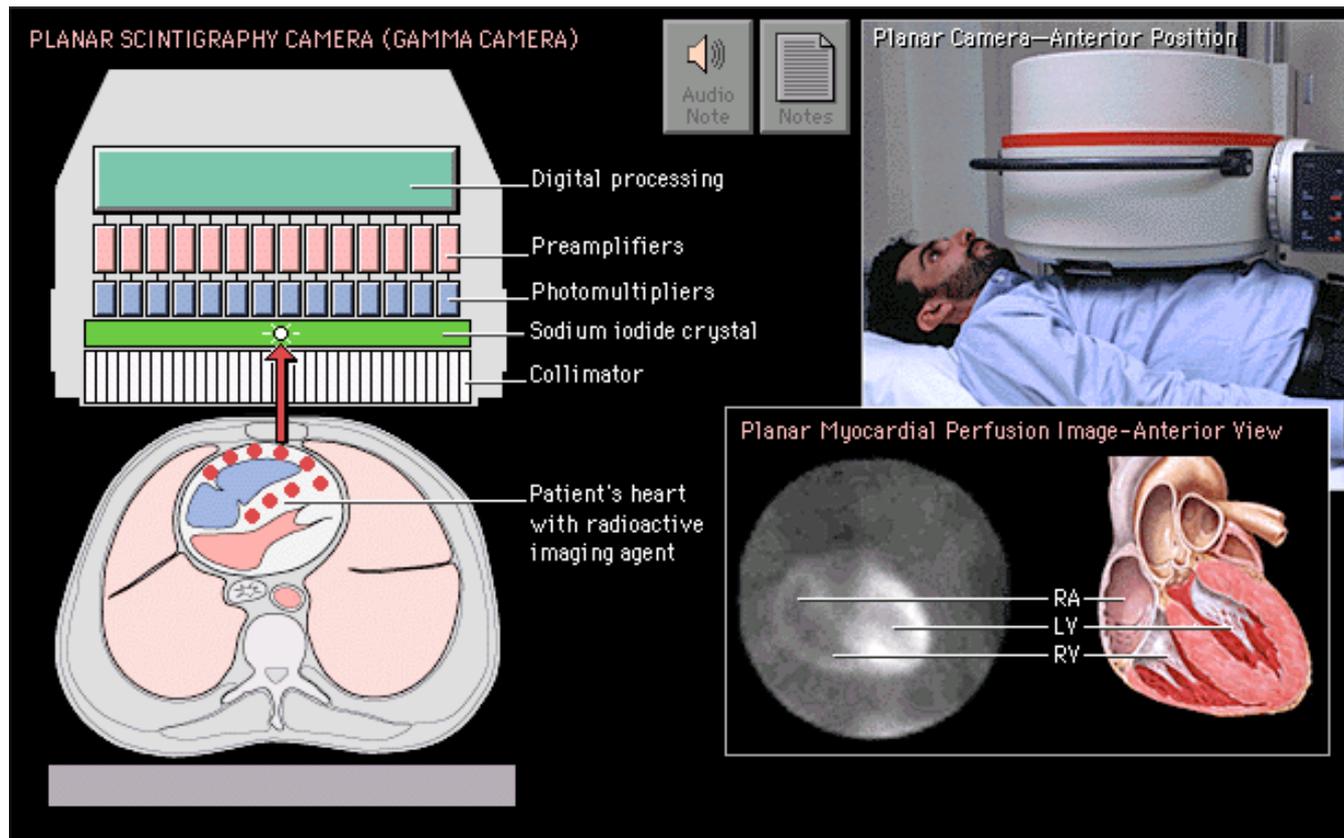
Estudos Fisiológicos em...

- Pneumologia
- Oncologia e Ortopedia
- Gastroenterologia
- **Cardiologia**

Estudos Fisiológicos

^{99m}Tc -SESTAMIBI

- Qual função está sendo estudada?



Estudos Fisiológicos

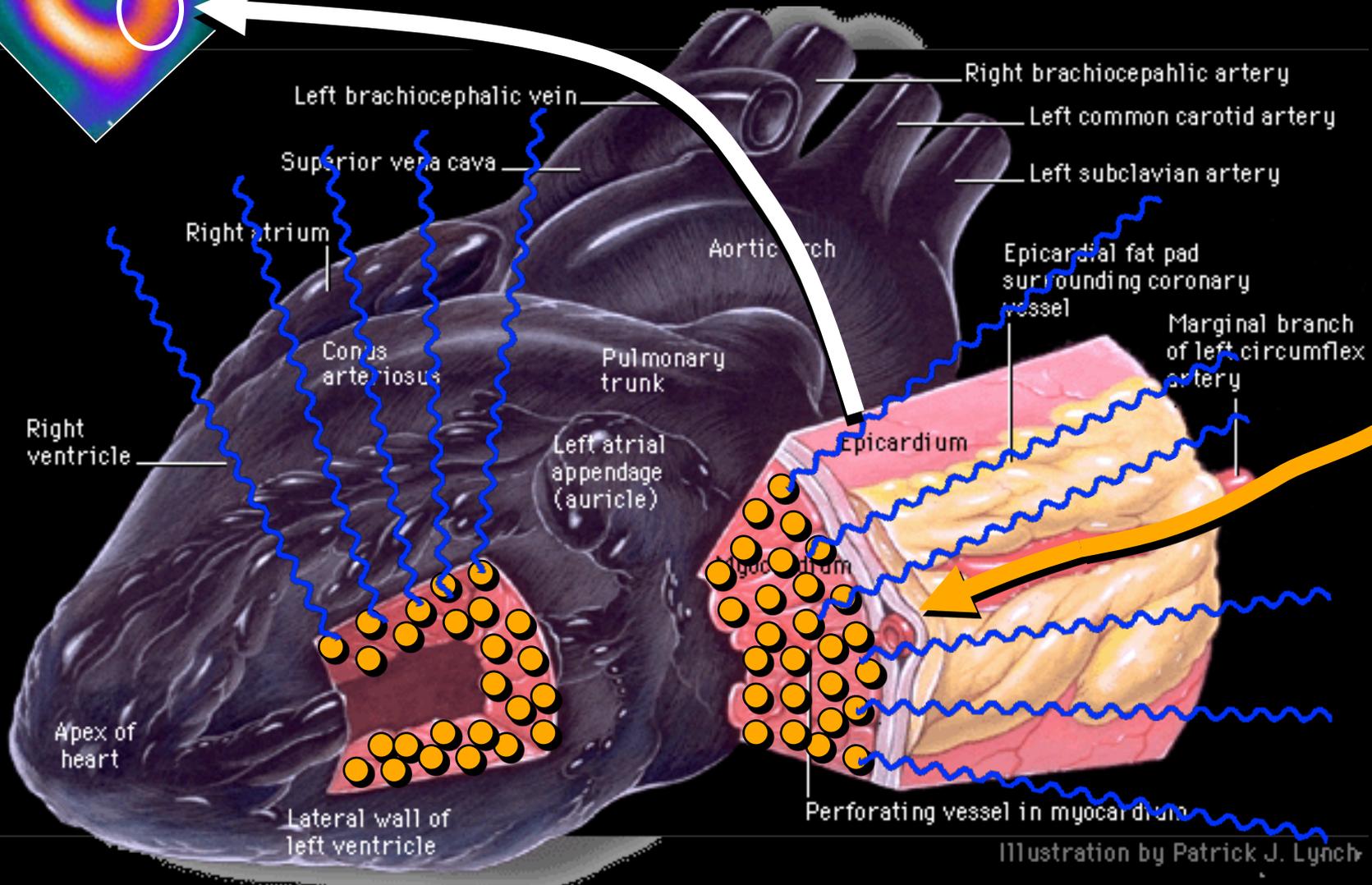
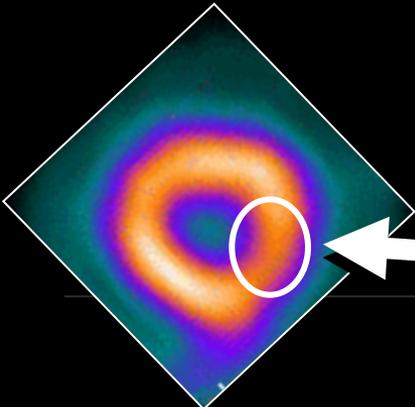
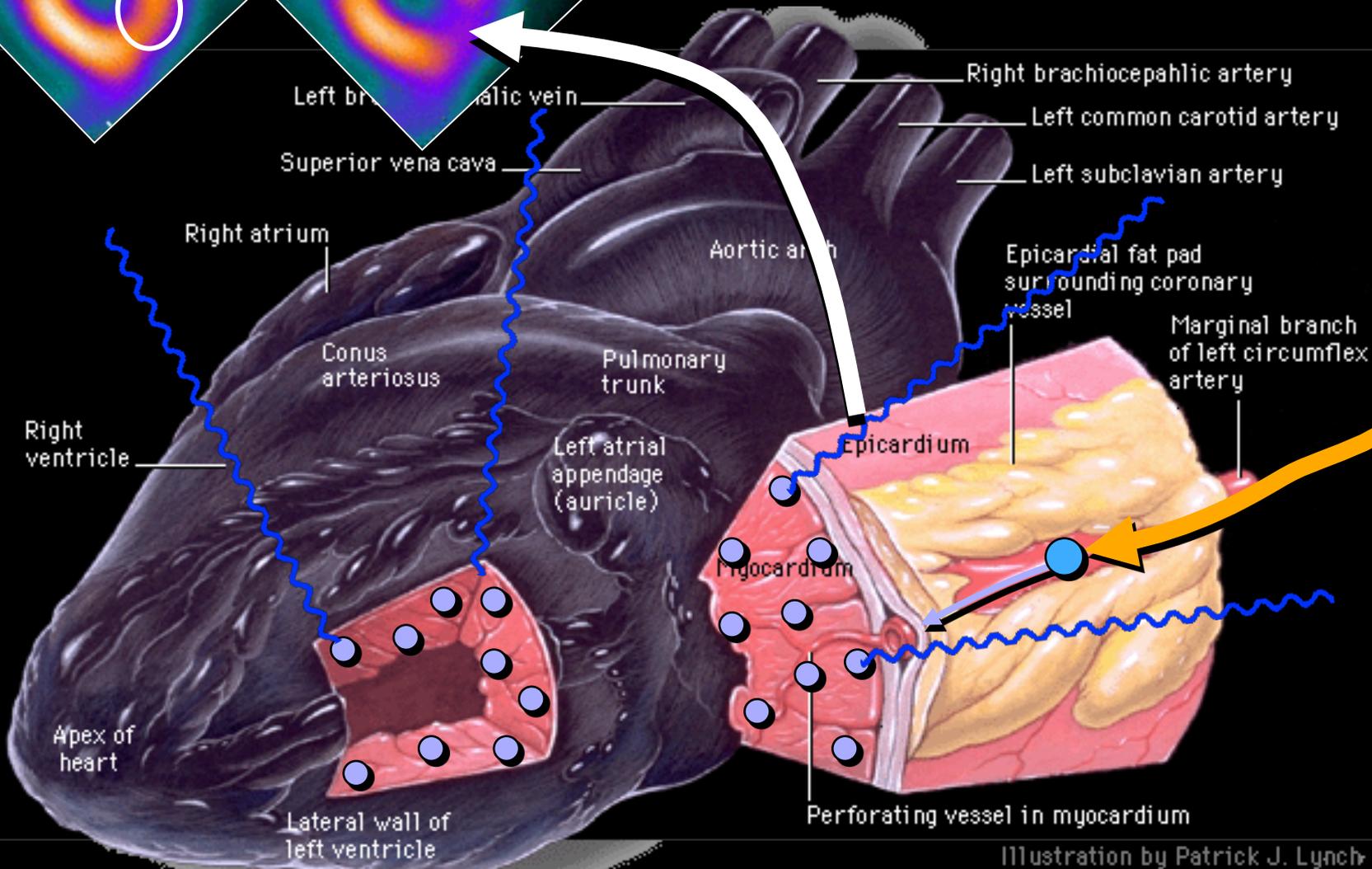


Illustration by Patrick J. Lynch

Estudios Fisiológicos

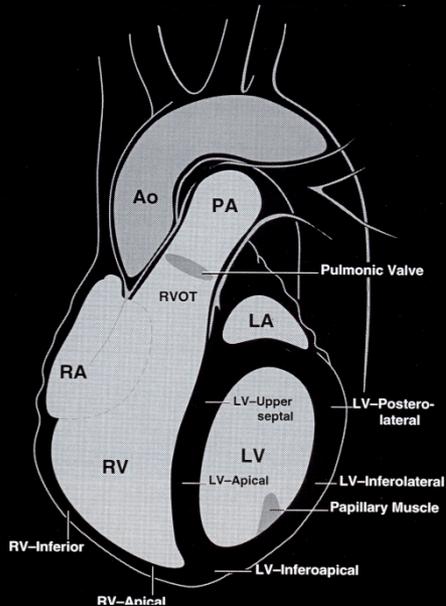


Estudos Fisiológicos

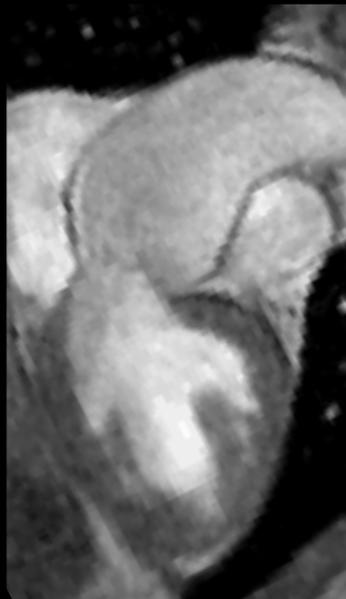
^{99m}Tc -PIROFOSFATO

■ Qual função está sendo estudada?

Anatomia Normal



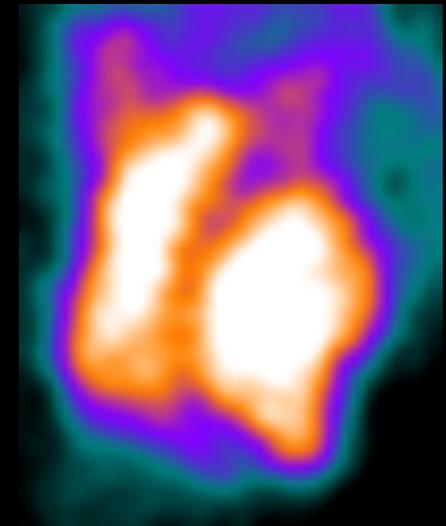
Motilidade Normal (RM)



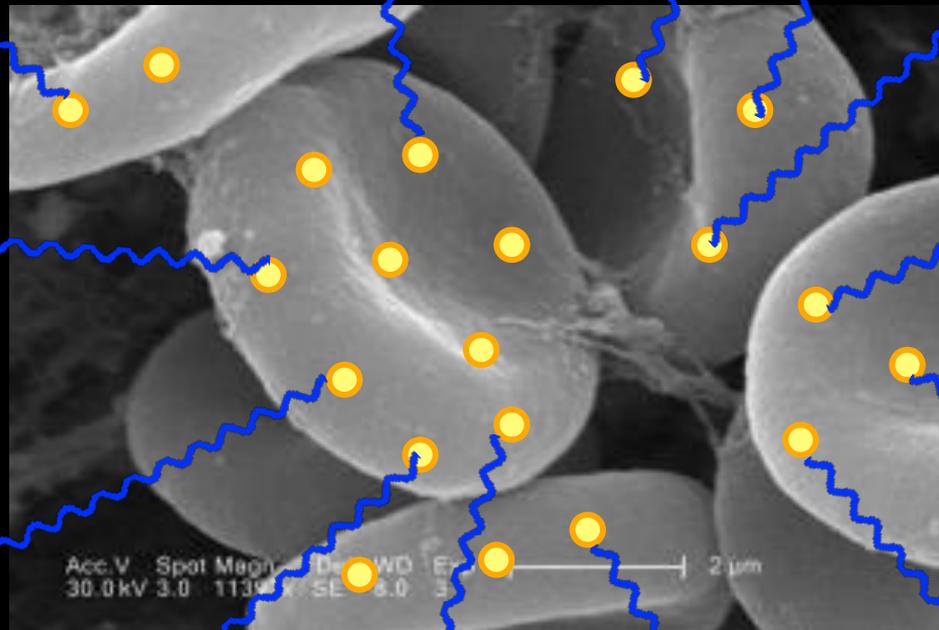
Motilidade Normal



Discinesia Apical (Aneurisma)



Marcação de Hemácias com Tecnécio^{99m}



Ventriculografia Radioisotópica

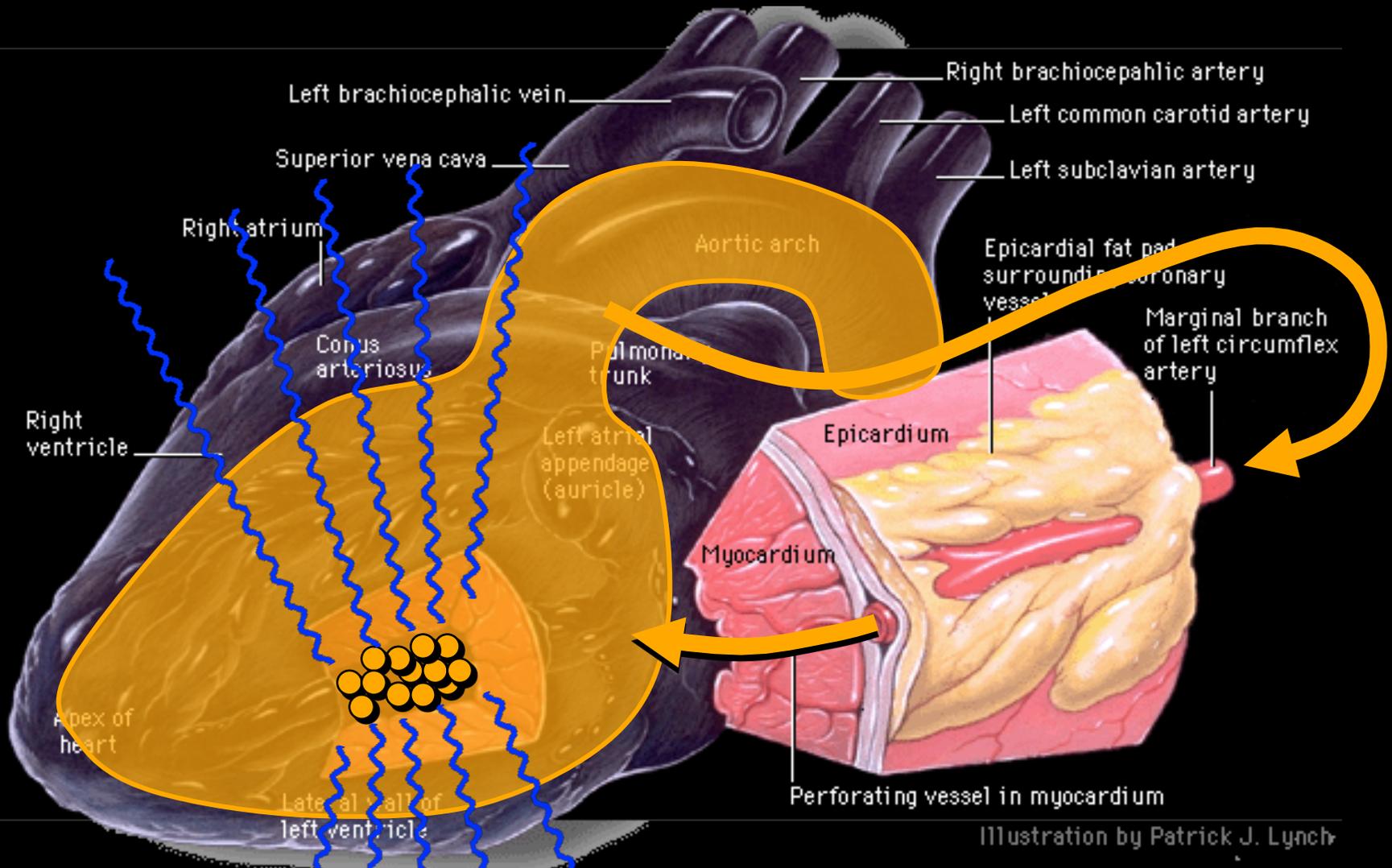
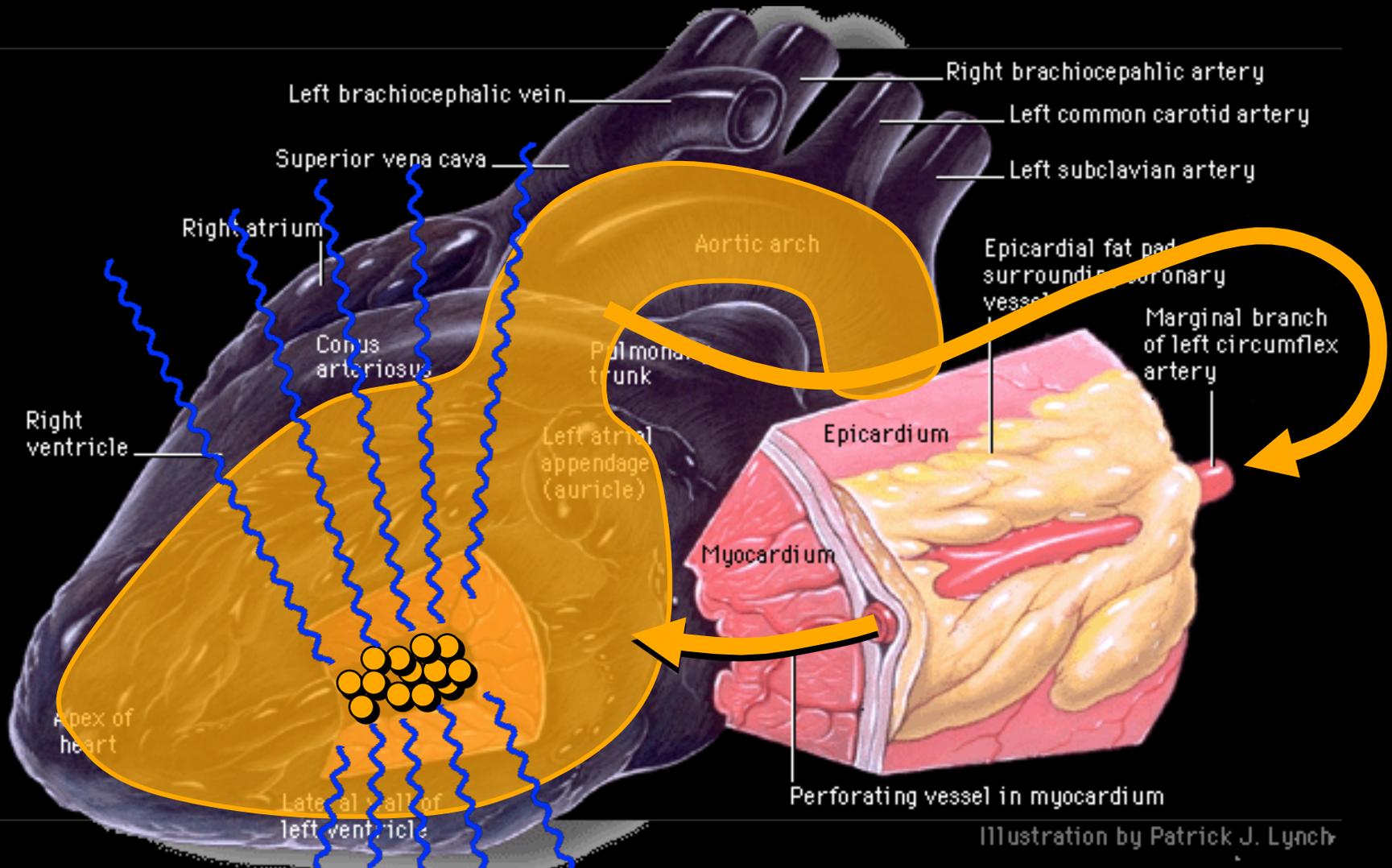


Illustration by Patrick J. Lynch

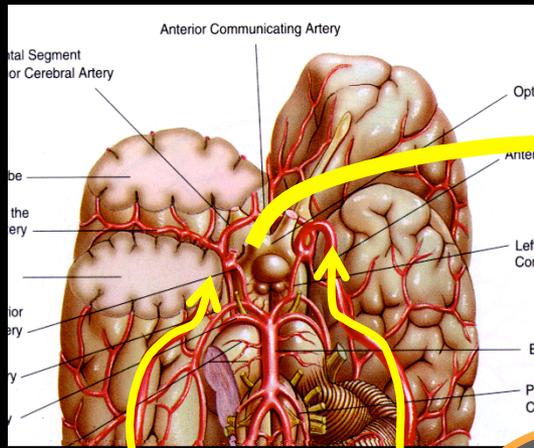
Ventriculografia Radioisotópica



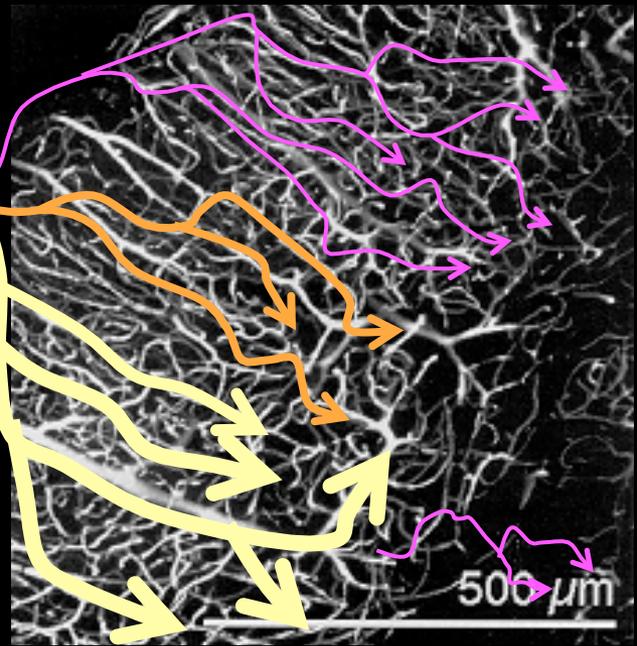
Estudos Fisiológicos em...

- Pneumologia
- Oncologia e Ortopedia
- Gastroenterologia
- Cardiologia
- **Neurologia e Psiquiatria**

2



3



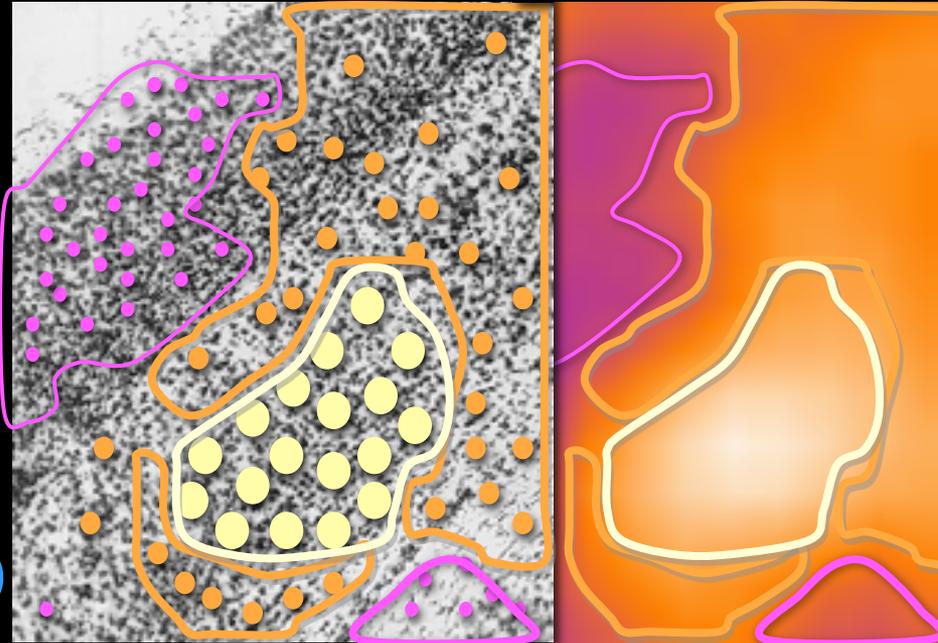
FSC 750ml/min
Vol. = 120ml

20% DC

1

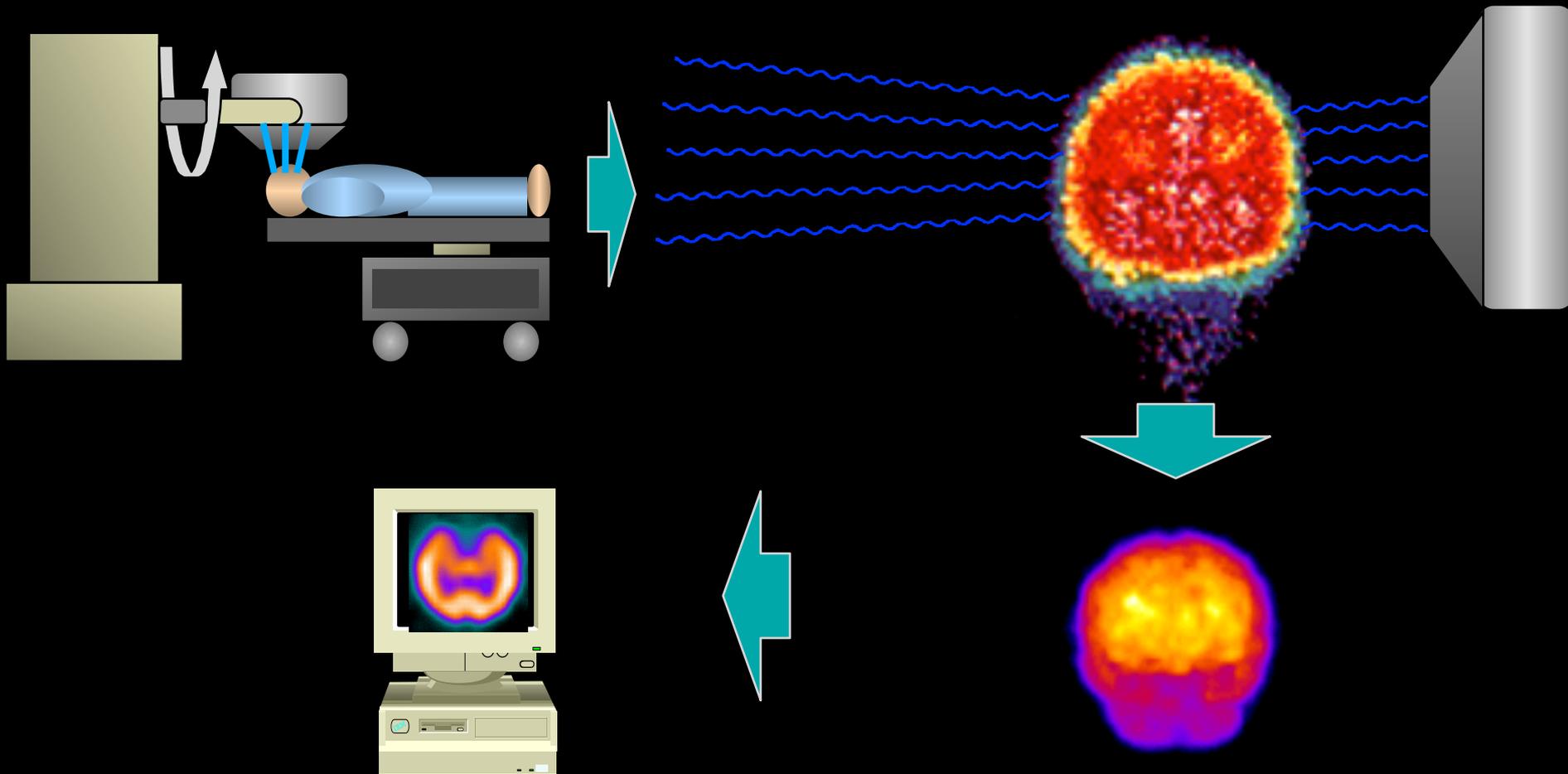


4

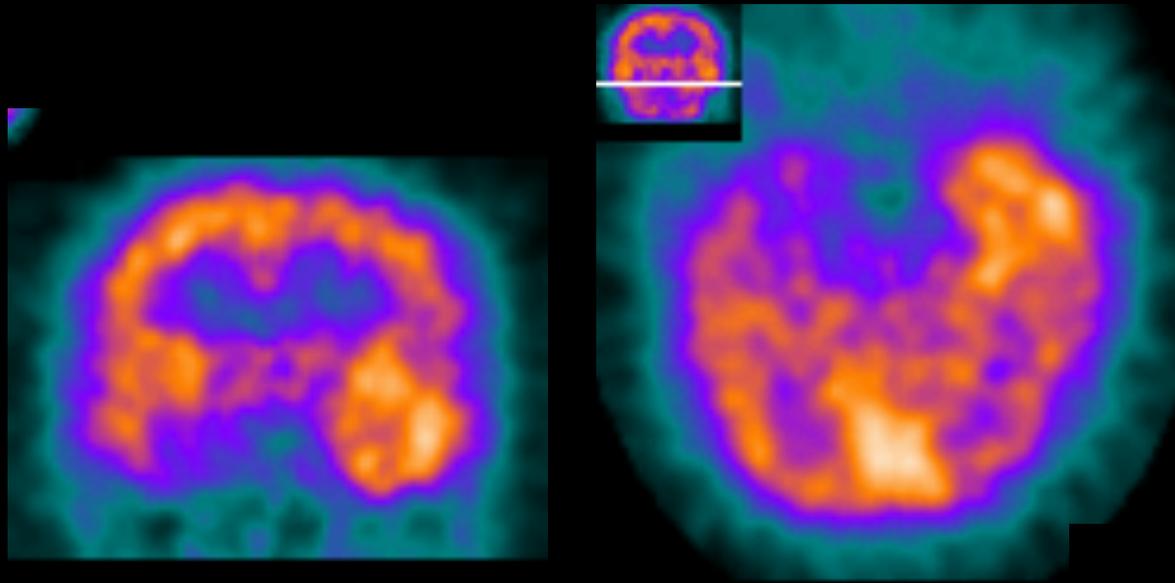


Estudos Fisiológicos

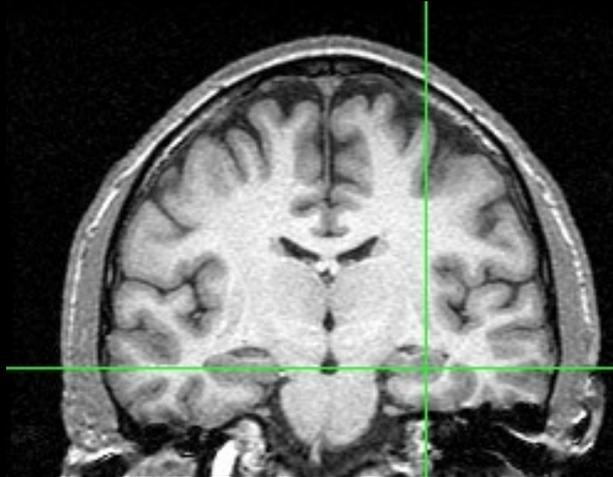
- Qual função está sendo estudada?



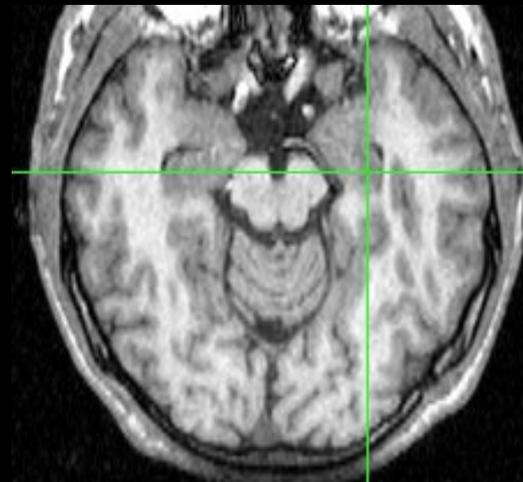
SPECT Crítico

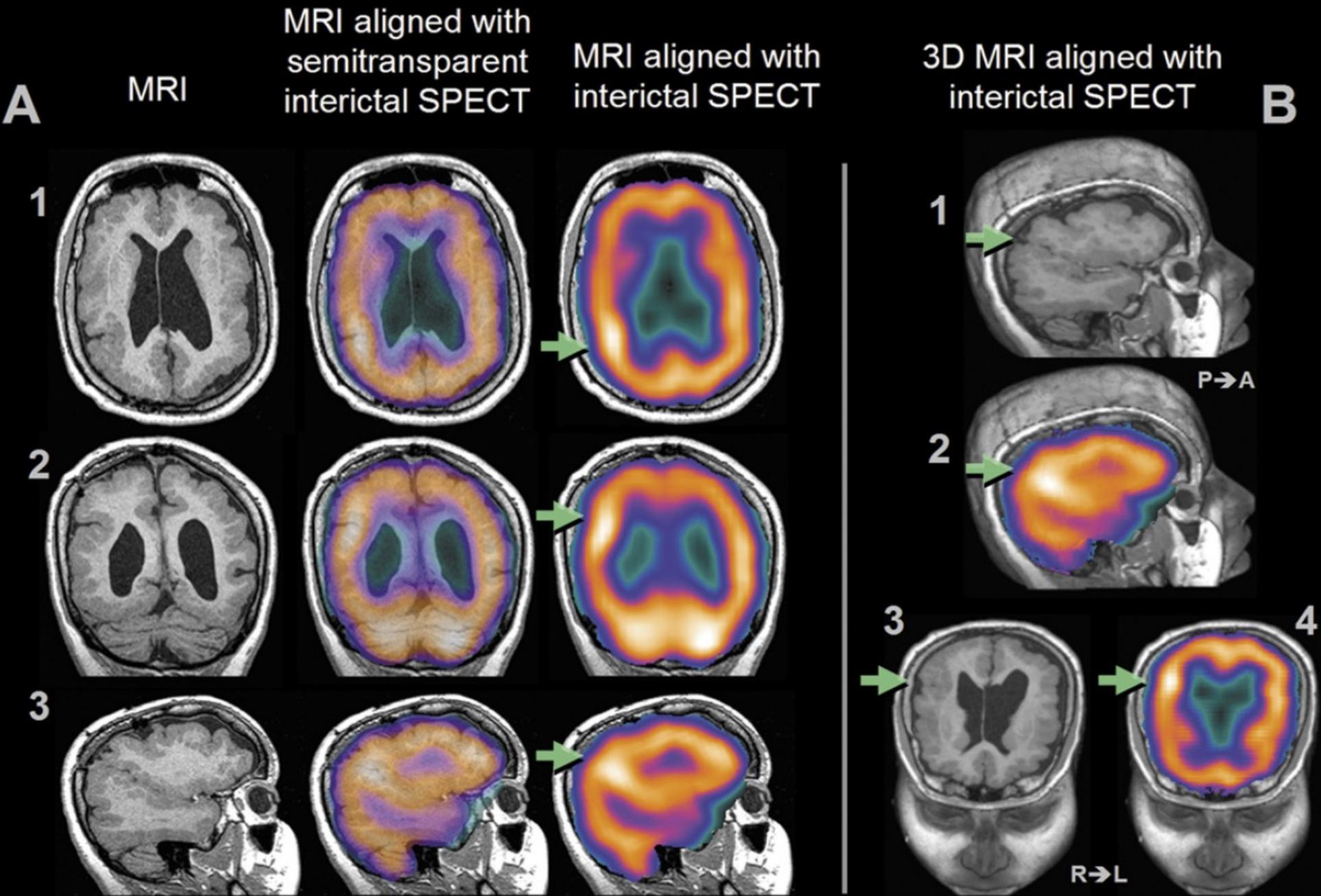


D



E





Conclusões

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