

# Compendium of Medical Physics, Medical Technology and Biophysics

for students, physicians and researchers

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Version of December 2009, 434 pages.

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Amsterdam

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This compendium describes from the physical point of view in simple concepts the principle of working of some 120 methods, techniques, apparatus and equipment used in medical practice. These subjects, divided in about 200 chapters, grouped in 12 sections (such as "Transport", "Vision"), have been written for especially students in medicine, medical biology, medical information and other medical disciplines. However, the text is also readable for clinicians and other academic physicians, and moreover for paramedical scientists, engineers and technicians with a higher education.

This compendium gives for some subjects more explanation than one would expect in a typical compendium. For extensive explanation, especially when it respects derivation of equations the reader is directed to textbooks and other publications (journals, the internet).

The subject descriptions comprise three parts.

The first one, "**Principle**" gives the basic principles.

"**Application**" is devoted to medical applications, but often also gives a very comprehensive description of applications in science, technology and daily live. In many cases "Application" does not literally consider a method, but the physical behavior of a biomaterial, organ or tissue governed by the described working principle.

A more detailed description of "Principle" can be found in "**More Info**". In general, this last part is also readable for students in the above mentioned disciplines, but in other cases it gives details and occasionally equations that require more knowledge of physics and mathematics.

The compendium has not yet been finished (various subject descriptions are still under construction). Underlined blue text fragments refer to chapters (some are in preparation).

To write the compendium innumerable sources, especially in the internet, papers in biomedical journals and textbooks are scrutinized. Important ones are given at the end of the subject descriptions. Many text fragments, figures and tables of the Wikipedia Free Encyclopedia were used. I greatly acknowledge all the concerning institutions and their authors for the free use of their material.

This compendium (a slightly shorter version with a different lay-out) can also be found at other websites:

<http://onderwijs1.amc.nl/medfysica/compendium.htm> (normal size)

<http://onderwijs1.amc.nl/medfysica/compendium2.htm> (PDA format)

I hoop that this electronic book meets a need, since comprehensive books in this field accessible for non-physicists are scarce.

I would very much like to obtain comments about obscurities, errors, etc. in order to improve this publication ([n.a.schellart@amc.uva.nl](mailto:n.a.schellart@amc.uva.nl), telefax +31-20-6917233, dept. of Biomedical Engineering and Physics, PO Box 22660, 1100 DD, Amsterdam).

### **What is new in the last 2009 version?**

Particle-X-ray interaction

Many rewordings and other improvements.

Nico A.M. Schellart, December 2009.

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Spirometry  
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### **Light and Optics**

CCD camera  
Chemoluminescence and Bioluminescence  
Dichroism  
Endoscopy  
Fiber optics  
Fluorescence  
Fluorescence resonance energy transfer (FRET)

- Fluoroscopy
- Holography and mass image storage
- Huygens' principle
- Interferometry
- Lambert-Beer law
- Laser
- Light
- Light: beam splitter
- Light: diffraction
- Light: Fresnel equations
- Light: the ideal lens
- Light: polarization
- Light: refraction
- Light: scattering
- Light: sources
- Light: units of measure
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- Optical microscopy
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- Optical microscopy: fluorescence
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- Phosphorescence
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## **Radiation**

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- Bioelectromagnetics
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- Diaphanography and optical mammography
- Electron diffraction
- Electron microscopy
- Electron microscopy: transmission EM
- Electron Spin Resonance (ESR)
- Gamma camera
- Image processing: 3D reconstruction
- Magnetobiology
- Mobile phone radiation risk
- MRI: Diffusion MRI
- MRI: functional MRI
- MRI: general
- MRI: other specialized types
- MRI: safety technology
- MRI: T1 and T2 relaxation
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- PET
- Planck's law
- Raman spectroscopy
- SPECT
- Spectroscopy
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- Thermography
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- Wien's displacement law
- X-ray machine
- X-ray microscopy

## **Sound and ultrasound**

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- Contrast enhanced ultrasound, CEU
- Doppler echocardiography
- Echography
- Optoacoustic imaging
- Phonocardiography
- Sound and Acoustics
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### **Hearing and Audiometry**

- Audiology
- Bone conduction
- Echolocation by marine mammals
- Otoacoustic Emission
- Physics of outer ear
- Physics of middle ear
- Physics of cochlea
- Sonotubometry
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- Tympanometry
- Vestibular mechanics

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- Bioelectricity: chemical synapse
- Bioelectricity: electrical synapse
- Bioelectricity: electrotonic propagation
- ECG: augmented limb leads
- ECG: basic electrocardiography
- ECG: body surface mapping
- ECG: hexaxial reference system
- ECG: vectorcardiography
- ECG: 12-lead ECG
- Electroencephalography
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- Electromyography
- Lorentz force
- Magnetoencephalography (MEG)
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