Enhancing Research in Academic Radiology Departments:
Recommendations of the 2003 Consensus Conference

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Opportunities for funded radiologic research are greater than ever, and the amount of federal funding coming to academic radiology departments is increasing. Even so, many medical school–based radiology departments have little or no research funding. Accordingly, a consensus panel was convened to discuss ways to enhance research productivity and broaden the base of research strength in as many academic radiology departments as possible. The consensus panel included radiologists who have leadership roles in some of the most well-funded research departments, radiologists who direct other funded research programs, and radiologists with related expertise. The goals of the consensus panel were to identify the attributes associated with successful research programs and to develop an action plan for radiology research on the basis of these characteristics.

Key Words: Research, research funding, research resources, academic radiology departments


Radiologists and other radiologic investigators currently enjoy unprecedented opportunities to secure financial support for clinical and basic imaging research. Molecular imaging, which is identified as one of the most important “new pathways to discovery” in the recently published Roadmap for Medical Research of the National Institutes for Health (NIH) [1], and many other types of imaging research are receiving support. With the establishment in 2001 of the National Institute of Biomedical Imaging and Bioengineering (NIBIB) and the continued growth of imaging programs in the National Cancer Institute and other NIH institutes and federal agencies, more funding has become available. Between 1995 and 2002, the amount of NIH research funding awarded to principal investigators in diagnostic radiology departments grew from $65 million to over $240 million [2]. In 2002, however, fewer than half of all university radiology departments had any NIH grants. Although such funding discrepancies are not unique to radiology within academic medicine, this major imbalance raised concerns about the vitality and future of research in most medical school–based radiology departments. Accordingly, the 2003 Consensus Conference was convened to determine ways to enhance research activity and funding in academic radiology departments around the nation. Defining a research agenda for radiology and imaging science is a related and important task. Leaders from the organizations that sponsored this meeting are participating in other efforts (e.g., the annual Biomedical Imaging Research Opportunities Workshops) to shape a broad, mul-

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Editor’s note: This article is being simultaneously published in this journal, in Academic Radiology, in the American Journal of Roentgenology, and in Radiology. The RSNA holds copyright and grants permission for simultaneous publication.
The focus of the current meeting was the improvement of the research capabilities of radiology departments.

**PARTICIPANTS AND CONFERENCE FORMAT**

The meeting was a cooperative effort of the Academy of Radiology Research, the ACR, the American Roentgen Ray Society, and the Radiological Society of North America. Support also was provided by the NIBIB, which contributed financially, assisted in program development, and provided staff members to facilitate the group discussions.

Participants were recruited in an attempt to create a representative sample of radiologists who had excelled at research, research administration, and/or advocacy for research. Representation was limited by both the maximum number of participants (n = 16) and by availability on the selected dates. Four of the radiologists were chairs of departments with well-funded research programs, and four were faculty members in such departments. The remainder of the radiologists were chairs (n = 4) or faculty members (n = 4) of departments with other levels of active NIH funding. Radiologists with training or practice experience in the following subspecialty areas were present: abdominal imaging, breast imaging, neuroradiology, nuclear medicine, interventional radiology, oncologic imaging, pediatric radiology, and thoracic radiology. Three of the participants had special interests in radiology information systems, two had major interactions with biomedical engineering departments in their universities, and one led the molecular imaging and small animal imaging programs on his campus. Two of the radiologists had served as deans (interim or associate). Of the radiologists in attendance, three had PhDs in addition to their MDs. A list of the radiologists who participated is provided in the Appendix.

An iterative consensus development format was used to perform the analysis and prioritization. Following initial overview presentations that set the context, established the goals, and outlined the structure of the meeting, smaller work groups met separately to consider specific issues. Each work group presented its findings and recommendations to the entire group of participants for further discussion. Finally, the selected strategies and tactics were displayed together on a screen easily visible to all participants. Without further discussion, each person was asked to record his or her ranking of the importance of the displayed variables. In each section of this report, the recommendations are presented in the order of overall priority established by the group ranking.

The following questions were debated by the entire group:

1. What resources do radiology departments need to build and maintain successful research programs?
2. What are the primary barriers to obtaining and using these resources effectively?
3. What should leaders outside radiology departments to support and conduct clinical trials and other fundable research?
4. What educational and training programs should be established to promote radiologic research to trainees and institutions?

**CONFERENCE FINDINGS**

**General Resources**

The group agreed that five critically important resources are needed to build and maintain successful research programs:

- enlightened leadership: throughout the workshop, a consistent theme was the necessity of having a departmental chair who understands and communicates the valuable contributions of research to the radiology department and to the institution as a whole;
- a culture that values research within the department and throughout the institution;
- a core resource strategy that matches the human, financial, space, and equipment resources for research in radiology with the overall strategic plan of the institution;
- the ability to leverage institutional resources, using diverse resources from outside the department to support departmental research; and
- ongoing academic support from the dean.

**Barriers**

The most commonly experienced barriers to success were

- a lack of support from the dean;
- time required to provide clinical service;
- diminished income associated with doing research rather than clinical service;
• a lack of protected time for conducting research;
• a lack of appropriate space to support competitive research;
• the perception of the role of radiology in the institution as that of a service provider only;
• misperception and poor communication within radiology, which causes a lack of respect between clinical radiologists and investigators, both physicians and nonphysicians;
• cultural conflicts between departments; and
• the selection of residents who have little or no interest in research.

Resources Needed for Clinical Research
Historically, much of published radiology research has consisted of descriptions of a series of observations (i.e., descriptive research). Although hypothesis-driven research is replacing these case study series to some extent in the published literature, the careful collection and analysis of descriptive series retain value as a way to reintroduce critical thinking to individuals not actively involved in research. With additional training, motivation, and a modest infrastructure, any radiology department can take the next step to participate in hypothesis-driven clinical research. Options for academic radiology groups that wish to embark on funded clinical research include participation as sites in multicenter clinical trials, performing hypothesis-driven prospective studies, contributing to or identifying the evidence base for clinical practice, technology assessment, cost-effectiveness analysis, outcomes analysis, and various stages of drug or device testing. The group identified specific components needed to support clinical research, including

- departmental leadership that supports clinical research by publicly recognizing its importance, by rewarding faculty members who conduct such research, and by celebrating success in obtaining funding and/or reaching study goals;
- readily available institutional support; necessary resources include an efficient grants management program, space, seed funds, access to clinical collaborations, mentoring and career development;
- time to do funded clinical research, which must be preserved either through the better use of existing research support awards or the development of new, innovative vehicles to support part-time research;
- an intensive training course on clinical research methods;
- the restructuring of study sections and federal research priorities to better support clinical research; and
- revision of the current NIH method for crediting research support, so that appropriate proportional credit is awarded to co-investigators, not just principal investigators.

Resources Needed for Basic Research
The group stressed the critical role that a department leader plays in setting a priority on advancing radiology research and maintaining a culture that respects research and researchers. In the case of basic science, that culture must include cooperation, equal opportunity, and mutual respect between MD and PhD researchers. Within that context, the group identified five essential functions:

• the recruitment of faculty members from within or outside the institution with proven track records of funding for basic research;
• the support of basic science faculty members through their integration into appropriate basic science departments, by joint appointment if possible; mentoring; the provision of adequate infrastructure; and realistic opportunities for promotion;
• the provision of appropriate infrastructure resources, including dedicated and/or shared laboratory and imaging facilities; animal handling facilities; small animal imaging; informatics and computational power; biostatistics; research technologists; and administrative grant support;
• the pursuit of funding from a wide range of sources, including but not limited to the NIH; and
• periodic evaluation and consultation by both internal and external research advisory boards.

In addition, the basic science work group considered the important issue of the resources needed to get a basic scientist started. This is of particular relevance to departments that do not currently have successful basic science programs. A sample startup package is provided in Table 1. It was estimated that the cost of such a startup package for an assistant professor might be $150,000 to $250,000, for an associate professor $250,000 to $400,000, and for a professor $500,000 to $1,000,000.

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<tr>
<th>Table 1. Sample startup package for basic science faculty members</th>
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<tr>
<td>■ Laboratory space</td>
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<td>■ Startup funds for postdoctoral fellows, technicians, and other personnel</td>
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<tr>
<td>■ Seed funding for preliminary data collection</td>
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<td>■ Timetable by which independent funding should be obtained</td>
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<td>■ Access to appropriate institutional resources</td>
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<td>■ Mentoring, including advice about promotions and tenure</td>
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<td>■ Interim funding</td>
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Departmental Leadership

The chair, by exercising leadership, sets the tone for the department. It is crucial, therefore, that he or she have a clear vision for the department and that the vision be understood and supported by the faculty. The chair should choose departmental leaders who understand and share the vision. Designating a vice chair for research can be a powerful way to ensure that the portion of the vision that involves research is not overlooked. Formal leadership can assist chairs in formulating, communicating, and realizing their visions. A scientific advisory committee, which may include individuals external to the department or institution, can assist and advise a chairman in evaluating progress. The group agreed that it was not necessary or practical for most chairs to be actively conducting research. However, having a professional history that allows the chair to be respected by the research faculty is highly desirable.

Departmental leaders contribute to establishing a favorable research culture in several ways. Incentives and reward structures can be created to encourage research and research mentoring. Although rewards may be monetary, they can also include time, space, recognition, support personnel, and general encouragement. Although successful grants should be celebrated, unsuccessful applications can be an opportunity for reassurance, learning, and mentoring. Incentives for grant writing and clinical work should be balanced, and residents should be exposed to opportunities in research as part of the range of rewarding careers from which they can choose. Junior faculty members, in particular, must be afforded protected time with which to establish their research work. The formal assignment of mentors during this formative period can be instrumental in maintaining faculty members’ morale and retaining young faculty members.

Opportunities for formal research training need to be created or expanded in departments in which they already exist. All residents should be exposed to research training in some form, including training in critical thinking, study design, basic statistics, and clinical methods. Some experience in hands-on research is highly desirable for all residents. Although it is recognized that the majority of residents will not go on to conduct research after training, these experiences can play an important role in counteracting the sense of isolation from research that many private-practice radiologists currently report. It also will prepare residents to more critically evaluate reports of imaging research in the future.

Training Opportunities

The workshop group agreed that there is a need for a trained pool of young investigators. This need is not unique to radiology. Since 1980, the number of traditional NIH grants awarded (in all disciplines) to investigators 35 years of age and younger has declined, whereas those to investigators over the age of 46 have grown [3]. The implications of this trend include a possible future decline in research mentors and a decrease in the overall pool of investigators. The NIBIB intends to “develop and implement programs that provide interdisciplinary training in the quantitative and biomedical sciences,” as well as to “assure the availability of future generations of highly trained biomedical imaging and bioengineering researchers” [4].

As imaging research has progressed from descriptive reports to the investigation of molecular and genetic questions, the need has grown for multidisciplinary, integrative approaches. As a result, trained radiologic investigators require multidimensional knowledge, including research methodologies and techniques for interdisciplinary collaboration. New training paradigms are needed to achieve such expertise.

A number of different funding mechanisms exist to support research training for residents and junior faculty members. Federal funding options include the R25T, T32, and career-level K series grants [5]. The NIBIB also is developing a new set of grants to address some of the training considerations that may be unique to biomedical imaging and bioengineering. Training grants also are available through the Radiological Society of North America’s Research and Education Foundation, the American Roentgen Ray Society, the General Electric Radiology Research Academic Fund administered by the Association of University Radiologists, and for clinical trials, the American College of Radiology Imaging Network [6,7].

There was lengthy discussion about how to best structure training programs to promote research, but no consensus was reached. A variety of approaches will be needed to accommodate different departmental and institutional structures and objectives. Some group members felt that young radiologists would find it difficult to compete directly with PhD scientists for funding. Accordingly, models for training more MD-PhDs and developing better and more lasting collaborations between MDs and PhDs should be developed.

SUMMARY AND RECOMMENDATIONS

On the basis of the final balloting process, the following strategies were identified as being the most important for building research programs in academic radiology departments:
1. Develop research-supportive cultures in radiology departments through the leadership of the chairs, based on a vision, incentives, and rewards system.
2. Recruit more PhDs and MD-PhDs into radiology departments and promote cooperation and communication between them and the MD faculty members.
3. Use a “core resource” strategy to leverage institutional resources and expand imaging research.
4. Create a national resource for research mentoring in radiology.
5. Populate NIH study sections with research-oriented radiologists.
6. Urge the Radiology Residency Review Committee and the American Board of Radiology to survey and test for research training and knowledge.
7. Urge the NIH to develop research training programs of 1 year in duration (as opposed to the NIH standard 2 years) for radiology residents and fellows.
8. Create multidisciplinary research training grants.
9. Create model curricula for research training for MD radiologists.
10. Explore the development of master’s degree programs in the radiologic sciences.
11. Develop a white paper on radiology research for medical school deans, for use by radiology department chairs.

The critical role of the chair and other department leadership in research efforts is evident in the final priority recommendations and discussion points emphasized by the 2003 Consensus Conference. Half the participants in this conference were chairs, so this high prioritization of the chair’s role could be seen as self-serving. The focus, however, was the criticism of failed leadership in research and was broadly supported as a vital element across the array of conference participants. Chairs and related department leaders create the culture, structure the incentives, establish the department’s institutional identity, leverage the institutional resources, and recruit the needed investigators. The challenges for chairs in academic radiology departments are substantial.

In radiology departments that are not currently successful in research, the biggest challenge may be getting started. In that regard, building the foundations of research programs around PhD scientists is faster and easier than building the programs around MDs. The formula for success of PhDs is more straightforward than that for young radiologists [8]. It relates primarily to the availability of space and research equipment (e.g., small animal imaging) and facility management. There is no reason to think that appropriately selected PhDs in departments of radiology should be any less competitive than PhDs from other departments if they have access to comparable resources and space. One way to gain further PhD support quickly and gain access to research space and related resources is for radiology leaders and PhDs to create alliances with receptive basic scientists in other departments (e.g., molecular biologists, biomedical engineers, medical physicists, and synthetic chemists). Such efforts to build interdisciplinary research teams are consistent with the NIH Roadmap [1] and begin the transformation of radiology departments into an institutional core resource for expertise in imaging research. This, according to the conference, is one of the critical elements on the pathway to research success for radiology. It is time for radiology departments to step up to this challenge or risk losing medical imaging to others.

REFERENCES
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APPENDIX
The radiologists who participated in the 2003 Consensus Conference were as follows:

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