EDITORIAL

Cardiology 1985: ‘Whither are we tending and what ought our aim to be?’

Presidential Address

THOMAS J. RYAN, M.D.

MUCH HAS HAPPENED in the field of cardiovascular medicine since the 1984 Scientific Sessions of the American Heart Association in Miami. For all the noteworthy advances that were made, certain events brought more notoriety than others. At times, the notoriety was unfortunate and ill focused, as in the abortive attempt at interspecies transplantation with “Baby Fae.” At other times the attention was particularly delightful and richly deserved, as in the awarding of this year’s Nobel prize for Medicine to Drs. Michael Brown and Joseph Goldstein. In a year of such extremes, it seems appropriate for the purposes of this annual address to ponder a question posed much earlier in this century by one of medicine’s leading thinkers of the day: “Whither are we tending and what ought our aim to be?” Francis Weld Peabody, Professor of Medicine at Harvard Medical School and the first Director of the Thorndike Memorial Laboratory, wrote these words in his 1928 essay, “The Soul of the Clinic.” The point of his essay was that the physician-investigator was the “soul of the clinic” and his plea in those years was for more science in medicine.

Considering that today’s events are taking place a scant 14 years from the end of this century and just before the dawn of the third millenium A.D., some reflection on certain of the medical events that have occurred during the past 85 years would seem a timely way of formulating a contemporary response to Peabody’s ageless question. Such reflection leads me to suggest there are two considerations that loom larger than all others in shaping an answer to the first part of the question, i.e., “Where are we heading?” The first is the incontrovertible fact that all the citizens of this country are headed for an increased life expectancy from birth. The second consideration relates to the rapid evolution of technology in medicine that has occurred during this century.

The field of cardiovascular medicine is at it’s highest state of technical perfection and is currently spawning a new discipline of interventional cardiology that holds great promise for remarkable therapeutic achievements. However, when viewed against the backdrop of an aging population, important questions surface that the cardiology community would do well to address. In the first place, does an increased life expectancy from birth imply an increased life span for the average individual? If so, should we be gearing for the care and management of centenarians as a matter of routine? It is my thesis that, in the milieu of an aging population: (1) intervention will give way to prevention, (2) impact on morbidity will become a more important criterion of successful therapy than impact on mortality, and (3) increasingly, the clinician will be faced with the moral and ethical judgments that relate to the apportionment of costly technology and the identification of who is senescent and who still enjoys adult vigor. These beliefs derive from a review of some of the medical happenings of this century, which, in point of fact, represents the entire gestational phase of cardiology in this country.

Consider that it was just before this century began that Wilhelm Roentgen invented the x-ray tube and Willem Einthoven developed the string galvonometer that would serve as the electrocardiograph. Thus, by 1900 the foundations had already been laid for the development of at least one species of high technology that was to blossom over the ensuing 85 years. At the turn of this century the medical care system was overwhelmed by the common infectious disorders of the day. Diphtheria, small pox, tuberculosis, and pneumonia represented the leading causes of death and accounted for an average life expectancy at birth of 47 years.

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This Editorial summarizes Dr. Ryan’s Presidential Address to the Annual Meeting of the American Heart Association, Nov. 11, 1985, Washington, DC.
It is remarkable that physicians caring for patients in the early years of this century had either the opportunity or stimulus to make new and original contributions. Fortunately they did, for it was Herrick's observations that led to the development of cardiology as a specialty. His monumental paper in 1912 that characterized the clinical features of acute myocardial infarction serves as a suitable and secure cornerstone for the foundation of contemporary cardiology. This publication was followed by others, and before long it was clear that the leading cardiologists of the day were quite aware of the lethal course of coronary artery disease. Table 1 lists the major publications appearing in each decade, beginning with the 1920s and extending through the 1950s, reporting on the high mortality rate of coronary disease. By mid century it was well recognized as the epidemic of our time.

While a number of these studies were underway, a new era dawned for cardiology in the 1940s as Forssman's catheter approach to the heart was taken up by Andre Courmand. It was his genius that paved the way in executing physiologic studies of the human heart. He is by all rights the father of invasive cardiology and from the outset attracted some of the best and brightest minds in medicine to this new brand of cardiology: Warren, McMichael, Lenegre, Bing, and Dexter, to mention but a few. His work was given the benediction of the highest level of science when the 1956 Nobel prize for Medicine was awarded to Drs. Forssman, Courmand, and Richards "for their discoveries concerning heart catheterization and pathological changes in the circulatory system." Given this early momentum, it is little wonder that invasive cardiology plays such a dominant role in the field today.

In the same time frame that Courmand and his colleagues received their Nobel award, the cardiac catheter had found its way into all four chambers of the heart and by 1960 into the coronary arterial tree as well. In that year, the late F. Mason Sones demonstrated that disrupting the coronary circulation with a bolus of dye did not cause lethal electrical imbalance as had been predicted by many. Moreover he showed that by coupling sophisticated x-ray equipment with high-quality recording cine cameras, diagnostic angiographic images of the coronary arteries could be obtained. A frame taken from his first selective coronary arteriogram is shown in figure 1. Although fuzzy by today's standards, it was truly a major achievement when it was recorded 27 years ago. Seven years later, his surgical colleague at the Cleveland Clinic, Rene Favelaro, was the first to report a successfully bypassed coronary artery obstruction by fashioning a reversed saphenous vein graft in the aortocoronary position. Figure 2 is an actual cine frame of this bypass graft, visualized in remarkable detail shortly after the surgery that took place in 1967. The work of these two men has led to what is now called a "multi-billion-dollar-a-year business."

From that time until now the cardiac catheter has undergone continued refinement and has enjoyed unheralded success in some of its newer applications. In addition to the conventional angiographic and pacing catheters that are readily available in virtually all of the 900 or so catheterization laboratories now operating in this country, the interventional catheter system for balloon angioplasty is rapidly becoming a stock item in many laboratories. In a few places, laser systems are in the testing phase. The array becomes rather awesome when one calculates both the cost of the high-technology equipment to which each of these catheter systems is attached and the expense involved in the performance of the more than 600,000 catheter-related procedures that are performed in this country each year.

The dollar cost of this technology, along with other health care–related expense, is receiving ever greater attention in contemporary society at virtually all levels. We are currently spending in excess of 1 billion dollars a day, and the suggestion has now been made, for the first time in our history, that the cost of medical care be rationed as it is in other countries. Although our long-established funding sources for biomedical research have traditionally and wisely excluded expensive diagnostic equipment from budgetary proposals, the escalating costs of research technology are forcing

### TABLE 1

<table>
<thead>
<tr>
<th>Author</th>
<th>Source</th>
<th>Year</th>
<th>n</th>
<th>5 yr survival</th>
</tr>
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<tbody>
<tr>
<td>Herrick</td>
<td>JAMA</td>
<td>1913–1918</td>
<td>200</td>
<td>3 yr</td>
</tr>
<tr>
<td>White and Bland</td>
<td>Am Heart J</td>
<td>1920–1930</td>
<td>200</td>
<td>49%</td>
</tr>
<tr>
<td>Cole and Katz</td>
<td>Circulation</td>
<td>1932–1941</td>
<td>285</td>
<td>67%</td>
</tr>
<tr>
<td>Juergens et al.</td>
<td>Arch Intern Med</td>
<td>1935–1951</td>
<td>279</td>
<td>55%</td>
</tr>
<tr>
<td>Honey and Truelove</td>
<td>Lancet</td>
<td>1940–1954</td>
<td>348</td>
<td>61%</td>
</tr>
</tbody>
</table>
these agencies into a cost/benefit mindset that raises many awkward questions. The dollar cost per gram of salvaged myocardium is but one such question.

An examination of the survival curves for the U.S. population generated over the past 85 years demonstrates that life expectancy has continued to extend well beyond the average age of 47 years that it was at the turn of the century. At the present time, life expectancy is 74 years from birth and for white women it is in excess of 78 years. Increasingly over the decades, the top of the curve has flattened (figure 3). This plateau clearly is due to the reduction in infant mortality and early death from infectious disease from the turn of the century to the present time. “Rectangularization” of the survival curve occurs as elimination of premature death results in a sharp downslope to the natural life span. According to the calculations of Dr. James Fries, by 1980 we had reached about 80% of the way toward his estimate of the ideal lifespan or maximal survival curve compared to where we were in 1900 (figure 3).

More important than the obvious increase in life expectancy during this century is the mounting evidence that life span for the human species may be fixed, or at best may extend no more than a month per century. In theory this would be predicted by the mathematical formula of the British actuary, Benjamen Gompertz, who observed in 1825 that beyond a certain age there is an exponential increase in the mortality rate. Currently, after the age of 30, the rate doubles every 8 years. Thus increased life span does not go hand in hand with increased life expectancy.

In his provocative paper, "Aging, natural death and the compression of morbidity," Fries calls attention to the relatively little increase in life expectancy for those over 40 years of age, comparing the turn of the century to the present. Indeed, for those who were 75 years of age in 1900 the increase in life expectancy over the subsequent 85 years is barely perceptible. The natural limit to the life span can be calculated by studying the rate at which life expectancy at various ages is.

![FIGURE 1. Cine frame taken from the first selective coronary arteriogram performed by F. Mason Sones, October 30, 1958.](image1)

![FIGURE 2. Cine frame of the first aortocoronary saphenous vein graft inserted by Rene Favelaro in 1967.](image2)

![FIGURE 3. The increasingly rectangular survival curve. About 80% (stippled area) of the difference between the 1900 curve and the ideal curve (stippled plus hatched areas) had been eliminated by 1980. (Reprinted with permission from ref 15.)](image3)
increasing and then determining the point at which the curves intersect (figure 4). During this century average life expectancy from birth increased at the rate of 0.33 years per year of the century, while life expectancy from age 65 increased by approximately 0.08 years per year of century. These curves intersect in the year 2018 at a mean age at death of 85.6 years. Calculations based on other periods or from other ages converge at similar points. The median projection for all curves shows a convergence at an average life span of 85 years, which will be reached in the year 2045.

Although the theory of a fixed life span for humans is not universally accepted, with opposing views expressed most notably by Schneider, Brody, and Manton. Dr. Fries defends his thesis of rectangularization of the survival curve in convincing fashion. First, the theory is in full accord with the seminal experiments of Hayflick and Moorehead. In 1961, these investigators studied normal human fibroblasts in tissue cultures and found these cells to have a strictly limited life span. They demonstrated that a finite number of cell doublings exists for each species, with human fibroblasts dividing about 50 times and no more.

Second, Fries notes the absence of an increase in the number of centenarians living over time. The rate has been fixed at about 1 per 10,000 population since well before 1850. Opposing views notwithstanding, the thesis of a fixed life span warrants careful consideration in responding to the original question posed: "Whither are we tending and what ought our aim to be?"

One line of reasoning would suggest that by the year 2000 there will be those who will be older, more infirm, and more expensive to care for with little or no prospect of altering longevity. The logic would seem inescapable that if life span is fixed, as we approach that immovable wall we should shift our inherent medical focus from mortality to the delay of the onset of infirmity. To the degree that our ever-expanding technology successfully handles the first morbid event, so it should continue to flourish. I submit, however, the symptomatic stage of chronic illness is better delayed by prevention than by intervention. Important initiatives, such as the newly organized National Cholesterol Education Program, must be given appropriate priority.

As acute illness gives way to chronic illness, important questions surface regarding (1) the allocation of resources, (2) social, moral, and ethical judgments that must be made, and (3) appropriate strategies for medicine and science that must be designed.

In addressing the first of these — the allocation of resources — the cardiology community should probably concede that this is a question largely out of our hands and likely to be decided either in the marketplace or by regulatory means. It is true, however, that the application of those resources, specifically the high technology presently in our hands and that to come in the next generation, should become a question not so much of “can we?” but of “should we?”

To address the social, moral, and ethical judgments that await us in the third millennium, we in medicine would do well to look back over the past three millennia to comprehend how paltry our inheritance in ethical judgment has been. Conventional thinking sees Hippocrates as the fount of medical ethics. It has long been recognized, however, that his ethic was directed at preserving the secrets of healing for the cult of Aesculapius. Allegiance to teacher and student came before any consideration of the patient. The prohibitions in the Hippocratic Oath have more to do with Pythagorean dogma than they have to do with an enduring medical ethic. So it remained throughout the golden age of Greece. In Roman times, Claudius Galen gathered and refined the total Hippocratic Corpus. Although this ensured its survival throughout the dark centuries to come, Galen added little to the existing ethic of medicine other than to emphasize the authority of the healer over his patient. For the next 1500 years medicine was virtually a guild without an ethic.

It is disappointing to note that the Royal College of Physicians of London, founded in the 10th year of the reign of Henry VIII at the behest of his personal physician Thomas Lineacre, was established "with a view to

FIGURE 4. Projection of life expectancy data into future years. Projections from birth (solid circles), at age 20 (open circles), and at age 65 (triangle) show convergence at life spans ranging from 83 to 86 years. The median projection from all ages (broken line) shows intersection at age 85 in the year 2045. (Reprinted with permission from ref 15.)
the improvement and more orderly exercise of the art
of physic, and the repression of irregular, unlearned
and incompetent practitioners of that faculty."23 The
preservation of the guild and deportment of physician,
one to the other, was the kernel of the Code of Medical
Ethics shaped by its succeeding President, the medi-

evial minded and crotchety John Caius (figure 5). This
was to dominate for centuries to come.

Just as we took much of our customs, culture, and
jurisprudence from our forebears in England, so did we
adopt their medical code of ethics with the founding of
the American Medical Association in 1847.24 This
code addresses the duties of physicians to their patients
in paternalistic terms and espouses the authoritarian
role of the doctor. The emphasis is on "firmness" and
"condescension with authority." The instructions are
"to inspire gratitude and respect." Missing is the lan-
guage that relates to the right of the patient to be in-
formed or to die serenely, or to the incompetent physi-
cian, conflict of interest, or conduct of research.

Even in the early days of this century, the focus of
medical ethics was directed more to the rules of eti-
quethe among physicians, to the issues of group prac-
tice, to advertising by physicians, and to the role of
national insurance.22 It has only been in the climate of
consumerism that has settled in since the storm of
World War II that there has been a true affirmation of
the patient as the central obligation of the physician,
with a heightened awareness of the need for humanism
in medicine.25 In the context of time, we are late in
arriving at this theme that is central to a true medical
ethic. From an evolutionary standpoint, the moral fiber
of medicine is still young and delicate. That fiber,
however, is being stretched to a point of danger as we
distance the physician from the patient by interposing
the marvels of today’s technology between the two.
The ethical obligation of the physician to his patient is
perhaps best expressed in Francis Peabody’s more
well-known work, "The Care of the Patient."26 Most
often quoted is his final phrase “. . . for the secret of
the care of the patient is in caring for the patient.”
Often overlooked in this collection of ageless in-
structions to medical students is the passage that reads:
“The treatment of a disease may be entirely imper-
sonal; the care of the patient must be completely
personal. . . [This] intimate personal relationship be-
tween physician and patient cannot be too strongly
emphasized, for in an extraordinarily large number of
cases both diagnosis and treatment are directly depend-
et on it.” In other words, the physician’s ethical obli-
gation is to know his professional business and he must
trouble to know the patient well enough to draw con-
clusions, jointly with the patient, as to what actions are
indeed in the patient’s best interests.

In considering appropriate strategies for medicine
and science in the years ahead, we come to the crux of
the question, “What ought our aim to be?” There are
some imperatives for the future of cardiology that are
ageless and as valid now as they were in Peabody’s
time: (1) caring for patients in the complete sense and
(2) the continued infusion of both elemental and clini-

cal science into the field of cardiology, for only herein
can we expect to find true cures. Among the newer
imperatives we must include a reordering of our crite-
ria of successful treatment because we are confronted
with an aging population that is about to reach the
probable limits of the human life span. In this context,
morbidity is perhaps a more meaningful marker than
mortality. As a corollary to this, we should be more
attentive to what benefits are gained from burgeoning
technology measured by quality rather than quantity of
life. To the traditional end points of disease — mortal-

ty, morbidity, and quality of life — we must now add
the fourth factor of cost. In concert they call for an-
other and quite immediate aim that would emphasize

FIGURE 5. John Caius. (Reprinted with permission from The Royal
College of Physicians of London Portraits, ref 23.)
prevention over intervention. Lastly, each of these objectives has its own implications for the training of future cardiologists, and it is critically important to reconsider the needs of our trainees.

The moral and ethical choices to be made in future years will require us to develop appropriate curriculum for our trainees. More challenging, however, will be the need to teach these concepts by deed and example. Their training years will have to be extended so they can grasp the expanded scientific base and the technical complexities of the specialty as it exists today. The number of true cardiovascular specialists will decrease perforce in the future.

Finally, if we are going to protect the intellectual future of our specialty, there would seem to be a genuine need to rekindle and cultivate a true zest for academic pursuit among our graduates and trainees. As stated most eloquently in a recent Herrick lecture, "Cardiology has been brought to the highest state of technical perfection — out of the genius of this century — and perhaps it has or will very soon, realize its brilliant promise."27 The techniques of tomorrow will be those of modern biology, and the cardiologist of the future will have to be more than an interventionalist. His stature is likely to be measured by how tall he stands among his colleagues in the fields of molecular biology, cellular physiology, and experimental pathology.

With these midcourse corrections we should reach safe harbor by the end of the century. I disagree with the editorialists who look upon the events of 1985 as indicative of a crisis in cardiology,14, 28 although their opinions may be incisive and alarmingly accurate. Rather I think it is more a matter of the questions being tougher and the solutions more complex.

I believe the future is extremely bright for cardiology because we continue to have superb science with appropriate role models like Drs. Goldstein and Brown. We continue to witness exciting and innovative means of caring for our patients directed by paragons such as the late Dr. Andreas Gruentzig.

If we maintain the proper balance between patient care, high technology, and elemental science, there would appear to be no limit on what will be achieved in the field of cardiovascular medicine in the next millennium.

I wish to acknowledge Carlton B. Chapman, M.D., whose scholarly work, "Physicians, law and ethics," provided the historical perspective and much of the language I have used in reference to medical ethics. I am also indebted to Delos T. Cosgrove, M.D., and his associates at the Cleveland Clinic for providing me the cine frames of Dr. Sones' first coronary angiogram and saphenous vein graft.

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