Background—Cardiovascular medicine is weathering challenges on multiple fronts, and the paradigm of cardiovascular fellowship training has changed as a result.

Methods and Results—On the basis of a review of the literature and surveys of former trainees, we have evaluated our Cardiovascular Fellowship Program at the University of Iowa. We have identified principles fundamental to the training of fellows. We extend these principles to propose practical ideas for responding to the challenges we face in the rapidly changing landscape of medicine in a new millennium.

Conclusions—we have proposed a few principles and numerous concrete, practical suggestions that will guide our Cardiovascular Fellowship in the future. These ideas may prove useful to other training programs. (Circulation. 2000;102:932-936.)

Key words: education cardiovascular diseases

Cardiovascular medicine is weathering challenges on multiple fronts, including the devaluation of physician services, declining reimbursement, perceived oversupply of specialists, dramatic expansion of new technologies, information overload, and more. Academic hospitals have struggled to deal with these threats, and many are experiencing financial and morale crises. As difficult as these challenges are, academic centers face yet another major challenge: preparing the next generation of practitioners for a new environment, the makeup of which is largely unknown. As we train the next generation of leaders in cardiovascular medicine, we must shape our fellowship programs to prepare them for challenges that none of us can easily foresee.

At the University of Iowa, we recently examined our Fellowship Training Program in Cardiovascular Diseases. From this evaluation, we have culled several principles that may be of general interest to training programs elsewhere in the United States and abroad. This article is written for a target audience of cardiology fellows, cardiology fellowship program directors, division chiefs, and others involved in the training of fellows. Recognizing that fellows are trained in a variety of settings (eg, state-supported and private hospitals), we describe practical measures that can be taken to prepare for the future.

Background and Perspective on the Problem
Much has been written regarding the rapidly changing environment of academic medicine1–6 and resulting changes in fellow education.7–9 Our tripartite mission of patient care, teaching and training, and investigation is threatened by the simple fact that faculty are working harder, faster, and longer, and much of this extra effort comes at the expense of teaching and research. Superimposed on this, we work now with fewer fellows. All of this is occurring while medicine expands geometrically, and the breadth and complexity of new technology progress apace. Finally, it is widely perceived that careers in academic medicine have become less attractive as marketplace and funding pressures transform the role of the academic physician.

Diminished revenues affect fellowship training in that clinical sources of funding provide the overwhelming majority of support for fellow salaries.10 Data provided by the Association of Professors of Cardiology for the period of July 1, 1996, through June 30, 1997, indicate that 82% of regular cardiology fellows are funded by clinical sources of revenue (hospital or clinical practice), 12% by the VA, and only 6% by grants (training grants or other grants). For the period of July 1, 1997, through June 30, 1998, the figures are 81%, 12%, and 7%, respectively.

These issues threaten to jeopardize an entire generation of cardiovascular practitioners and investigators and may adversely affect American preeminence in cardiovascular medicine. We have taken this opportunity to reevaluate our fellowship and have identified principles important to the training of cardiovascular fellows at the turn of the century.11

What We Do Right
First, it is important to capitalize on the strengths close to home, to identify institutional emphases and work to nurture and maintain them. At our institution, we take pride in a track
record of academic achievement and a history of training successful cardiologists (both practitioners and academicians). We recently surveyed former fellows from our program dating back to those who commenced training in 1965. Of 222 physicians approached, 95 (43%) responded to the survey. Of the respondents, 31 (33%) indicated they were presently employed in an academic position or had a significant teaching commitment.

We and many other divisions can point to a strong, broad-based faculty—both clinical and scientific—that has demonstrated success in each of the 3 components of our academic mission. It is important to capitalize on unique aspects of the institution: patient mix, special technologies, unique faculty strengths and research opportunities, alliances with the VA hospital system, and ties with industry. It will be crucial to build on these strengths as a foundation for reacting to future developments.

**Responding to the Challenge**

Some factors that contribute to the challenge of training tomorrow’s cardiovascular leaders lie beyond our control, reflecting nationwide trends toward primary care at the expense of subspecialty medicine. It is crucial that we grapple with these issues at the level of legislative policy, federal sources of funding, and national professional organizations because these shifts in policy fundamentally affect the future of academic cardiology. Closer to home, however, much can be done with resources currently at our disposal.

**Clarify the Mission**

We have identified a need to reestablish a clear mission for our training program. For many years, most of our trainees have pursued careers in practice. Although we are proud to prepare these individuals to assume positions of leadership in their medical communities, there is a disparity between our academic mission and our success in passing the baton to trainees.

We have urged all faculty members in our division to acknowledge our core mission to train excellent, data-driven clinical cardiologists equipped with the skills to provide outstanding care throughout a long career. Beyond this, we aspire to train cardiologists who will become outstanding investigators and clinical educators. Indeed, each fellow must be trained in the fundamentals of research because each will be expected to interpret and, we hope, contribute to the scientific and medical literature. For the foreseeable future, a major part of our role will remain educating cardiologists who will pursue careers in private practice. Although as academicians we may prefer another goal—that of training clinician-investigators and clinician-educators who will push back the frontiers of knowledge—we must equip each fellow, regardless of his or her chosen career path, to be a superb clinician.

We have revised our approach to identifying fellows who will be offered positions in our training program; viz, rather than seeking candidates predisposed to a career in academicians, we try to nurture fellows toward careers in academic medicine. Our track record for selecting “academic” fellows has been only marginally successful, and conversely, some who initially lean toward practice ultimately choose academics. This should not be surprising because it is difficult to expect a second-year medical resident who is only 18 months out of medical school to have a clearly identified career path. Now, we recruit fellows on the basis of the composite of their clinical and research skills and interests. To this end, clinical track faculty are increasingly involved in the recruitment and selection of fellows.

**Inspire Fellows to Consider Academics**

Why should fellows be recruited on the basis of both clinical expertise and research interests? Taking an analogy from sports, we look for the best overall “athlete” and then provide a learning environment that maximizes achievement of potential. This approach involves recruiting and matriculating some outstanding clinicians with little or no experience in research because we prefer to recruit an outstanding clinician headed toward private practice rather than a fellow of lesser clinical stature who professes an interest in research.

Once we have appointed a fellow who is exceptional in some way—clinically, scientifically, or both—we work to inspire him or her to consider a career in academics. We seek to demonstrate what it is about our careers that led us to choose academics. We must relate our drive to discover and to communicate new knowledge to future generations of physicians.

We have adopted several measures to help educate and inspire fellows regarding careers in academic cardiology. We have held a Saturday retreat on how to be an academic physician. Perspectives from both clinical and basic researchers and from clinical educators were provided. Discussants presented their views of academia and related why they chose this career path. We outlined the academic career path and explained the concepts of academic rank and tenure. We outlined the different professional tracks available—tenure and clinical educator. Surprisingly, we found that many fellows are unaware of the variety of career options in academic medicine, and we exposed them to this spectrum. We explained the processes of grant application and review, manuscript publication and review, and membership in national organizations, committees, and study sections.

In addition, we prepare fellows in advance for their year of research. First-year fellows attend a session in which interested faculty (typically spanning several departments) present research project ideas. After a few weeks pass, providing an opportunity to read and to talk with prospective research mentors, fellows meet with a Fellowship Research Committee. This committee is charged with helping match trainees with research opportunities consistent with their interests, prior training, and career goals. Next, we require fellows to apply for a grant to support the research year. As a part of this, we provide early intramural critique as training feedback and to ensure quality of the applications. Overall, this process obligates trainees to project themselves into the future, to think about where they want to be in 5 to 10 years, and it maximizes the training potential of the research year.

We also provide funds for travel to a national meeting each year. It is important for all fellows, whether bound for academia or practice, to witness and experience aspects of
cardiology that occur at national meetings. Rigorous practice sessions precede each meeting. When possible, we encourage fellows to attend American College of Cardiology–sponsored didactic conferences at the Heart House, including one devoted to preparation for a career in academics.

It is beneficial to invite a graduate of the program who has been successful in academia to visit, lecture, and interact with fellows (possibly as a component of a retreat on academic cardiology).

We try to identify promising fellows with academic potential early in their careers and mentor them appropriately. The Fellowship Research Committee helps guide fellows headed toward academic careers, assisting with the transition to faculty status.

Revitalize Interactions Between Faculty and Fellows

Interactions between faculty and fellows have changed in recent years for many reasons. Unfortunately, the time and effort faculty are able to devote to teaching have diminished, and fellow training is likely to suffer. Efforts and resources should be directed at maintaining and revitalizing these interactions.

The director of the training program is responsible for orchestrating many of these faculty-fellow interactions. Effective leadership of a training program requires fervent interest in fellow education, accessibility to fellows and excellent communication skills, a willingness to advocate for fellows vis-à-vis faculty, a willingness to discipline fellows, clinical credibility, and access to resources.

The post of fellowship director must be valued and rewarded in a fashion commensurate with the important responsibilities it carries. The divisional leadership should be willing to commit significant time protection to the director of the fellowship program, along with appropriate administrative support.

Regular (eg, bimonthly) meetings between the fellows and the division and fellowship leaders are imperative. These encounters provide an opportunity for fellows to voice concerns and propose suggestions for change. In addition, these meetings provide a forum whereby fellows learn of changes within the division and department (eg, arriving or departing faculty, research and funding opportunities, institutional financial issues).

Each fellow is directed to identify a personal mentor within the faculty. Fellows working toward subspecialty certification (eg, electrophysiology, interventional cardiology) and those pursuing additional research training are similarly encouraged and mentored. The role of the mentor is to provide counsel and advice regarding professional matters, as well as personal support. The mentor should be accessible and willing to provide candid, confidential guidance. Although the mentor serves as a liaison between fellow and faculty, the mentor’s function must not supplant that of the program director. It is preferable that trainees select a mentor who is not the research advisor to ensure candor and latitude in the relationship. Finally, divisional leaders must emphasize the importance of this counseling process to the faculty and reward mentors who are truly effective.

Regular meetings of fellows with a panel of divisional leaders are useful. Their purpose is not to assess the performance of the fellow. Rather, they are designed to assess the fellow’s effectiveness at preparing for his or her personal career goals. For example, each fellow meets annually with a panel consisting of the division director and the program director, a clinician, and a physician-scientist. The purpose of these meetings is to evaluate and facilitate attainment of the trainee’s goals (“What do you want to do? How can we help you get there?”). These encounters are most effective if they occur early in each academic year. Each fellow is expected to draft a brief action plan that summarizes the encounter and outlines specific training goals for the coming year. This document, which obligates fellows to plan for the future, is kept on file and available for subsequent annual meetings.

Our chief fellow functions as a liaison between faculty and fellows, arranges and coordinates call schedules, and implements a variety of educational activities. This individual assumes a position of leadership within the program and is a significant resource person to both fellows and the program director.

Didactic Education of Fellows

Teaching of fellows occurs in small and large forums, from small, weekly conferences to cardiovascular grand rounds and medical grand rounds. As the time available for teaching shrinks, we must maximize the effectiveness of our regularly scheduled didactic sessions.

We have found that a weekly clinical conference serves a number of important goals. The meeting provides an opportunity for the entire division to come together to discuss that aspect of our careers that is common to us all: the practice of clinical medicine. The conference is a time for all of the division, both full-time clinicians and those with significant research efforts, to sharpen clinical skills, learn from clinical experts in our midst, and celebrate our role as teachers of cardiovascular medicine. Each fellow and faculty member in the division presents 2 to 3 times per year.

A core curriculum series of conferences is successful in many programs. This can be set up as monthly evening sessions (coordinated with a component of social interaction) or a regular conference during the workday. Echocardiography conference, catheterization conference, and journal clubs should be regular components of a multifaceted didactic experience.

Many of our faculty serve as visiting professors at other institutions, yet our own trainees interact only infrequently with them. This represents a missed opportunity for teaching. A forum can be devised to expose fellows to national leaders within the faculty, both clinical and scientific, on a regular basis. Furthermore, we now see relatively few cases of certain important diseases (eg, mitral stenosis or constrictive pericarditis), and all of us can profit from our more senior faculty with considerable experience caring for patients with these diseases. In addition to scheduled presentations by distinguished faculty, we have a monthly fellows report conference at which instructive cases are discussed with senior faculty.
On-the-Job Training of Fellows

A major portion of a cardiologist’s education occurs at the bedside, caring for a large number of patients in a variety of settings under the direct tutelage of faculty educators. Considerable effort must be directed at maximizing the educational benefit our trainees derive from hands-on training.

As the pace of academic medicine quickens, it is increasingly difficult to provide a quality education in the context of a high-throughput practice. Although it is important that fellows be busy and exposed to many different patients, time must be allotted for them to assimilate information at a tempo slower than that of more experienced practitioners. There must be a dissociation, at least on certain very busy services, between the pace of the entire service and that of the fellow. For example, in our program, we do not expect fellows to perform more than 5 diagnostic catheterizations each day. This limit affords fellows time to learn how to prepare the patient for the case, analyze the data carefully, compile an accurate report, and prepare the patient for the postprocedure phase of care. We must be mindful that fellows are here primarily to learn to be cardiologists and not to be assistants who facilitate the functioning of the service.

Each clinical rotation must identify a critical body of information that helps propel the fellow toward board-eligible status. To this end, each service should develop a “core curriculum” that outlines the information and skills each fellow is expected to have learned by the end of each rotation. For each clinical service, we have identified a single individual as coordinator of fellow education, and he or she is charged with preparing and maintaining up-to-date packets of reading. Similarly, this education coordinator is charged with assessing how well each fellow attains educational goals by the end of each rotation.

We have observed a tendency within our program toward procedure-based training at the expense of time devoted to clinical matters. We shortchange our fellows if we do not provide them access to our more experienced colleagues, many of whom have practiced cardiology for years and have considerable experience making difficult management decisions. Adequate time caring for patients longitudinally and encompassing the entire diagnostic and therapeutic spectrum is crucial. As such, we have worked to expand the time encompassing the entire diagnostic and therapeutic spectrum. Adequate time caring for patients longitudinally and encompassing the entire diagnostic and therapeutic spectrum is crucial. As such, we have worked to expand the time encompassing the entire diagnostic and therapeutic spectrum.

Part of the training process is the gradual assumption of the mantle of responsibility. As fellows mature in cardiology, they learn by making decisions on their own and by assuming the role of teacher. It is important to structure a rotation schedule that allows fellows to assume increasing responsibility in terms of making clinical decisions, public presentations, teaching, and performing procedures as they mature in the program. Often, rotations at a VA Medical Center afford opportunities for increasing responsibility, and these rotations are often best reserved for senior fellows. These rotations can also serve as a reward for months of hard work in more junior roles.

Orientation of Incoming Fellows

Most fellows begin their training on clinical service, whereas some start with laboratory-based research. In either case, initial overnight call responsibilities take place at a time when the fellow has had little formal training within the division. Despite the existence of a complete and redundant backup system, junior fellows must field questions as cardiology consultants with little formal training. In addition, fellows must negotiate a complicated chain of command without a clear understanding of how things should work and what the faculty expect. Finally, fellows represent the entire division to other services in the hospital—and indeed the entire university when taking outside calls from patients and physicians—with little formal teaching from the faculty.

We must provide excellent training for incoming fellows before they are called on to provide clinical service. To this end, we have instituted a 2-day orientation at the beginning of each academic year. During these sessions, fellows are exposed to each of the core components of the clinical service, meet with divisional leaders and support staff, and are introduced to representatives of the divisions of cardiothoracic and vascular surgery.

During the orientation, speakers limit their presentations to practical matters as they pertain to their respective services. Particular emphasis is given to “how things work at Iowa,” recognizing that some institutional variability exists in the practice of medicine. Fellows are instructed in their responsibilities on different services, and clear expectations of performance and rigor are communicated. Fellows are instructed on how to handle calls from outside the university, and the system of clinical support and backup is outlined, both at the university and at the VA.

Internet

The World Wide Web has emerged as a powerful means of communication and interchange. In its most effective forms, it allows for dynamic, interactive, up-to-the-minute information transfer. Many of these strengths can be harnessed for a fellowship program; education within and outside the institution (post syllabi from lectures, courses, and grand rounds; post case reports, bibliographies, and clinical images; and announce continuing medical education), publicity for the clinical enterprise (describe inpatient and outpatient clinical services; publicize highly specialized clinical resources, both
human and physical; post telephone numbers and addresses to facilitate information exchange and patient transfer; and describe ongoing clinical research to facilitate subject recruitment, and publicity for the training program (describe the breadth of faculty, both clinically and scientifically; describe the training curriculum, including clinical rotations, conferences, and fellow orientation; publicize involvement in multicenter clinical trials; publicize current trainees and graduates of the program; and describe resources on campus and in the local community).

A Web site is useful only if attention is devoted to maintaining the content up to date. This maintenance phase requires resources, and it is important that these be available.

**Fellowship Class Size**

Healthcare delivery is being reorganized around primary care physicians, and as such, we are training fewer cardiologists (reviewed in Reference 9). Accordingly, most cardiovascular fellowship training programs have diminished in size over the past several years. This is appropriate. Taken too far, however, these trends may have negative consequences on fellow education.

At some point, restricted fellowship class size affects our ability to fulfill our mission as academic cardiologists. We have observed several instances in which this impact is significant. For example, much learning in medicine occurs via interaction among peers. There must be a critical mass of fellows within a program to allow vital communication. With too few fellows, opportunities for flexibility and growth diminish. Additionally, individual teaching and didactic conferences suffer from small class size, because again a critical mass of fellows is required for discussion and interaction to occur effectively.

**Recapitulation**

At the University of Iowa, we have scrutinized our fellowship program in cardiovascular diseases to determine how best to fulfill our academic mission of patient care, teaching, and research. In today’s environment in which the perceived value of physician services is being eroded, the principles of training remain the same, but their implementation must change. We are optimistic that many of our problems will bend to the concerted effort and resolve of the faculty and its leadership.

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Quo Vadis?: How Should We Train Cardiologists at the Turn of the Century?
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