Arteriosclerosis
Policy, Polity, and Parity

By Theodore Cooper, M.D.

OVER THE YEARS, 14 years since the Lyman Duff Memorial Lecture was established, the memory of Dr. G. Lyman Duff and his contributions to the pathology of arteriosclerosis have been honored by men who have continued to advance the frontiers of science in these same areas. Still, a man who would so influence others that a society of peers would be set up (the Society of Arteriosclerosis, later to merge with the American Heart Association) would fully understand that from time to time it is necessary for someone to accept the responsibility for the allocation of public resources for the solution of public health problems. Within present polity, that is, within the present form of government, the current method of doing federal business, this responsibility falls in part upon me, as Director of the National Heart and Lung Institute. In exercising this responsibility it often appears that I speak for you, the scientists and physicians interested and involved in any way in diseases of the heart, particularly in arteriosclerosis. I speak, or I appear to speak, as your representative and at times as your advocate. I am aware and sensitive to the fact that this is not representation by participatory selection. Hence, it is not only appropriate—it is vital that we talk about policy, that you understand polity and recognize what is involved in parity. I am sure, although his setting was different, that Dr. Duff would have intuitively understood this

need for discussion, for interchange, for decisions.

Within our present polity and for as long as we are a republic, some bureaucrat will be the spokesman for the scientists, the physicians involved in eradicating or treating arteriosclerosis, and for the patients who may have, or are at risk of acquiring, arteriosclerosis in one or more of its clinical manifestations. All groups need to know what our present policy encompasses, and what is involved in attempting to obtain a share of the public purse commensurate with the magnitude of the problem and its promise of solution, and proportional to expenditures in other cardiac and noncardiac disease areas.

Many investigators feel that many of our decisions are unwise. Some investigators and even some laymen feel that I am ill-informed, and perhaps biased by certain lobbyists, politicians, and vested interests, including the particular interests of a select group of distinguished scientists.

If you were to ask whether or not we have a national policy on arteriosclerosis, the answers that you would receive would be quite guarded and varied, for national policy is a spacious mantle. To ask about our program would be different even though “program” usually implies, or should in this context imply, an ordered plan to implement policy. “Do we have a program on arteriosclerosis?” The answer is: “Indeed, we do!” The boundaries of that program are not always clearly distinguishable from our broad interest in the rest of the “basic or clinical research” supported by the Institute. Too often the conclusion has been drawn that the Coronary Drug Project or the Diet-Heart Feasibility Study were in fact the Program—with a capital “P.” At other times the problem of heart attack or the establishment of specialized centers of

From the National Heart and Lung Institute, National Institutes of Health, Bethesda, Maryland.


Address for reprints: Dr. Theodore Cooper, Director, National Heart and Lung Institute, National Institutes of Health, Bethesda, Maryland 20014.
research have been equated with the program. No one of these is true.

Similarly, it is not necessarily true that the policy and program in arteriosclerosis, as I see it, and the National Heart and Lung Institute attempts at implementation are synonymous with either the report of the Task Force on Arteriosclerosis assembled last year at the behest of the Institute or with the national activity in arteriosclerosis. This latter would be true only if the national program was encompassed entirely by the federal research program, or if the National Heart and Lung Institute were the single focus in the federal government for all activities relevant to arteriosclerosis from biometrics to medicare including all research, education and training, diagnosis, acute care, preventive care, and health maintenance and regulation, for all people from veterans to infants. At the present time many agencies of the government are involved in the facilitation of various facets of the health system and thus are participants in the national activities on arteriosclerosis. I think it is fair to say that despite the many federal activities, there is no systematic interrelation of them—no national policy in arteriosclerosis; but this is not a criticism. “There is a time for everything,” the proverb says. I believe, however, that the time is now imminent for the development of a national policy in arteriosclerosis.

This development would include some changes in the Institute’s research program. I realize that change is a very threatening word. And it should be understood that just because I will advocate change does not mean that I propose to scrap basic research, peer review, or grants-in-aid. It does not mean that I want to discard our current investments in arteriosclerosis research, an investment which will total some $82,000,000 this year. It does mean that I want to consider change in how we are dealing with the national health and social problem which is arteriosclerosis. As Oliver Wendell Holmes once said, “Just because I say that I like sea bathing doesn’t mean I want to be pickled in brine.”

With or without a national policy, changes are certainly occurring in the treatment of coronary manifestations of arteriosclerosis and, indeed, the rate of this change is very rapid in certain surgical approaches. Changes are occurring in how the physician approaches the diagnosis of the risk of arteriosclerosis. Changes are appearing in the study and investigation of this disease.

As an example of this, let me consider, for a moment, the changes which I am sure would have been vigorously nurtured by Dr. Duff himself, were he still with us. They appear in the many current possibilities for a recoupling of morphologic research with clinical physiology and biochemistry. Although there are still some nontrivial disputes such as whether thrombosis precedes or follows coronary occlusion and myocardial infarction and how one can accurately assess myocardial injury after sudden death, most investigators agree upon the components and the sequence of the lesions of arteriosclerosis per se. Most can match these with classical clinical histories obtaining concurrence with clinical colleagues. What is now available, and what seems to me should strike a spark of renewed excitement in descriptive pathology, is the opportunity to link pathologic data with the increasingly precise clinical and laboratory data such as are obtained by coronary arteriography and lipid fractionation. To capitalize on new opportunities we need changes in resources, in ways of working together, in crossing traditional discipline boundaries, in approaching problems, and last, but far from least, in changing attitudes. To finance such activities as these we need to have a program or policy that the public can evaluate and choose to accept.

The decision to try to formulate a national policy or program and the determination as of the size of such a program should depend upon three major considerations:

1. The magnitude of the problem.
2. The importance that the public attaches to the problem.
3. The scientific, social, and, necessarily, the political possibilities for significant change in the acquisition of new knowledge and in the application of it.
Table 1

Deaths from Cardiovascular and Lung Diseases (United States, 1967)*

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>All ages</th>
<th>Under 65 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular diseases</td>
<td>1,002</td>
<td>251</td>
</tr>
<tr>
<td>Arteriosclerotic heart disease</td>
<td>573</td>
<td>159</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>202</td>
<td>37</td>
</tr>
<tr>
<td>Hypertensive disease</td>
<td>61</td>
<td>15</td>
</tr>
<tr>
<td>Rheumatic heart disease</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>Other cardiovascular disease</td>
<td>132</td>
<td>31</td>
</tr>
<tr>
<td>Bronchitis and emphysema</td>
<td>26</td>
<td>8</td>
</tr>
<tr>
<td>All other causes</td>
<td>823</td>
<td>456</td>
</tr>
<tr>
<td>Total deaths</td>
<td>1,851</td>
<td>715</td>
</tr>
</tbody>
</table>

*All figures are in thousands. Data from Division of Vital Statistics, National Center for Health Statistics, U.S. Public Health Service.

No one in this field doubts the magnitude of the public health problem which is arteriosclerosis and arteriosclerotic heart disease (tables 1 and 2). Each year, 200,000 Americans between the ages of 15 and 65 die with what has been called premature coronary heart disease but which, in the concept of preventive medicine, might better be called unnecessary heart disease and heart disease deaths. Furthermore, for every one such person dying before 65 years of age, three will die after that age of complications of arteriosclerosis, and a far from trivial number will be disabled from these diseases prior to death. Diseases of the circulatory system account for $1.1 billion annually in worker disability allowance: $7 billion annually in expenditures for care and treatment. The magnitude of the problem can scarcely be overstated.

Nevertheless, for some reason, calculations of the economic costs of this disease have not impressed the public, at least not to the degree that they have urged support of research commensurate with the burden of the disease. Parity in program funding has been based on something else. However, that something else is not a cost-benefit ratio unless in some fashion the “cost” of this disease has been discounted and the benefit to be derived from research correspondingly downgraded. In addition, it has not been easy to advise the public just how much needs to be spent to conquer arteriosclerosis.

Quite apart from, and in spite of, the magnitude of the problem and the potential cost-benefit ratios, it may be that the public does not see any need for a change in national commitments for the conquest of heart

Table 2

Estimated Numbers of Persons with Cardiovascular Disease and Lung Disease (United States, 1967)*

<table>
<thead>
<tr>
<th>Disease</th>
<th>20–64 years</th>
<th>$65 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diseases of cardiovascular system</td>
<td>16,400</td>
<td>11,400</td>
</tr>
<tr>
<td>Coronary heart disease</td>
<td>2,100</td>
<td>1,600</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>600</td>
<td>1,000</td>
</tr>
<tr>
<td>Hypertension</td>
<td>13,000</td>
<td>8,100</td>
</tr>
<tr>
<td>Rheumatic heart disease</td>
<td>1,000</td>
<td>500</td>
</tr>
</tbody>
</table>

*All figures are in thousands. Data from the American Heart Association; Heart Disease and Stroke Control Program and Chronic Respiratory Disease Control Program, Division of Chronic Disease Programs, U.S. Public Health Service.

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disease, believing that coronary artery disease, like so many other disorders, is being conquered and will in due time disappear. Unfortunately, the data are contrary to this idea.

It is true that between 1940 and 1970 there was a significant decrease in the number of deaths from all cardiovascular and renal diseases in this country. The most striking improvement occurred in the 5-14-year age group where cardiovascular deaths decreased 86% in 1970 compared with 1940. This change is due in large measure to the control of rheumatic fever and the initiation of therapy for congenital heart disease. Thus, in the young and middle-adult years, a 20% improvement in the death rates from all cardiovascular and renal diseases has occurred. Unfortunately, grouping all disorders of the cardiovascular system together conceals important changes in some components of the whole. Looking at coronary artery disease from 1950 to 1970, one finds that there has been, particularly in the 35-44-year age group, a far from trivial percentage increase in the death rate due to arteriosclerosis of 12.4%.

It may be that coronary heart disease is seen by the public as a relatively new disease. Impressions given by outstanding physicians and scientists may have conveyed to the laymen an idea of "newness" in this disease. For example, Dr. P. D. White is quoted in Family Circle magazine as saying: "When I was an intern at Massachusetts General Hospital in 1911 there was no department of cardiology. Infectious diseases were our great problem then." Notice Dr. White does not say that there was no heart disease, just that there was no department of cardiology. But the implication to the lay reader is that heart disease did not kill many people at that time and that it has only recently become a public health problem. In actual fact, heart disease has been the number one killer in the United States since at least 1910.

A third possibility is that the public believes that heart disease is, as many people say, "the way to go." Clinical experience and the morbidity data cited above show this to be far from the truth. However, in determining priorities and establishing parity what the public believes may be more important than what medical science knows. Conversely, the reason we lack an accepted, well-known, national policy on arteriosclerosis may be that the public feels the cure or the prevention would be worse than the disease. Many people may not be willing to alter sufficiently their diet, their smoking habits, nor any other aspect of their present way of life to reduce their own risk of heart disease. Undoubtedly, they would be less willing to do this en masse to save someone else's life. Prevention of disease obtained by short-term personal involvement or by long-term changes in public utilities (such as sanitation) are one thing. A standard of health which appears to conflict with accepted norms of "the American way of life" is something else.

Many members of the medical community and a corresponding number of laymen may believe that there are no promising leads to prevention or cure at this time, no practical possibilities for a "breakthrough," to use the current jargon, and so attention (dollars) should be directed elsewhere.

Thus we are forced to acknowledge that policy and parity are highly related. In deciding one, the other is often preset if not defined. Concepts of parity are based on "how much something costs when viewed in relation to other things available for purchase." By discussing parity, one is really discussing how many dollars go, or should go, into which program.

To my mind there is little, if any, merit to discussing the relative importance of domestic issues vs foreign ones. Furthermore, it does not seem to me to be profitable to pit one disease against another. Pain, suffering, and death are pain, suffering, and death irrespective of etiology. Furthermore, as a physician, I, like you, have been trained to try to alleviate disease by working through approaches governed by the laws of probability. All of our information, all of our thought processes are geared toward making the most probable diagnosis and prescribing the
therapy which is most likely to relieve the signs and symptoms.

However, decisions on resource allocation are largely determined by people whose background is in law, business, or public administration. They, and this is particularly true of lawyers, are trained to consider all the possibilities, to accept that the best advocate will be judged the winner, and to adopt his proposal for implementation. This often puts physicians in a disadvantageous position when attempting to hammer out with other members of the federal government, a large number of whom are lawyers, the content, form, and priority of a particular health program. In effect, skill in advocacy can be, and sometimes is, an overriding force in policy determination. Even if this were not so, I would still feel that a disease problem such as arteriosclerosis should have consideration as a health problem and should have the concomitant allocation of national resources determined on a simple, factual basis, namely, its magnitude and the high likelihood that something can be done about it.

These two have been major determinants of the National Heart and Lung Institute's program in arteriosclerosis. We have been soliciting the opinions of the scientific community as to the optimal form and nature of such a program. There are some who feel that our past activities have been more closely related to that Washington phenomenon, the filibuster, than to the industrial/academic phenomenon, planning. For my part, I do not consider the discussions, debates, and publications which we have had as either unnecessary or excessive. Having had access to all this wisdom, these many data and some content of emotion let me try to explain what I think the Institute should do to be responsive to the community's concerns about the diet-heart issue, risk factors, the lipid hypotheses, and prevention.

First, I endorse the judgment that prevention should be a prime objective of our program, but I do not equate prevention only with the prevention of "premature" disease. I am unwilling to view the appearance of disease after the age of 65 years as inevitable and I believe in the present state of our ignorance of aging processes to say that something is "inevitable" is akin to describing etiology as "idiopathic."

I am concerned lest success be defined too narrowly. If 25% fewer heart attacks occur due to an imposed intervention—if this is our horizon of success—then we could be lulled into the conclusion that we understand the biologic processes involved and that we need no more research on the basic biologic processes. Such a definition of success would be a tragedy, however desirable the gain might be. I am further concerned that we

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**Table 3**

*Projections of Ages in United States Population in 1985*

<table>
<thead>
<tr>
<th>Population ≥ 65 years of age</th>
<th>Actual population, 1965</th>
<th>Estimate for 1985 under various assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Current mortality trends</td>
</tr>
<tr>
<td><strong>Percentages</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>8.3</td>
<td>8.6</td>
</tr>
<tr>
<td>Females</td>
<td>10.4</td>
<td>12.0</td>
</tr>
<tr>
<td><strong>Number of persons</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>7.9</td>
<td>10.1</td>
</tr>
<tr>
<td>Females</td>
<td>10.2</td>
<td>14.6</td>
</tr>
<tr>
<td><strong>Total population, all ages</strong></td>
<td>195</td>
<td>240</td>
</tr>
</tbody>
</table>

*All figures are in millions. See text for discussion. Computations assume persistence of current mortality trends for all other causes of death, all ages.
†Codes 420-422 in the International Classification of Diseases, 7th Revision.
‡Codes 140-205 in the International Classification of Diseases, 7th Revision.*
recognize the sociological responsibilities which success, as equated only with the prevention of death, will impose.

Table 3 shows the percentages and the numbers of the U. S. population 65 years of age and over in 1965 and the estimate for these percentages in 1985 under the following assumptions: (1) that current mortality trends continue; (2) that mortality from coronary heart disease is eliminated below 65 years of age, but other mortality trends continue at their present rate; and (3) that cancer is eliminated in patients under 65 years of age, with present mortality trends continuing in other diseases. The lower part of the table translates these percentages into numbers of persons in millions.

Two facets of this table bear emphasis. The first is that the percentage of the population in the "senior-citizen" category would not become unmanageable under any of these assumptions. The second point is that the greatest parity between the sexes would be achieved if coronary artery disease before 65 years of age could be eliminated both in men and women. In my opinion, this is most desirable because the problems of older people are greatly magnified by the disparity between the number of women and the number of men over 65 years of age. Our society and their lives have been geared to a pair structure. Not only may it be disrupting and demoralizing for those accustomed to having a partner to have to shift to living alone, but the simple, albeit essential, activities of everyday life are often made much more complex when one must live alone in a compromised state of health. I think we must provide for some sociological research to enable us to anticipate success in prevention and to capitalize upon it.

Second, as I have already indicated, I think that progress in understanding this disease and hence in the ultimate conquest of it lies in basic research. By this I mean finding new concepts and acquiring new data. These data and ideas can be found in test tubes, in experimental animals, in individual patients, and in populations. A vigorous basic research program must be insured and adequate support must continue.

Third, to enhance the utilization as well as the development of this new knowledge, I believe we should develop a coordinated system of groups of scientists interested in and working on arteriosclerosis. In order to provide national resources for this kind of activity we recently initiated our Specialized Centers of Research in Arteriosclerosis. This network needs to be completed.

In the resolution of many problems, there comes a time when a variety of forms of organized activity can contribute. Knowledge is accumulated and formulated into hypotheses of causality of disease. To test these hypotheses may require the cooperation of large numbers of people over long periods of time. Among the current hypotheses dealing with arteriosclerosis none rates greater attention than the lipid hypothesis.

Therefore, I believe we need to proceed with testing whether lowering blood lipids will prevent arteriosclerotic vascular disease in man. Put another way, we need to learn in which people lowering of the lipids would prevent or retard the development of vascular disease.

More needs to be known about the prevalence and distribution of what are considered blood lipid abnormalities in the population at large, i.e., in populations living in their own environments. These data should emerge not only from some of our ongoing epidemiologic activities and some specialized centers but particularly from our Lipid Research Clinics. The characterization of the population will be an important step in the selection of the appropriate people for the human clinical trials which are needed. Indeed the fourth part of our arteriosclerosis program should be the completion of a nationwide network of these research clinics for just these purposes.

It has long been recognized that clinical trials (particularly in this area) are costly. Part of the expense is based on the requirements of cohort size which in turn is based on end-point measurement. To be able to evalu-
ate inception, distribution, progression, and regression of vascular lesions has long been identified as a critical need in this field. To achieve this goal we are seeking new noninvasive methods. Noninvasive techniques of detection would also contribute greatly to the ability of physicians to diagnose disease in its earliest phases. Arteriography and stress testing already offer possibilities for the refinement of end points. A great deal of information can evolve from a longitudinal study of patients already characterized as being at high risk because of a metabolic disorder, using the more sophisticated current diagnostic end points. Such a study in patients with type II hyperlipoproteinemia has been initiated at the Institute in Bethesda. Together these segments of our program constitute part five.

However, a small trial at Bethesda is not adequate, alone, to deal with the lipid question. Consequently my sixth recommendation is that the test of the lipid hypothesis using the usual clinical end points be extended to a large-scale trial in patients at high risk because of their lipid characterization. Such trials should strive for maximal lowering of lipids by any method available, effective, appropriate to the patient situation, and safe, be it diet, drugs, surgery, or any combinations thereof. The test is therefore not of diet or drugs or surgery, but rather it is a test of a lipid hypothesis. This distinction is most important. As you know, the Institute has been urged to endorse and undertake a national study of the effect of alteration of the diet on the course of heart disease. All diet studies that have been initiated or proposed would be expected to reduce lipid levels to some extent. We now know that the reduction from a single dietary regimen would not be expected to constitute optimal metabolic management in all patients. Thus, in my opinion, a diet-heart study alone is not an adequate test of the lipid hypothesis. I recognize that advocates of the national diet-heart study are not basing their recommendation solely on this contention. I hope I can make it clear that I do not recommend the diet-heart study as the fulcrum of our national policy, but I do recommend clinical trials which will involve dietary therapy.

In my view, no one clinical trial can serve to answer all the questions that need to be answered. Trials are needed to study mechanisms, and trials are needed to test the preventive potential of practical public health measures. I advocate another clinical study as my seventh point. A trial is needed to assess the role of blood pressure control on the prevention of myocardial infarction. We need to know whether control of hypertension in the young, the black, and the female, as well as the middle-aged white male, will reduce the incidence or severity of coronary artery disease, as well as of stroke, congestive heart failure, and other clinical abnormalities. We need to know the minimum clinical conditions which would indicate aggressive therapy including antihypertensive drugs. The first phase of this study was initiated last year.

Elevated blood cholesterol, elevated blood pressure, and cigarette smoking have been repeatedly reported as prime "risk factors" for coronary heart disease. It seems reasonable to extrapolate these observations to practical prevention by advocating a program which includes elimination of cigarette smoking along with reduction of serum cholesterol and control of blood pressure. Since all these measures seem prudent and sensible, perhaps even obvious, do we need to have a multifactor clinical trial? I think we do. This is my eighth recommendation. A good deal of present clinical practice, public discussion, and scientific endeavor is rationalized on the "risk-factor concept." One can calculate, I am told, that successful elimination of risk factors in a young-adult population should exert a powerful reduction in attack rates for myocardial infarction. Because the effect should be so powerful, the cohorts required would be relatively small. Hence, costs would be within a manageable range. Of course, one probably could not distinguish which factor in such a regimen was exerting the principal or perhaps all of the effect. However, the purpose of such a trial is not to study mechanism. The purpose is to test the prevention concept and to
provide guidance and reassurance that time-consuming, expensive practices are justified. This might be considered by some as an application of knowledge rather than a clinical trial, or a test of a hypothesis.

It is my opinion that the study of the lipid factor, the study of the hypertension factor, and the test of the multiple risk-factor concept can and should be done concurrently. The cost in human and financial resources would be manageable and would not, to an unreasonable extent, encroach on resources necessary for a balanced, progressive national biomedical research program or the general medical resources of the communities that would be involved. I think such a program would cost less than $112,000,000 over a 7-10-year period. Let me make two things clear about this estimate. This would be an increment over our current expenditures for arteriosclerosis. Secondly, the $112,000,000 does not provide for growth for other project needs and opportunities for progress available to the Institute. Arteriosclerosis is important, but it is not the only public health problem facing this nation. It is not even the only cardiovascular problem.

I want to reiterate that a vigorous program requires more than studies aimed at risk factors. Other factors in pathogenesis should be approached with an open mind: possible immunologic factors in vascular wall permeability, biophysical characteristics relating to lesion susceptibility, and neural and hormonal factors in the control of lipid metabolism and in vessel-lesion susceptibility. Other genetic, behavioral, and environmental factors which might contribute to the disease should be explored. We need to continue to find and evaluate techniques for early diagnosis of arteriosclerosis. We need a more realistic scientific and sociological approach to the rehabilitation of patients who have suffered heart attacks and strokes, and we surely need to be more effective in the areas of professional and public education. Children must learn to take care of their hearts as well as their teeth.

The overall national attitude or policy in arteriosclerosis should take into account the magnitude of the problem, appropriate cost-benefit analysis, opportunities to effect prevention, and the possibilities of new therapies. It should take into account the way the scientists plan their research. The funding decisions should reflect parity within the disease entity, between disease entities, and between competing domestic and social problems. Of necessity, those who make decisions should recognize current realities of policy and make due allowance for educating not only the scientists and the physicians but the consumers as well. One should also be prepared for the problems which will arise simply by virtue of semantics. In a country such as ours with well springs in so many different cultures and languages, one must be constantly alert to understand as well as to hear.

It is not enough in order to formulate a national policy merely to obtain expert opinions. One must be prepared to communicate in an intelligible fashion with consumers and producers alike. This communication must be reasonably lucid. Otherwise the validity of the policy cannot be assessed. We must resist absolutely the temptation to oversimplify complex issues and to treat every issue as a crisis understandable only by the scientific elite. We must take our plans to the people, for in the final analysis it is the people, and their representatives, who make the priority decisions upon which the dollars and the programs depend.

Acknowledgment

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THEODORE COOPER

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