THE CHARACTER AND EMPHASIS OF RESEARCH IN NUCLEAR MEDICINE

In nuclear medicine, as in other fields of health care, the development of more effective diagnostic and therapeutic programs requires sound foundation in the basic sciences. However, in the end, it is essential to evaluate the developments by clinical investigations. One may ask how many of the various research efforts in nuclear medicine are devoted to determining clinical efficacy as a measure of final success.

To obtain information on this question, articles published in the *Journal of Nuclear Medicine* from July 1969 through June 1970 and the abstracts of papers presented at the 1970 national meeting of the Society of Nuclear Medicine (*1*) were reviewed and classified as to the character and emphasis of the research performed. Each was assigned to a single category.

The following criteria were used in the classification.

1. Diagnostic tests.

a. New or improved diagnostic tests. Investigations involved either comparison of a modified test or new agent with a standard test or agent, or a delineation of the results of a new test in patients with specific diseases.

b. Efficacy of diagnostic tests. Investigations tested clinical hypotheses; the results of the tests were clearly related to the management of patients with specific diseases.

2. Therapies.

a. New therapies.

b. Efficacy of therapies. Studies evaluated advantages and disadvantages of therapy relative to the course of patients with specific disorders. No article or abstract fulfilled this criterion.

3. Case reports. Three or less cases were described.

4. Physiology. Studies were concerned with physiology or pathophysiology in man and/or animals.

5. Radiopharmaceuticals and pharmacology.

6. Physics and radiation safety.

Although classification is somewhat arbitrary, certain patterns of research emphasis are seen.

As noted in Table 1, basic laboratory approaches to problems in nuclear medicine, both in the published articles and in the abstracts, comprise a large segment of the studies. That many of the investigations were aimed at problems in physics and radiopharmaceuticals is not surprising in a specialty that is technologically oriented, but it is noteworthy that so little attention is given to evaluating methods specifically designed to improve patient care in a discipline that aspires to clinical status.

An emphasis on research somewhat removed from clinical utility is not confined, among the health sciences, to nuclear medicine. Feinstein and coworkers (*2–4*) have drawn attention to the orientation toward nonhuman and nondisease in investigations by members of organizations whose basic goals involve clinical research.

To some extent, the types of manuscripts and abstracts accepted may reflect, respectively, editorial and program committee policies. However, it is difficult to believe that well designed and carefully executed clinical studies would be deemed uninteresting and therefore unacceptable to either the *Journal* or the Society of Nuclear Medicine. Still, it may be helpful to investigators if the policies and interests of those responsible for scientific communications were enunciated from time to time.

TABLE 1. THE CHARACTER OF RESEARCH IN NUCLEAR MEDICINE

	Articles in *J Nucl Med* July 1969–June 1970		Abstracts of papers presented at 1970 Annual Meeting of Society of Nuclear Medicine	
	Number	%	Number	%
1. Diagnostic tests	28	22.4	75	42.6
a. New or improved diagnostic tests	25	20.0	66	37.5
b. Efficacy of diagnostic tests	3	2.4	9	5.1
2. New therapies	2	1.6	2	1.1
3. Case reports	9	7.2	3	1.7
4. Physiology	24	19.2	28	15.9
5. Radiopharmaceuticals	25	20.0	25	14.2
6. Physics	37	29.6	43	24.5
TOTALS	125	100.0	176	100.0

My purpose in analyzing the work of others is to draw attention to areas where there is too little emphasis, and hopefully to encourage more investigators to enter the fertile field of establishing clinical efficacy.

It should be pointed out that many previous clinical studies were ended after a test in question demonstrated pathology. The correlations of results of a particular test with pathologic findings in selected patients is insufficient.

As an example, the physician is not interested in a report correlating the liver-scan findings with anatomic changes in a wide variety of diseases, but rather how often liver scans reliably reveal otherwise undetectable metastases from carcinoma of the colon or carcinoma in general, thereby justifying a modification in his therapeutic approach.

Too often investigations have stopped short of the goal: improvement in the care of patients. Investigations relevant to patient care are not difficult to design, but they require a clear grasp of the clinical problems. The selection of subjects for study must be such that a hypothesis can be properly tested.

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A DIGITAL RATEMETER SYSTEM FOR RECTILINEAR SCANNING

In their Preliminary Note (*1*) Simmons, Hunkar, and Kereiakes describe how the use of a digital ratemeter avoids the degradation of the overall frequency response which results from the exponential response of an analog ratemeter. The authors then go on to observe that in practice the two instruments "show little discernible difference in scan quality." They fail to observe that this result was predictable because they used analog ratemeter time constants and digital ratemeter averaging times which were so short that the resulting distortions were, in any case, negligible.

It can be deduced from the information provided by the authors that the space constants, i.e., the product of analog ratemeter time constant and scan speed, they used were about 0.05 cm. This is typical of the values employed in conventional bidirectional scanning and is dictated primarily by the need to avoid undue "scalloping," i.e. relative displacement between successive scan lines.

We have found that when this limitation is removed by unidirectional scanning (*2*) and arrangements are made for the photoscan and colorscan displays to be dependent only upon the ratemeter output by operating them at a constant pulse rate, space constants of 0.5–1.0 cm can be used without losing the ability to resolve objects of about 1 cm diam. Larger objects can then be visualized with greater certainty because of the much improved statistics. The optimum choice of space constant involves a compromise similar to that involved in the choice of collimator resolution, which is in most cases in the region of 1–2 cm (full width at half height). The use of finer resolution than this does not generally result in better diagnostic information because of the worsened statistics.

If Simmons et al (*1*) were to extend their investigations to larger values of analog ratemeter space constant and digital ratemeter averaging interval than those described in their Preliminary Note, they might well demonstrate that the advantages for the digital ratemeter they predict on theoretical grounds do result in appreciably improved scans. We feel that such an investigation would be of value because the result would provide guidance for others who might be encouraged to invest in this fairly expensive modification.

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