

The rationale for the OIR and EIR series

ICRP Webinar
6 December 2023

Charity 1166304 registered with the Charity Commission of England and Wales

**François Paquet
et al.**

Many ICRP publications already published on dose coefficients

For workers

Publication 30 (ICRP, 1979, 1980, 1981, 1988)

dose coefficients and ALI for inhalation and ingestion.

based on Reference man (Publication 23, 1975) and 1977 recommendations (Publication 26, 1977)

Publication 68 (ICRP, 1994)

updated dose coefficients following 1991 Recommendations (Publication 60, 1991), HRTM (Publication 66, 1994), new skeletal data (Publication 70, 1995) and revised systemic biokinetic models. No ALI anymore.

Publications 54 and 78 (ICRP, 1988, 1997)

guidance on the design of monitoring programs and the interpretation of results, to estimate doses to workers following radionuclide inhalation or ingestion. Provide predicted values of measured quantities after intake.

Many ICRP publications already published on dose coefficients

For members of the public

Publications 56, 67, 69, 71 and 72 (ICRP, 1989, 1993, 1995)

age-specific dose coefficients for inhalation and ingestion for 91 elements, using up-to-date models and latest ICRP recommendations.

Publications 88 and 95 (2001, 2004)

Dose to embryo/fetus and infants

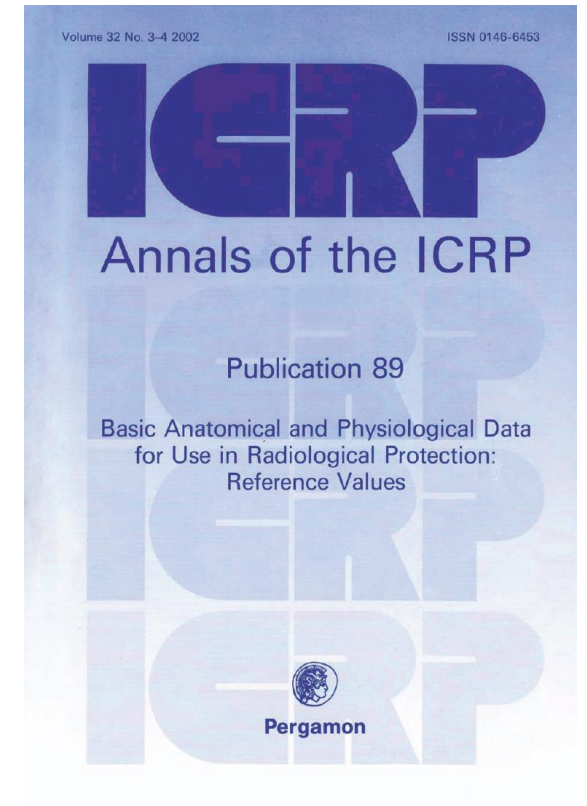
Coefficients compiled in ICRP 119, 2011

Still used in many countries

Progress and changes made since this period

In physiology and biokinetic models

- New data on Reference man (including age and sex-specific data) (ICRP 89, 2002)



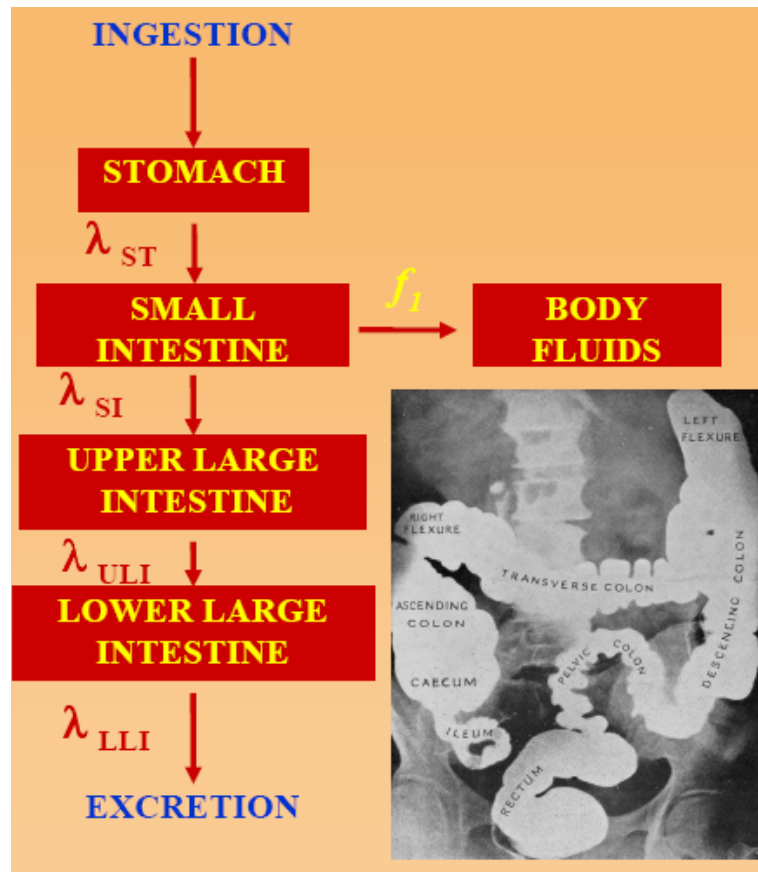
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In physiology and biokinetic models

- New data on Reference man (including age and sex specific data) (ICRP 89, 2002)
- Human Alimentary Tract Model (ICRP 100, 2006)

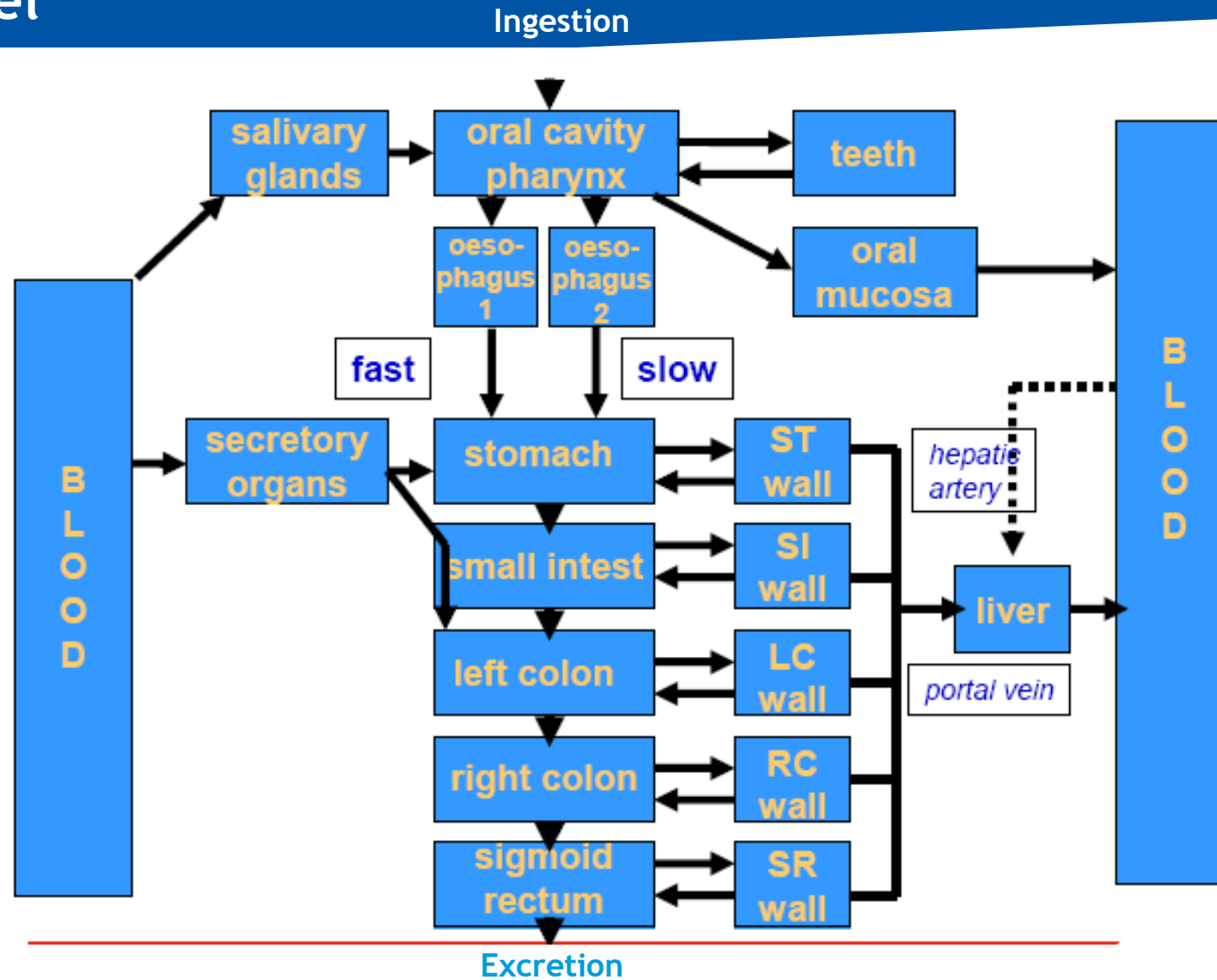
The Human alimentary tract model

The former model



The Human alimentary tract model

The new model



Progress and changes made during this period

In physiology and biokinetic models

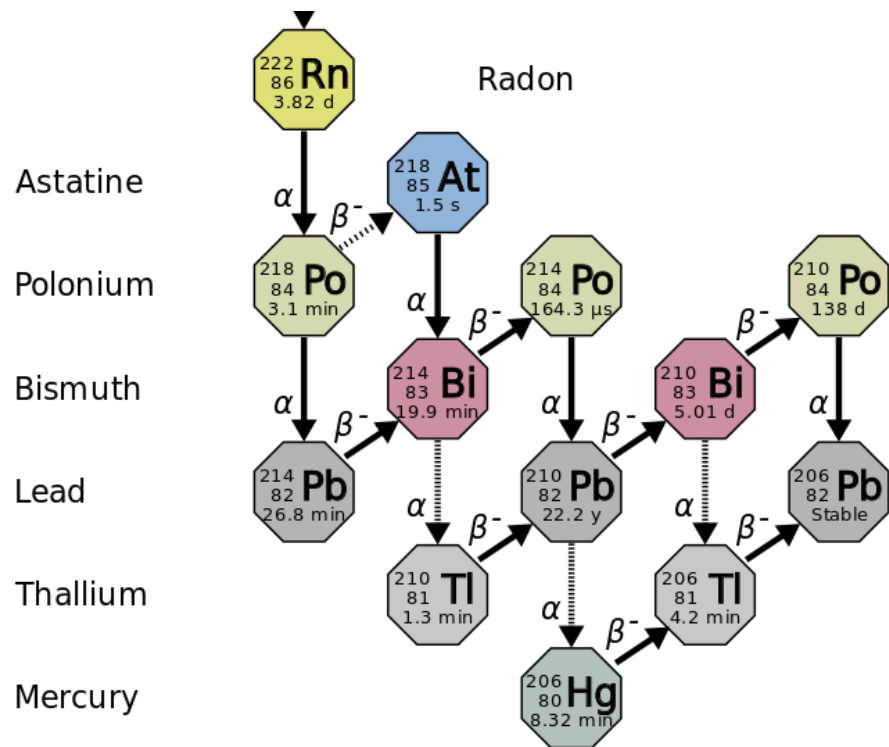
- New data on Reference man (including age and sex specific data) (ICRP 89, 2002)
- Human Alimentary Tract Model (ICRP 100, 2006)
- New element-specific systemic models, physiologically realistic (see Rich and Vlad presentations)

Progress and changes made during this period

In physiology and biokinetic models

- New data on Reference man (including age and sex specific data) (ICRP 89, 2002)
- Human Alimentary Tract Model (ICRP 100, 2006)
- New element specific systemic models, physiologically realistic
- More realistic treatment of the biokinetics of radionuclide daughters

Radon and progeny



Dose coefficients take into account the biokinetics and decay energy of the element AND those of the progeny
(see Tracy presentation)

Progress and changes made during this period

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- Human Alimentary Tract Model (ICRP 100, 2006)
- New element specific systemic models, physiologically realistic
- More realistic treatment of the biokinetics of radionuclide daughters
- New data supporting update of the Human Respiratory Tract Model (see Demetrio presentation)

Progress and changes made during this period

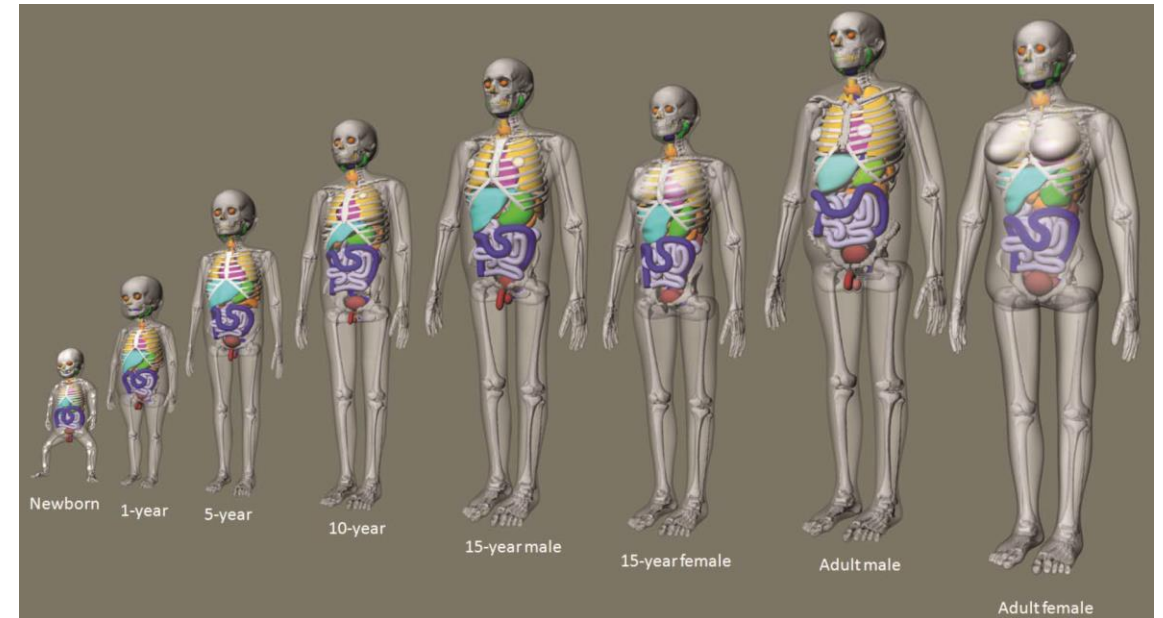
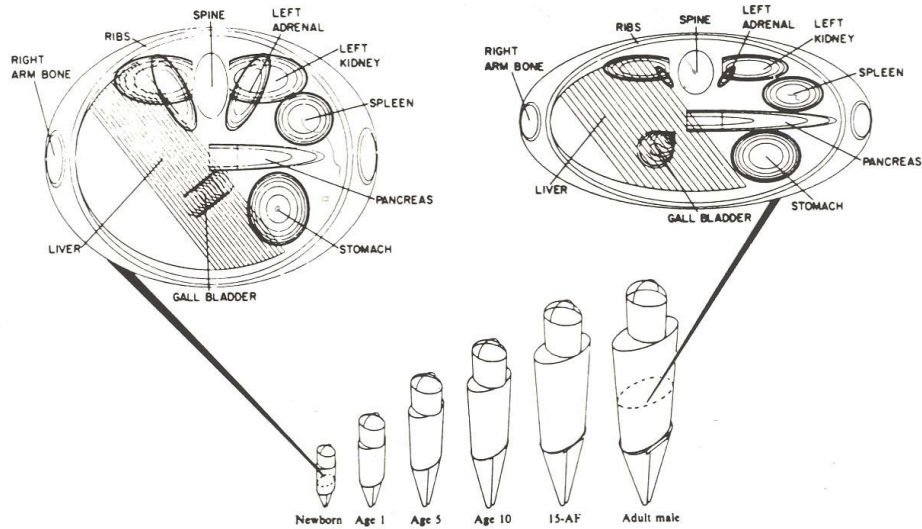
In physiology and biokinetic models

- New data on Reference man (including age and sex specific data) (ICRP 89, 2002)
- Human Alimentary Tract Model (ICRP 100, 2006)
- New element specific systemic models, physiologically realistic
- More realistic treatment of the biokinetics of radionuclide daughters
- New data supporting update of the Human Respiratory Tract Model

In dosimetry

- Development of adult and paediatric reference computational phantom, based on the new reference man (ICRP 110, 2009; ICRP 143, 2020)

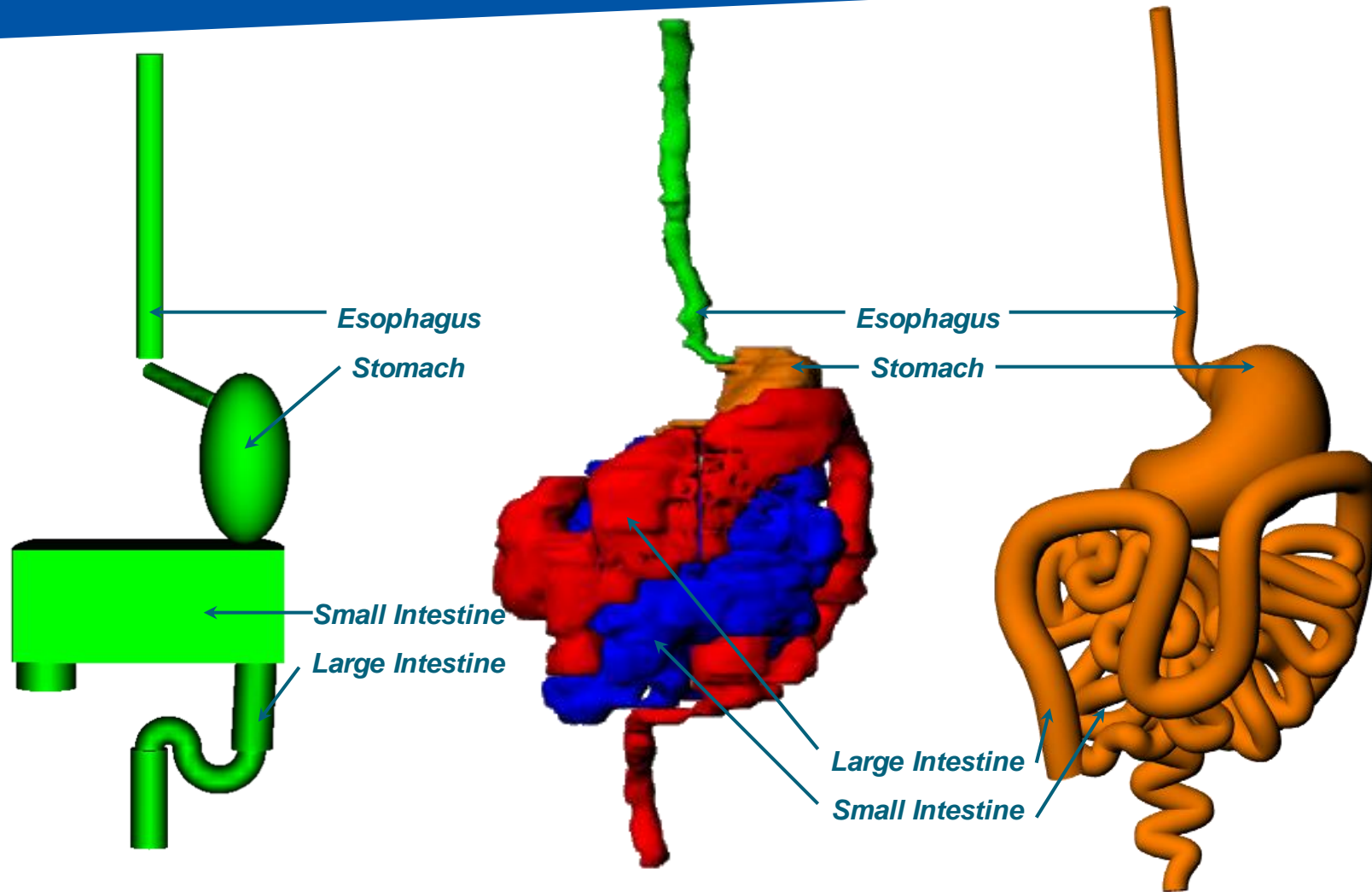
Phantoms : evolution over the years



Stylized hermaphrodite phantoms
80s

Age- and sex-specific computational phantoms

Phantoms : evolution over the years



Stylized Phantom

Voxel Phantom

Hybrid Phantom

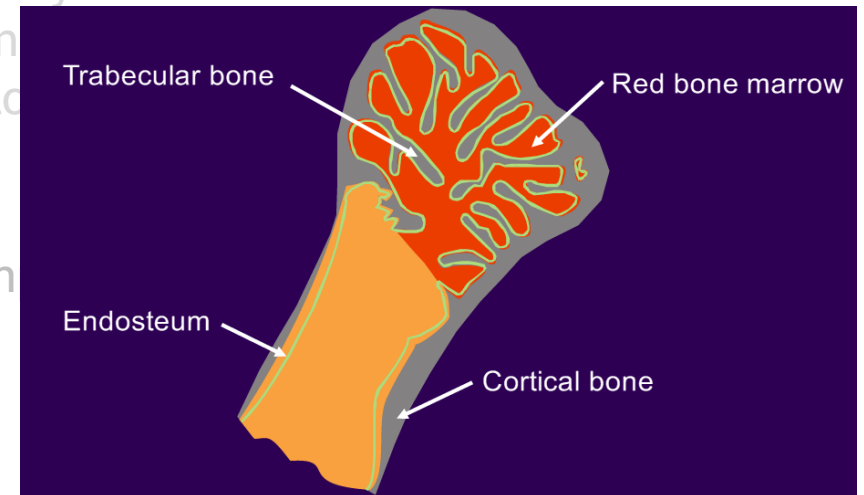
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- New data on Reference man (including age and sex specific data) (ICRP 89, 2002)
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- New element specific systemic models, physiologically realistic
- More realistic treatment of the biokinetics of radionuclides
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In dosimetry

- Development of adult and paediatric reference compartmental models (ICRP 110, 2009; ICRP 143, 2020)
- New skeletal dosimetry



ref

Target for bone cancer from 10 μ m layer to 50 μ m layer on all internal bone surfaces, excluding Haversian canals
Target for leukaemia in all red bone marrow

Progress and changes made during this period

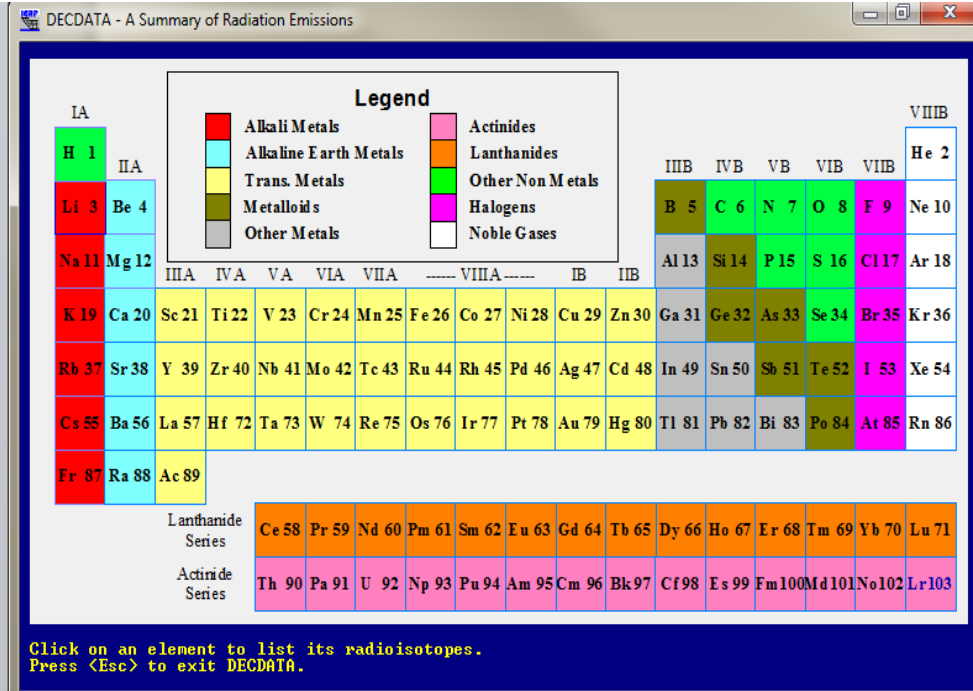
In physiology and biokinetic models

- New data on Reference man (including age and sex specific data) (ICRP 89, 2002)
- Human Alimentary Tract Model (ICRP 100, 2006)
- New element specific systemic models, physiological
- More realistic treatment of the biokinetics of radionuclides
- New data supporting update of the Human Respiratory

In dosimetry

- Development of adult and paediatric reference com
- man (ICRP 110, 2009; ICRP 143, 2020)
- New skeletal dosimetry
- Revised nuclear decay data (ICRP 107, 2008)

DECDATA - A Summary of Radiation Emissions



Legend																	
Alkali Metals	Alkaline Earth Metals	Trans. Metals	Metalloids	Other Metals	Actinides	Lanthanides	Other Non Metals	Halogens	Noble Gases								

IA																	VIIIB				
H 1																	He 2				
Li 3	Be 4															B 5	C 6	N 7	O 8	F 9	Ne 10
Na 11	Mg 12															Al 13	Si 14	P 15	S 16	Cl 17	Ar 18
K 19	Ca 20	Sc 21	Ti 22	V 23	Cr 24	Mn 25	Fe 26	Co 27	Ni 28	Cu 29	Zn 30	Ga 31	Ge 32	As 33	Se 34	Br 35	Kr 36				
Rb 37	Sr 38	Y 39	Zr 40	Nb 41	Mo 42	Tc 43	Ru 44	Rh 45	Pd 46	Ag 47	Cd 48	In 49	Sn 50	Sb 51	Te 52	I 53	Xe 54				
Cs 55	Ba 56	La 57	Hf 72	Ta 73	W 74	Re 75	Os 76	Ir 77	Pt 78	Au 79	Hg 80	Tl 81	Pb 82	Bi 83	Po 84	At 85	Rn 86				
Fr 87	Ra 88	Ac 89																			
Lanthanide Series		Ce 58	Pr 59	Nd 60	Pm 61	Sm 62	Eu 63	Gd 64	Tb 65	Dy 66	Ho 67	Er 68	Tm 69	Yb 70	Lu 71						
Actinide Series		Th 90	Pa 91	U 92	Np 93	Pu 94	Am 95	Cm 96	Bk 97	Cf 98	Es 99	Fm 100	Md 101	No 102	Lr 103						

Click on an element to list its radioisotopes.
Press <Esc> to exit DECDATA.

Progress and changes made during this period

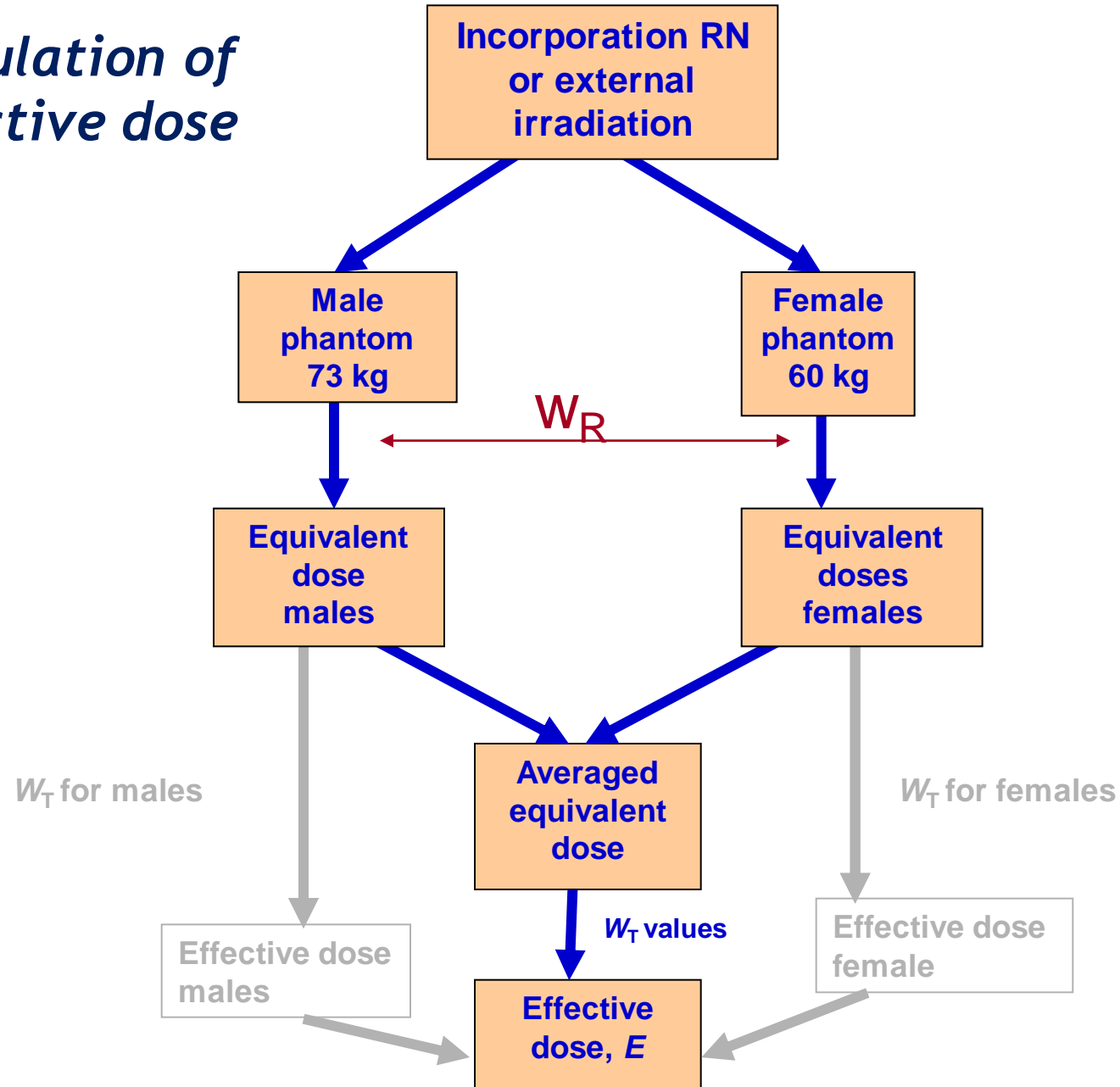
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- New data supporting update of the Human Respiratory Tract Model

In dosimetry

- Development of adult and paediatric reference computational phantom, based on the new reference man (ICRP 110, 2009; ICRP 143, 2020)
- New skeletal dosimetry
- Revised nuclear decay data (ICRP 107, 2008)
- Changes in weighting factors (ICRP 103, 2007)
- Changes in calculation of effective dose (ICRP 103, 2007)

Calculation of effective dose



Reference male or female

Reference person

Progress and changes made during this period

In physiology and biokinetic models

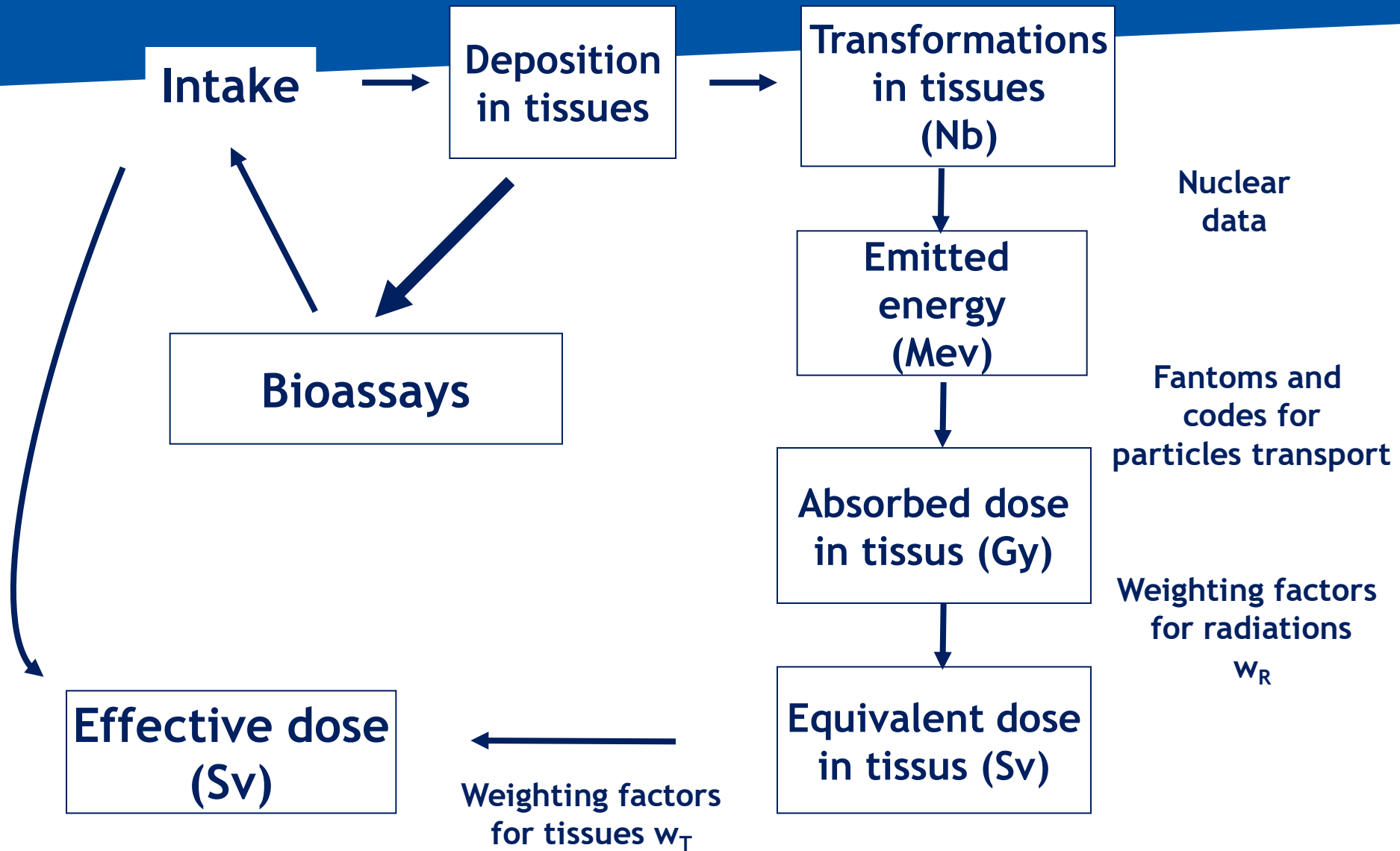
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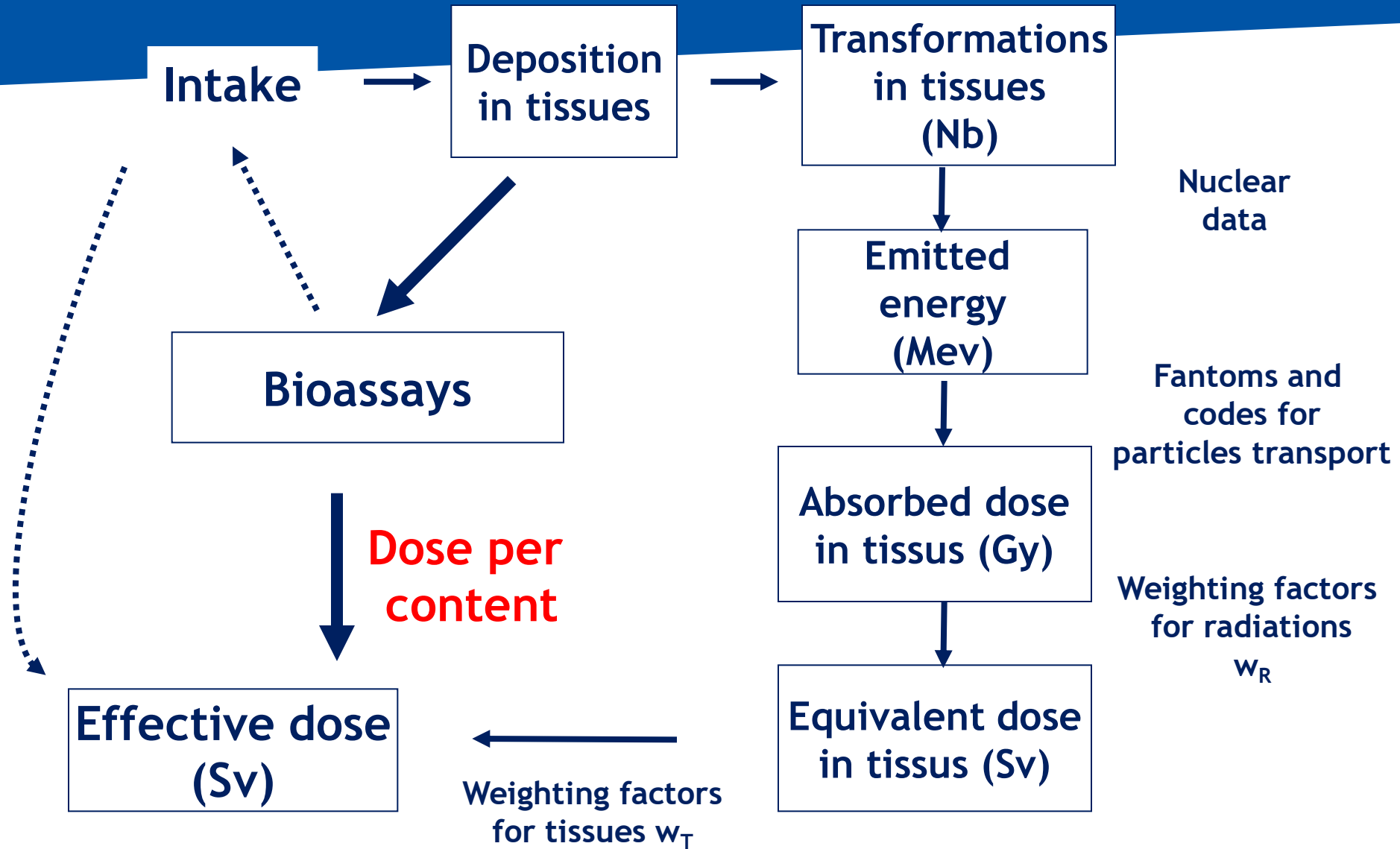
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In monitoring

- Concept of dose per content





Progress and changes made during this period (con't)

These new data and recommendations support a revision of previous reports and provision of new dose coefficients with guidance on monitoring programs and data interpretation

**Done for external dosimetry (ICRP 116, 2010)
Should be completed for internal dosimetry**

Revision of the reports on internal exposure

Division of the work in two parts :

- Revision of models and dose coefficients for workers (*OIR series*)
- Revision of models and dose coefficients for members of the public (*Age dependant series, Embryo and fetus, maternal transfer,..*)

OIR series for workers

5 publications from 2015 to 2022
ICRP Publications 130, 134, 137, 141, 151

Review of data on inhalation, ingestion and systemic behaviour

Biokinetic models and data

Monitoring techniques and detection limits

Coefficients and bioassay functions for about 1200 isotopes

Different chemical forms at workplaces

Particulate size from 0.001 μm to 20 μm

Exposure by submersion for noble gases

Production of the app data viewer

Open access data on www.icrp.org



OIR series for workers

OIR Part 1

Methods

OIR Part 2

Hydrogen (H), Carbon (C), Phosphorus (P), Sulphur (S), Calcium (Ca), Iron (Fe), Cobalt (Co), Zinc (Zn), Strontium (Sr), Yttrium (Y), Zirconium (Zr), Niobium (Nb), Molybdenum (Mo) and Technetium (Tc).

OIR Part 3

Ruthenium (Ru), Antimony (Sb), Tellurium (Te), Iodine (I), Caesium (Cs), Barium (Ba), Iridium (Ir), Lead (Pb), Bismuth (Bi), Polonium (Po), Radon (Rn), Radium (Ra), Thorium (Th) and Uranium (U).

OIR Part 4

Lanthanides series, actinium (Ac), protactinium (Pa) and transuranic elements

OIR Part 5

Be, N, O, F, Na, Al, Si, Cl, Ar, K, Sc, Ti, V, Cr, Mn, Co, Ga, Ge, As, Br, Kr, Rb, Rh, Pa
Cd, In, Sn, Xe, Hf, Te, W, Re, Os, Pt, Au, Hg, Th, As, Fr

EIR series for members of the public

- Replace ICRP 56 series and ICRP 119
- Dedicated to members of the public at age of 3mo,1,5,10,15 y, adult
- Physiological data specific to the public (i.e. breathing rate) and to different ages (tissues masses, transfert rates, etc..)

Content

- Review of data on inhalation, ingestion and systemic behaviour
- Age-dependant biokinetic models and data
- No data for bioassays
- Dose coefficients for about 1200 isotopes
- Chemical forms from worklaces plus organic forms
- Data for particule size from 0.001 μm to 20 μm

- Data available using data viewer to download from ICRP website

EIR series for members of the public

Schedule

Part 1 (29 elements) in Press

Hydrogen, Carbon, Phosphorus, Sulphur, Calcium, Iron, Cobalt, Nickel, Zinc, Selenium, Strontium, Yttrium, Zirconium, Niobium, Molybdenum, Technetium, Ruthenium, Silver, Antimony, Tellurium, Iodine, Caesium, Barium, Iridium, Lead, Bismuth, Polonium, Radon, and Radium.

Part 2-3 (every other elements) between 2023 and 2025

Part 4-5 (embryo/foetus and infants) from 2026 to 2027

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