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IDAC2.0 a new generation of internal dosimetric calculations for diagnostic examinations in nuclear medicine

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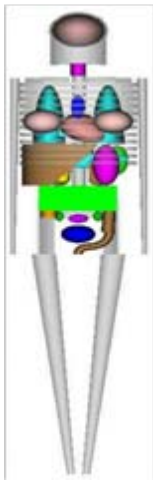
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Introduction

Internal Dose Assessment by Computer (IDAC)



Cristy & Eckerman (1987)
Male phantom

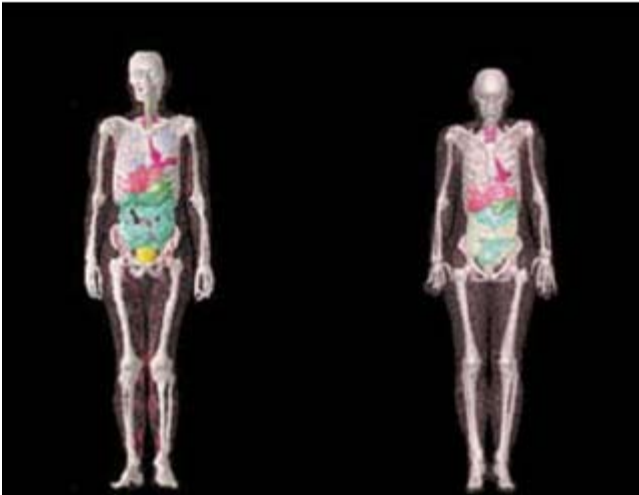
- IDAC1.0 was developed in 1987
- Used by ICRPs Task Group 36
- Made estimation of patient dose from radiopharmaceuticals
- IDAC1.0 used the family phantoms of Cristy & Eckerman
- No graphical user interface



Aim

Develop a new program IDAC2.0
that includes:

- ICRP/ICRU adult computational reference voxel phantoms
 - Gender specific
 - With 63 source and 73 target regions
- MC simulated electrons
- The ICRP publ. 100 Human alimentary tract model
- The ICRP publ. 103 Tissue weighting factor
- A graphical user interfaces



ICRP adult reference male and female computational phantoms (2009)



Effective and absorbed dose calculations

$$D(r_T, T_D) = \sum_{r_S} \tilde{A}(r_S, T_D) S(r_T \leftarrow r_S)$$
$$S(r_T \leftarrow r_S) = \sum_i \Delta_i \Phi(r_T \leftarrow r_S, E_i)$$

where $\Phi(r_T \leftarrow r_S, E_i)$ is taken from the adult male and female ICRP/ICRU reference computational voxel phantoms, and the mean energy per nuclear transformation $\Delta_{R,i}$ is from the ICRP publication 107

$$E = \sum_T w_T \sum_R w_R \left[\frac{D_R(r_T, T_D)^{Male} + D_R(r_T, T_D)^{Female}}{2} \right]$$

w_R and w_T is radiation and tissue weighting factors from ICRP publication 103



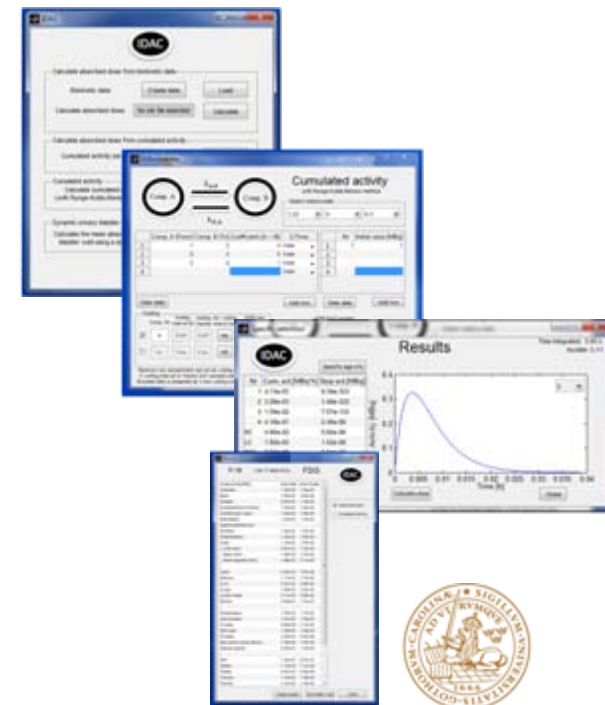
IDAC2.0 - The program

Three possible calculation methods

Biokinetic data

Cumulated activity

Transfer factors



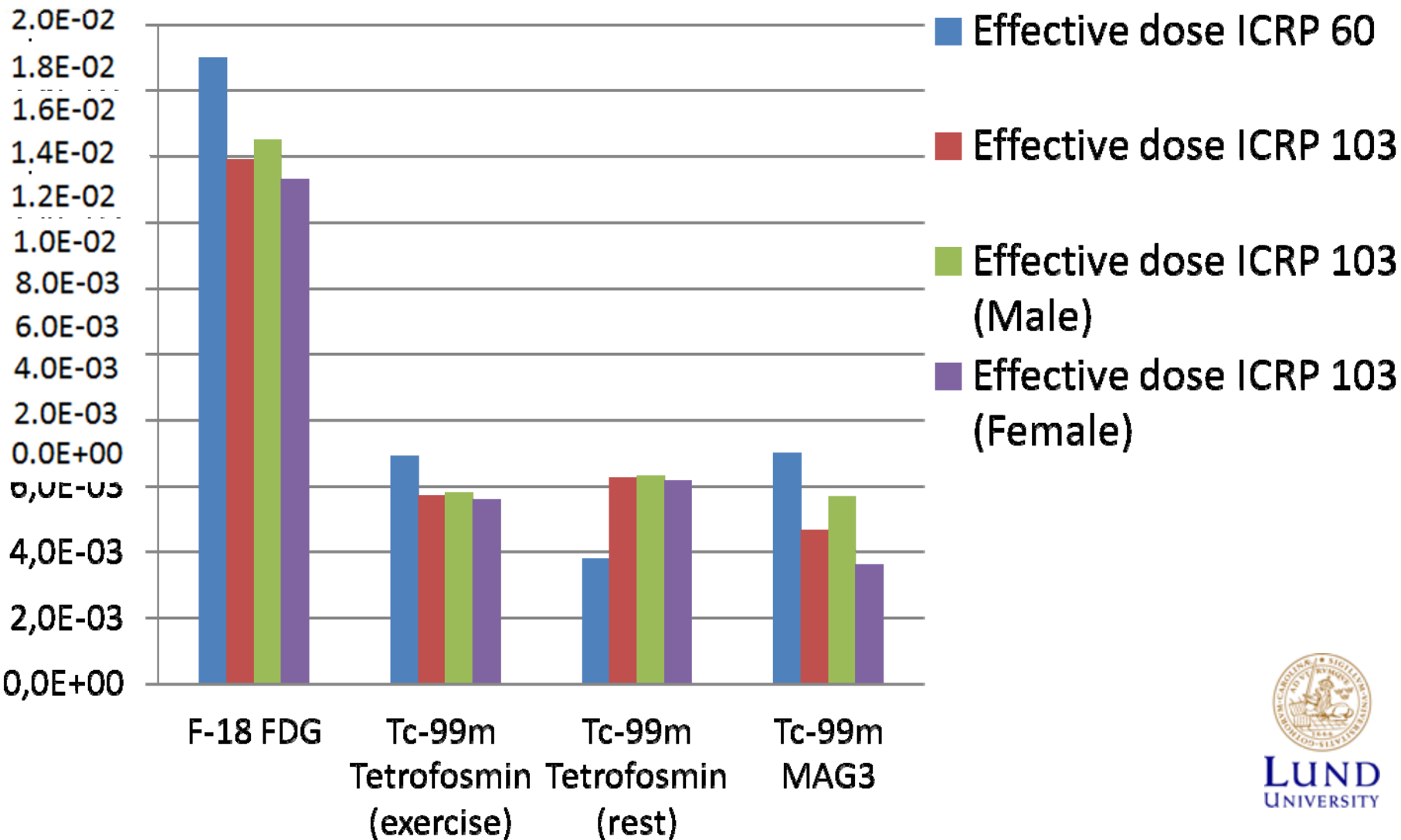
Methods – Validation

The computer code of IDAC2.0 was validated against:

- The radiopharmaceuticals published by Zankl *et al.* (2012), using the same SAF values
- Manual Excel calculations



Results - Effective dose [mSv/MBq]



Results

The effective dose are in 69% of the cases lower with the new voxel phantom and the new tissue weighting factor

The effective dose is in 61% of the cases higher to the female phantom than to the male



Conclusion

The new IDAC2.0 makes more realistic dose calculations

Adopting the new phantom makes it possible to incorporate the Human Alimentary Tract model.

With the new adult phantoms the effective dose can be calculated with the new tissue weighting factors from ICRP publication 103.



Thank you for listening



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