Oak Ridge

*Talk prepared for WHO/IAEA
Seminar on Training and
Education in Med. Physics
Kiel, Federal Republic of
Germany, 10-22
April 1972*

THE TRAINING OF MEDICAL PHYSICISTS
SOME EXISTING TRAINING SCHEMES

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*ACRH-1000-349
CONF-720435--4*

Talk Prepared for WHO/IAEA Seminar
on Training and Education in Medical Physics

MASTER

Kiel, Federal Republic of Germany

10-22 April 1972

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Following a study of the status and future manpower needs of physicists in medicine in the United States, the AAPM-ACR Joint Committee on Manpower Needs in Medical Physics formulated a series of recommendations.⁽¹⁾ One of these is that "graduate training programs in medical physics shall terminate in a master's or doctoral degree. In addition, experience shall be provided in clinical applications of pertinent subspecialties of physics."

In its study, the Joint Committee did not attempt to analyze the curricula of the various physics departments in the United States. In fact the committee found very little negative criticism of the present or past undergraduate physics curricula although it was recognized that medical physics, including radiological physics, is not usually considered to be a specific subject of undergraduate study.

A report published a few years ago by the National Advisory Committee on Radiation,⁽²⁾ suggested that persons intending to work in the radiological sciences would fulfill the needs in this area if their backgrounds included training in all of the following fields: optics, mechanical engineering (mechanics), electricity, magnetism, electronics, information theory, and computer technology. These subjects as well as atomic structure, including x-rays, nuclear physics, and solid state physics are included in one form or another in typical present-day bachelor's degree programs at good United States colleges and universities.

At this stage of development of medical physics in the United States, there are no uniform standards of training and undoubtedly it would be to the detriment of medical physics if there ever were rigid standards. It is generally agreed, however, that a desirable starting point is a bachelor's degree in physics with a minor in mathematics. A diversity of views exists regarding the curriculum at the graduate level. Some schemes require that the medical physicist have a strong major in conventional physics, and that he present a research thesis on "pure" physics. Others require a research thesis on some aspect of medical physics. Still other schemes de-emphasize "pure" physics in favor of a medically oriented curriculum.

In a study published last year, lists of existing graduate school training programs offering medical physics courses in U. S. colleges and

universities were compiled.⁽³⁾ The degree awarded in many of these schools is not in medical physics per se, but is awarded in a field closely related to medical physics. There were (1) 16 programs leading to a Master's degree after one year of graduate study, (2) 33 programs leading to a Master's degree after two years of graduate study, (3) 27 programs in universities, colleges or teaching hospitals offering training preparatory for certification in the various branches of medical physics by the American Board of Radiology, (4) 30 programs leading to a Ph.D. program, and (5) 15 programs in universities or institutes offering post doctoral training in medical physics.

The existing training schemes generally consist of lecture and laboratory courses. In some cases courses such as Introduction to Research as well as research itself are included. Actual experience is gained from practicum courses as well as on-the-job training.

In conclusion, I hope that regardless of what training scheme is employed, the medical physicist would be proficient in the following after his period of training.

1. radiological physics, including interactions of radiation with matter, radiation dosimetry and radioactivity
2. production of x-rays
3. accelerator and reactor physics
4. medical instrumentation
5. health physics
6. thermography and ultrasonics
7. human anatomy
8. biochemistry (that which applies to the human)
9. human physiology
10. cytogenetics and some population genetics
11. enough embryology to understand a little about the development of the human embryo
12. computers and computer programming in physics, biology and statistics
13. mathematics including calculus, differential equations, infinite series and statistics including biological applications

1. L. H. Lanzl, E. L. Saenger, M. A. Greenfield, J. R. Cameron, D. S. Childs, E. E. Christenson, E. W. Webster, R. O. Gorson, and J. G. Kereiakes. Recommendations of the Joint Committee on Manpower Needs in Medical Physics. Quarterly Bulletin of the American Association of Physicists in Medicine, Vol. 5, No. 4, p. 163, December, 1971.
2. Morgan, R. H. et al. Report to the Surgeon General, U. S. Public Health Service on Protecting and Improving Health Through the Radiological Sciences. U. S. Department of Health, Education, and Welfare, Washington, D. C., 1966.
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