RECENT TRENDS IN THE STUDY OF CORONARY-ARTERY DISEASE*

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The mounting incidence of coronary-artery disease in the past two decades in Britain, America, Canada and Western Europe and among South Africans has stimulated world-wide interest in the problem of causation with a view to providing measures to meet this challenge. Scientists in these and other parts of the world are engaged in intensive research and a vast literature has already been published dealing with many aspects of this problem. In the past an attitude of resignation to coronary disease prevailed because it was accepted as a natural development of the aging process. But, with the alarming increase of the disease in recent years and its occurrence in progressively younger age-groups, the problem of the aetiology has become urgent and has been receiving intensive consideration. The increase in the life-span of man must be taken into account when assessing the rapid upward trend of coronary disease since the beginning of this century. For example, figures quoted by White[1] indicate that the average age of 1,221 persons who died in Boston in 1829 was 25·2 years. In 1953 the average age of death in Boston was 69·5 years. Similarly Master's figures for the average life-span of the American from 1879 to 1899 was 34 years, whereas this increased progressively to 64·40 years by 1944 (Wood). It is obvious that one of the reasons for the lower incidence of coronary disease before the 1920s was the fact that many people did not live long enough to acquire coronary disease. There can, however, be little doubt that this increase in coronary disease is very real and cannot be attributed only to the longer span of man's life in the past few decades or the introduction of the wider use of the electrocardiograph and other methods employed in the more accurate diagnosis of coronary heart disease.

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Historical

It is of some interest to survey the history of coronary disease briefly and to present figures to prove that it has assumed a steep rise in incidence in recent years. The disease must have existed from time immemorial, the earliest evidence being indicated in the generalized atherosclerosis found in Egyptian mummies dating from 1580 B.C. There is very scant historical evidence to suggest that anything was known of the disease till the 17th century. In 1649, William Harvey described the vice-like paroxysms of chest pain which occurred in a knight who died in such a paroxysm—undoubtedly due to coronary thrombosis. Heberden's graphic description of angina pectoris in 1772, has remained a classic although he was not aware of the cause.[2]

The famous surgeon John Hunter was a victim of angina and, in his own words, 'his life was in the hands of any rascal who chose to worry him'. His fatal attack occurred in a fit of anger. His close friend, Jenner, of vaccination fame, performed an autopsy and concluded that his chest pains were due to calcification of the coronary arteries.

The 19th century brought very few advances in the recognition of this disease which must undoubtedly have taken its toll of life. This was probably due to the dogmatic statements made by leading clinicians of the day and accepted by their disciples without question. We find, for example, that Napoleon's personal physician, Corvisart, ascribed angina to a nervous disorder. His views were accepted in Europe, Britain and America for over 30 years. The famous pathologist Virchow believed that the scars he found in the heart in his post-mortem examinations were due to infection. A view was also prevalent that the coronary arteries were end-arteries, and that when an occlusion occurred in such a vessel, death was instantaneous and could, therefore, not have been preceded by any symptoms.

At the turn of this century, the great physician William Osler[3] remarked that the disease was 'not uncommon'—about 700 people dying annually of it in England and Wales. He commented that it was a disease of the better classes and not of the working classes and that a consultant in active practice would see about a dozen cases a year. He also mentioned that it was a rare disease in hospitals and that a case a year even in the large metropolitan hospitals in London was about the average. In Osler's series of 268 cases, including angina pectoris and coronary thrombosis, there were 33 physicians.

In 1912 James Herrick, of Chicago made medical history when he published a classic account of coronary thrombosis, but the First World War again delayed its general recognition till the 1920s. In subsequent years there was an increasing recognition of coronary disease, as shown by Cassidy's figures for Great Britain[4] (Fig. 1).

TABLE I

Year	*Number of Coronary Deaths*
1926	1,880
1936	14,095
1939	19,496

Other striking statistics are available to show the appalling increase in coronary disease. In 1926, 6·3% of all deaths in Great Britain from heart disease were attributed to this cause. In 1954 this figure had risen to 62·5%—an almost tenfold increase. American and British figures have shown an alarming increase in the mortality from coronary disease in the past 25 years and much more so during the past 10 years. Alarming, too, is the way in which it is creeping down to the younger age-groups—35 to 50 years—affecting chiefly men in the prime of life. South Africa is now considered to be level with the United States in having the highest incidence of coronary disease. Authorities have stated that as a single cause it accounts for the largest number of deaths after the age of 45 years and kills 4 out of every 10 European adults over this age. It has also been shown that the incidence of the disease among Europeans in Johannesburg is the highest in the Union. Table II shows the number of deaths due to coronary

* Valedictory Presidential Address, Johannesburg, 18 February 1957.

TABLE II. DEATHS FROM CORONARY THROMBOSIS (RATES PER 1,000)

Year	Europeans		Coloured		Asiatics		Natives		Mine Natives	
	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
1939–40	155	·54	6	·24	4	·35	3	·02	1	·02
1940–41	205	·74	4	·16	8	·70	9	·05	1	·02
1941–42	197	·69	2	·08	8	·69	8	·04	1	·02
1942–43	237	·81	1	·04	7	·59	10	·05	—	—
1943–44	263	·95	3	·12	14	1·14	2	·009	1	·02
1944–45	287	·93	9	·35	7	·55	15	·07	1	·02
1945–46	289	·89	5	·21	12	·86	11	·04	4	·08
1946–47	309	·93	6	·25	15	·96	20	·06	1	·02
1947–48	364	1·07	8	·35	8	·33	28	·08	1	·02
1948–49	298	·87	12	·45	7	·42	25	·06	—	—
1949–50	404	1·15	12	·44	13	·75	30	·07	1	·02
1950–51	457	1·34	12	·40	24	1·22	25	·06	3	·07
1951–52	439	1·27	11	·35	17	·82	40	·10	2	·05
1952–53	461	1·32	12	·37	19	·88	28	·06	—	—
1953–54	526	1·48	13	·39	23	1·05	52	·11	3	·08
1954–55	534	1·50	16	·47	21	·89	60	·12	1	·02
1956	534	1·47	17	·46	26	1·04	30	·06	—	—

The last figures available of the total population of Johannesburg were 1,030,200: European 393,300, Native 561,600, Asiatic 28,700, Coloured 46,600.

The total death rate from infancy to old age in South Africa (White population) is approximately 8·5 per thousand. Of these 1·47 per thousand die of coronary-artery disease. This means that approximately 10 people die daily (babies to old age) in Johannesburg; of these approximately 2 people die from coronary heart disease daily.

thrombosis n Johannesburg from 1939 to 1956 and the comparison with Coloureds, Asiatics and Natives:

The Changing Pattern of Man's Life

Three points present themselves for consideration:

1. There is undoubted proof that coronary disease has taken a steep upward trend in the Western countries in the past 10-15 years.

2. Preceding generations were, to a great extent, less prone to coronary disease.

3. In Eastern countries, such as China and Japan, and among approximately 200 million Bantu in Africa, the incidence is extremely low.

A solution of the problem is being sought along comparative lines. The question arises: How did the mode of life of our ancestors differ from ours and did such differences have a bearing on the problem? Such differences, if pertinent, should also be applicable to differences in living customs between East and West. Factors such as racial characteristics and heredity, diet and physical activity, obesity and endocrine influences, smoking and the so-called 'stresses and strains' of modern life may play their part in this inquiry. The vastness of the problem calls for every effort to be made in an attempt to expose the factors responsible for the sudden increase in this disease.

In this intensive search for the cause, teams of biochemists, pathologists, physicians, statisticians and many other workers have contributed and are contributing a great deal in conjunction with important studies from an epidemiological approach. More and more publications are appearing and adding to the mass of literature already available from many parts of the world. It is worthy of note that research units have been established in this country in Cape Town and Johannesburg, where there is the unique opportunity of studying comparative race groups side by side.

At this stage I shall attempt to examine briefly the evidence on some of the changing features in the pattern and habits of the average European's life during the first half of this century.

Hereditary Factors and Racial Characteristics

The high incidence of coronary disease in America, Britain and Western Europe and among South Africans, and the comparatively low incidence in some Eastern countries and among the Bantu of the African continent suggest that racial characteristics operate in a great measure. This presents the question whether healthy or potentially unhealthy coronary arteries are inherited on a racial basis. It would suggest that the Japanese, Chinese or Bantu are, from the coronary point of view, in a much happier position than the European. On analysis certain objections can be raised against such generalizations. For example, in America there is, on the whole, no distinction in the mode of life among different national groups living in communities. Coronary thrombosis occurs with equal frequency among Americans of English descent and American Italians, Jews and Irish. The southern Italian and the Irishman have certainly not emigrated to America with a poor coronary-artery heritage. The defect has developed in America where a uniform way of living exists. In Chicago, for example, the American negro, who is a descendant of the African Bantu, has the same high incidence of coronary disease as the White American. The Americanized Japanese in Hawaii are subject to coronary disease to practically the same extent as the White Hawaians, although they are descendants of a race in which the disease has a very low incidence.

It is a well-known fact that the disease is almost equally prevalent among all the racial groups of European South Africans in contrast with the Bantu, in whom the disease is still a rarity. But it is significant that the urbanized Bantu, who is adopting European customs, is beginning to show increasing evidence of coronary disease. Another example of the weakness of the hereditary explanation is the significant decline during World War II in coronary disease among the Nordic and Anglo-Saxon peoples, in whom the post-war incidence has again risen steeply. These examples appear to indicate that hereditary and racial factors are not as significant or constant as they would appear to be and even when present can be reversed. Nevertheless, a genetic factor cannot be entirely denied, because of the common experience that coronary heart disease frequently occurs in families. But American statistics indicate that 30% of deaths over 40 years of age are due to coronary disease, which challenges the view that the disease is essentially a familial one.

Coronary Heart Disease in relation to Physical Activity

Interesting figures were published by Ryle and Russell,[5] who found that the mortality rate from coronary disease among professional groups was twice that of skilled artisans and 3 times that of unskilled workers. In this analysis of figures in England and Wales, physicians and surgeons head the list, with proprietors of wholesale businesses second, and the legal profession third. Morris *et al.*[6] carried out an extensive survey of coronary disease in relation to physical activity and inactivity. Their illuminating figures show that bus drivers have a higher incidence of coronary disease than bus conductors, and telephonists, whose occupation is sedentary, than the 'foot-slogging' postman.

During the past 3 or 4 decades there has been a striking diminution of physical activity among all classes of Europeans. This has been encouraged by the mechanization of industry and agriculture and the extensive use of the motor-car to replace the normal exercise previously derived from manual labour, walking and cycling. Even in the field of sport there is much more enthusiasm for watching games than for taking part, and it is doubtful whether the popular week-end sport indulged in by many professional men and office workers compensates for this change. This decline in physical activity during the past few decades has coincided with the sharp increase in coronary disease. It is possible that the motor-car is an important factor in the aetiology of coronary disease.

Endocrine Aspects

Up to 50 years of age the incidence of coronary disease in women is much less than in men, the ratio being about 10 to 1. The sex ratio from 50 to 60 years is approximately 3 males to 1 female. Only after the age of 70 years are the death rates from coronary disease equal in both sexes. It would appear that women whose pattern of living, in some important aspects such as their diet, is identical with that of men in the same community, must have some protective hormonal influence. With the spread of the disease into the younger age-groups this mechanism is becoming insufficient to protect some women in the thirties and forties from developing angina or coronary thrombosis. Experience in practice indicates that there has been a notable rise in the number of younger women with this disease. There is some evidence to indicate that oestrogen can reduce plasma cholesterol while androgens can raise this level. Fibrinolytic activity can also be retarded by oestrogen and accelerated by androgens. The possible value of oestrogen therapy must await the long-term control studies on patients with myocardial infarction.[7] An excess of thyroid hormone produces a diminution of the cholesterol level, whilst hypothyroidism increases it. Barr[8] has shown that cortisone may increase the cholesterol level, which would suggest that if used at all for myocardial infarction its use should be restricted to combating shock only. Oliver and Boyd[9] summarized their views on the hormonal influences of the circulating cholesterol by stating that the adrenal, thyroid and oestrogens produce a normocholesterolaemia and that the androgens and progesterone induce a hypercholesterolaemia.

Some evidence[10] has also been presented to suggest that 'stress' factors may stimulate the hypothalamus which, in turn, may increase the output of adrenaline, increase the prothrombin concentration, decrease heparin activity, and so accelerate clotting. In other words, it is suggested that a fit of temper may bring on an attack of coronary thrombosis in a susceptible individual. Endocrine factors appear to be important in the aetiology of coronary heart disease, but much work is still necessary to elucidate the exact relationship.

Smoking

Doll and Hill,[11] in their survey of cancer of the lung among doctors, have, incidentally, also produced figures to show that the incidence of coronary disease is about 1½ times as great in doctors who smoke as in non-smokers. Although there is no clear-cut evidence that smoking causes damage to the coronary vessels, a lurking suspicion of such damage remains in one's mind when one recalls the close association of smoking with thrombo-angiitis obliterans. Other reports[12] also support the view that smoking promotes coronary disease.

However, there is also evidence to the contrary. Coronary disease in the Bantu is rare, and in the Cape Coloured far less than in the Europeans,[10] yet there is no difference in the heavy smoking habits of the three groups. In the south of Italy the men smoke as much as those in the north, yet the incidence of coronary disease is much less in the south. In Japan, where coronary disease is very rare, heavy cigarette smoking is the custom.

Although it cannot be proved beyond doubt that there is a relationship between smoking and coronary disease, most patients who develop coronary thrombosis are usually heavy smokers, and this should be regarded as a warning.

Psychological Factors

Factors such as ambition and drive, the striving after economic and social success, frustration or contentment at work, domestic bliss or jarring, emotional reactions to environment, equilibrium or tension, still await assessment. Do these factors operate through the hypothalamus and so produce endocrinological effects? What appears fairly obvious is the frequent association of the 'stresses and strains' in the higher socio-economic levels among professional men and business executives, who, incidentally, have the highest incidence of coronary disease. It is difficult to dissociate stress factors from coronary thrombosis.

Obesity

In practice one is not impressed with a particularly high incidence of coronary thrombosis in the obese. On the contrary, most of the victims are of normal build and a fair number are thin. Ancel Keys[10] has calculated that over 95% of coronary deaths in America have not had their insurance premiums loaded on account of obesity. Under 50 years of age there is some evidence that there is a proportionate increase in coronary heart disease in obese people. In passing, it may be noted that obesity is not uncommon among the Bantu with little coronary disease. The fact that there is no considerable increase of coronary disease has no bearing on the accepted view that obesity is a hazard to good health. Some distinction may be made between endocrine obesity and that due to over-indulgence. The latter type carries a greater risk of coronary disease.

Diet and Fat Metabolism

This subject has received the greatest amount of attention and appears to be the most important one from the aetiological point of view. In general, the higher incidence and exceptional increase of this disease has occurred among Europeans all over the world who consume luxury diets, i.e. high in calories and fats. Ancel Keys conceived the idea of an epidemiological approach to the problem of coronary disease and must be regarded as the real pioneer of this work. In looking East it is apparent that the Chinese and Japanese are not prone to coronary disease, and the same applies to the Bantu of the African continent. One of the dominating contrasting features is the difference in diet. The American, the Englishman, people of Western Europe, the North Italian and the European in South Africa feed well; their diets are generous in calories and, in many countries, the fats comprise 40% or more of these calories. The Japanese and Chinese eat frugally and consume little fat. The African Bantu lives chiefly on maize and carbohydrates, with little protein and even less fat. Here, then, a striking difference in the diets of two large sections of the world's peoples has been observed, with a marked difference in the relative incidence of coronary disease. Ancel Keys[13] studied the fat metabolism in surveys covering numerous groups of people in different countries; he did this by estimations of the serum cholesterol and then enunciated two rules from his epidemiological studies. Firstly, whenever a population has a relatively high cholesterol level for middle-aged healthy men, a relatively high incidence of coronary disease is exhibited in such a group. These cholesterol studies were made in cities in America, England, Sweden and Italy, and also in Cape Town. Secondly, in his survey among the poor in southern Italy, the indigenous peoples of Nigeria, the Yemenite Jews, the Japanese, and the Bantu in Cape Town, he found a low incidence of coronary disease. That cholesterol levels in communities may be influenced by the variation of the percentage of fats consumed was convincingly demonstrated during World War II. In Great Britain, Holland, Denmark, Sweden, and particularly in Finland and Norway, the mortality from coronary-artery disease was diminished in proportion to the percentage reduction of fats in the diet.[13]

Significance of Increased Cholesterol Levels

Over a hundred years ago cholesterol was found in atheromatous plaques, and its significance in coronary-artery disease has never been disputed. The problem which has faced the biochemist and the pathologist is how this lesion occurs in the coronary vessels. The solution to this question is still being eagerly anticipated because it may provide the answer to the disease. In the meanwhile we must apply the information which is available, although it is still inadequate.

It should be appreciated that the average level of the serum cholesterol in a community is regarded as an index to the incidence of coronary disease. Serum-cholesterol levels are not influenced by the amount of cholesterol ingested in food, but are dependent on the quantity of fats consumed. By an intricate biochemical mechanism, cholesterol becomes embodied in the various fractions of the metabolized fat—chiefly in the alpha- and beta-lipoprotein fractions of the circulating lipids. The raised serum-cholesterol level is significant because it usually reflects disturbances in the general lipoprotein pattern[14–18] and not because the cholesterol itself is raised. In other words, it is a convenient measure of potential or established coronary disease in community surveys, while at the same time it has limitations in individual interpretation.

Clinically, essential hypercholesterolaemia provides a good example of disturbed cholesterol metabolism. From the laboratory aspect there is usually an abnormally high serum cholesterol associated with an abnormal lipogram and, clinically, about 80% of these patients develop ischaemic heart disease, usually at an early age.[18] Gross disturbance of fat metabolism also occurs in the well-known condition idiopathic hyperlipaemia, in which the raised serum cholesterol is incidental and the important laboratory evidence is the high lipid content due to an increase in the neutral fats and lipids, which give the serum a milky appearance. This condition is also associated with an extremely high incidence of coronary disease.[19,20]

A raised serum cholesterol is not so significant when it is not associated with a disturbed lipogram in such diseases as, for example, nephrosis,[21] myxoedema,[22] and biliary obstruction.[23]

Population surveys have been carried out in communities in many parts of the world to determine the average serum-cholesterol level in relation to coronary disease. Keys has surveyed population groups in Italy, Sweden, America, Nigeria and the Far East, and the constant and significant finding is the higher the average serum-cholesterol level in a community, the higher the incidence of coronary disease. In South Africa, where the special advantage of studying race groups side by side exists, a number of important surveys have also been made. In Johannesburg, Bersohn and Wayburne[24] have studied the serum-cholesterol levels in newborn African and European infants and in mothers. They found that the cholesterol levels in the two groups of infants were identical, but that the European mother invariably showed a considerably higher level than the African mother. Although the European infant begins life without a 'cholesterol handicap', this advantage is not maintained, for the level rises steeply with age, as demonstrated by the work of Adlersberg *et al.*[25] and Walker and Arvidsson,[26] and in the Cape Peninsula by Bronte-Stewart *et al.*[27] Walker and Bersohn[28] have confirmed the fact

'that the lipoprotein pattern of the Bantu remains young'. In South Africa, as elsewhere, the population surveys indicate that raised serum cholesterol in the European is associated with a high occurrence of coronary heart disease.

The question of fat metabolism in relation to atherogenesis of coronary disease is extremely involved, and the highly technical laboratory studies are outside the scope of the average physician. These problems await further elucidation by the laboratory workers in this field. The work now proceeding in many centres, including those in South Africa, promises results in this important field of fat metabolism. In the meanwhile, on the basis of the evidence available, the clinician may reasonably accept the view that a raised serum cholesterol predicts the probability of coronary disease.

SUGGESTED MEASURES TO REDUCE THE INCIDENCE OF CORONARY DISEASE

At this stage, with the mass of undigested information, and views based on many divergent theories and immature conclusions, such a heading as 'prevention of coronary disease' may appear to be unjustifiably ambitious. Nevertheless, the clinician is faced daily with the growing problem of the scourge of coronary disease and, aware of his obligations to his patients, must attempt to decipher some pattern of advice from the information available on reasonable, if not on dogmatic, grounds. It is essential, however, to realize the limitations imposed by the present state of our knowledge.

Prevention of coronary disease is a recent concept and may at this stage be considered from 3 aspects, viz. (1) environment, (2) dietetic hygiene and (3) drugs. *Environmental Factors* will include advice in respect of regular and sufficient exercise, strict moderation in smoking, ample recreation and rest. Psychosomatic factors are more difficult to control because they are linked up with the striving for economic and social success and the highly competitive trends in modern life. Nevertheless, when the probable penalty for immoderate living is appreciated by the individual, a measure of cooperation may be anticipated.

Dietetic Factors

To quote Ancel Keys[10]: 'No major primary role in atherogenesis or in the prevention of clinical coronary disease can be assigned to race, nationality, obesity and overweight, cigarette smoking or indulgence in alcohol. Some of these factors may make a secondary contribution, perhaps contingent upon the existence of a particular set of circumstances'. He is, however, not prepared to minimize the influence of physical activity. He continues: 'When we come to the diet, apart from sheer calories, there is much firmer ground to conclude that it is of major primary importance. The evidence is consistent in theory, in field studies, in statistics and in experiments, both on man and animal'. Replacing the saturated fats, such as the animal and hydrogenated vegetable fats, with highly unsaturated fats derived from vegetables and some fish oils, or even adding these unsaturated fats to a normal fat intake, will reduce the total plasma lipids and serum cholesterol in most people.

Interpreting the importance of diet in its practical application, the course to be followed is a general reduction in calorie intake, with not more than 20-25% of calories to be provided by fats, and the utilization of *unsaturated* with a minimum of saturated fats. While the advice to 'cut down fats' may in general terms be sound for patients with established or threatening coronary disease, specific diets should be provided. Such diets are available

TABLE III

Fat	Saturated	Mono-ethenoid	Poly-ethenoid
Butterfat	57	39	4
Coconut oil (hydrol)	97	3	0
Corn oil	12	37	51
Cotton-seed oil	25	25	50
Lard	43	—	10
Margarine	65	25	10
Sardine Oil	23	23	54
Sunflower-seed oil	10	28	62
Tallow (beef)	53	—	4
Olive oil	12	—	12

and should clearly indicate the foods which are allowed or prohibited. In addition, a table should be provided showing the exact content of unsaturated and saturated fats in oils and fats commonly used in household cooking, with the strict injunction that those with a high percentage of saturated fatty acids should be avoided as far as possible. Table III an example of such a table, adapted from the studies of Ancel Keys[9]:

Additional dietary changes should include the replacement of white bread by brown bread, coarse cereals such as wheat, oats and maize, which have a high content of coarse fibre and cellulose, vegetables, potatoes and legumes. McCance in Cambridge and Walker in Johannesburg (quoted by Walker and Bersohn)[28] have reported that large amounts of fats, up to 22 g. daily, are voided in the stools of those who consume large amounts of these coarse foods: This is in striking contrast with the very small quantity, approximately 1 g. of fat voided in the stools of those who consume a low-residue and high-fat diet.

Not only sufferers from coronary-artery disease, but also those who are prepared to make a conscious and serious effort to try and avoid becoming victims of this scourge should follow such a dietetic regime. It would not be overstating the case to warn people that rich, fatty foods may in due course 'silt up' the coronary arteries in much the same way as an over-rich petrol mixture will carbonize the cylinders of a motor-car. There is encouraging evidence to indicate that a strict and sustained low-fat, moderate-calorie and high-cellulose diet may retard the formation of atheromatous deposits in the coronary arteries. Atheromatous plaques produced experimentally in rabbits or chicks on a high cholesterol diet may be made to regress by removing the dietary cause. Although it may not be possible to infer that the same change would occur in man, it has been claimed that the cutaneous xanthomata due to cholesterol deposits on the skin may be made to regress somewhat on a low-fat diet.[29] This theory of clinical regression of coronary atherosclerosis receives further support from the relatively low incidence of severe atherosclerosis in autopsy findings in emaciated individuals who have died from cancer.[13] The prophylactic approach to coronary heart disease receives logical encouragement from these facts.

The modern trend in the dietetic approach is a valuable contribution in the field of prophylaxis in coronary-artery disease, although there are still many gaps in our knowledge. There are, of course, other views expressed by nutritional experts and others, as for example the opinion that atherogenesis may be caused by a threefold vitamin deficiency of essential fatty acids, vitamin E, and vitamin B6,[31] caused mainly by the artificial processing of foods. Future developments will, no doubt, clarify the association, if any, of vitamins, proteins, carbohydrates or minerals with the process of coronary-artery damage. We should also appreciate the important evidence available that atherogenesis is initiated in early life through the over-feeding of children by over-zealous parents. It is not surprising, then, that such a high incidence of coronary atheroma was found amongst the young US soldiers killed in the Korean War.

Drug Treatment

No drugs are known to have any beneficial effect on the atheromatous plaques in the coronary vessels. At present drug treatment is aimed at diminishing either the cholesterol level or the coagulating factors of the blood. Trials with triiodothyroacetate have failed.[32] High-dosage nicotinic-acid therapy produces variable results on the cholesterol level and is a cumbersome treatment, although concentrated preparations are now available. The oestrogens have been withheld on account of their obvious disadvantage but evidence of their probable value may yet be forthcoming. At present the beta-sitosterols which are said to reduce the cholesterol levels are being tried with some measure of success.[33]

From the prophylactic aspect, the anticoagulant drugs may be of considerable value. 'Physiologic clearing process' of lipids by heparin several hours after the ingestion of a fatty meal is well recognized.[34] The rapid excretion of heparin, the need for parenteral therapy, and the usual extensive bruising, limit heparin administration to short periods or long intervals. Long-term treatment with dicoumarol or similar drugs has been advocated for prophylaxis against recurrent attacks of coronary thrombosis.[35,36] My impressions of the long-term dicoumarol treatment of a large series of cases over a number of years are that this treatment is of considerable prophylactic value. Nevertheless, a further assessment of its value is necessary. During Prof. Melville Arnott's visit to South Africa last year he informed me that an extensive investigation, with a control series of cases, was being initiated in Great Britain under the auspices of the Medical Research Council. This should provide valuable information for the

prophylactic use of dicoumarol in preventing recurrence or threatening attacks of coronary thrombosis.

In conclusion, I would again remind you of the urgency and importance of the problem connected with the steep rise in coronary-artery disease as illustrated by the history of this condition and the alarming statistics in all Western countries, no less in South Africa and not least in Johannesburg.

Heredity, race and obesity do not appear to be consistant factors in this sharp increase. There is evidence that female sex hormones have some protective effect and that the androgens increase vulnerability, but Ancel Keys has assured us 'that being a male is not necessarily fatal'. Linked with the hormonal influences are the psychosomatic factors which play an obscure role in the aetiology depending on a tense or peaceful mode of living. Although alcohol has not as yet been mentioned, it has been stated that, for unexplained reasons, heavy drinkers tend to have a low serum cholesterol and a correspondingly low incidence of coronary disease.[37] With reference to physical activity, the evidence seems to indicate a considerably increased incidence of coronary disease in sedentary occupations. In view of the vast amount of research work now proceeding, the prospects of improving prophylactic measures in the future are very promising.

To avoid the threat of coronary disease as far as possible one should follow, not the precept of Horace, 'To-morrow do thy worst, I have lived to-day', but that of the old Latin proverb, 'Not as it pleases us but as it is right for us—so let us live'.

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