A STUDY OF HEREDITARY PREDISPOSITION TO CARDIOVASCULAR DISEASES

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A STUDY OF HEREDITARY PREDISPOSITION
TO CARDIOVASCULAR DISEASES

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By

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CHAPTER I

INTRODUCTION

The controversial question of heredity versus environment has been debated often, but one writer expresses it thus: "Heredity and environment are indispensable in the life of every organism; and if both are indispensable, neither can be considered more important than the other."\(^1\)

Since man exhibits a certain heredity and shows effects of his environment, another geneticist has said:

Human beings in so far as they have been studied, appear to obey the same laws of heredity as other organisms. The only essential difference is that human beings are capable to a large extent of controlling their environment. This may profoundly modify the expression of a heredity factor, but it neither obviates the fact of the genetic nature of any hereditary condition, nor changes in the least the potentiality or mode of its transmission.\(^2\)

Man is heir to his forebears' heredity, and he is susceptible also in a large measure to his environment, particularly diseases which maim, incapacitate, or cause death.

Causes of illness or disease have been described thus:

The causes of illness are composite. They do not consist exclusively of either environmental influences or of hereditary predispositions; it is usually found

\(^1\)Edward C. Colin, Elements of Genetics, Ch. XII, p. 244.

\(^2\)Laurence H. Snyder, "Genetics and Medicine," The Ohio State Medical Journal, XXIX (November, 1933), p. 705.
that factors belonging to both classes have been at work. When we speak of hereditary diseases, we mean those in whose production morbid hereditary factors have been chiefly operative. Morbid hereditary conditions are induced by single hereditary factors, and normal qualities by many such factors. The inheritance of normal or morbid endowments is equally determined.

Relatively few physicians have accepted the premise that a predisposition to cardiovascular disease is of significance in a history of the patient’s disease expectancy. They are prone to say that heart disease is a result of the mode of living, occupational hazards, etc. The few who have been cognizant of the role of heredity in the life of the individual have expressed various opinions.

Review of Literature

Man in his genetic make-up inherits predispositions to numerous diseases and according to Thompson\(^4\) (1912), it is probable that some predispositions are much more definite than others.

Cardiac disturbances in more than one member of a family led St. Lawrence\(^5\) (1922) to believe that a susceptibility had been transmitted, or the exciting cause had been transferred from generation to generation.

Heredity had evidently produced or was the exciting cause

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\(^3\) Edwin Baur, Eugen Fischer and Fritz Lenz, *Human Heredity* Ch. IX, p. 219.


\(^5\) Wm. St. Lawrence, "The Family Association of Cardiac Disease, Acute Rheumatic Fever, and Chorea," *Journal American Medical Association*, LXXIX (December, 1922), 2051-2055.
of hypertension in cases cited by Rosenbloom\(^6\) (1923).

Weitz\(^7\) (1923) seemed to think that hypertension was produced by heredity and was inherited as a dominant factor, and O'Hare, Walker, and Vickers\(^8\) (1924) are in agreement with Weitz.

Draper, Allen, and Sprock\(^9\) (1929) contend that each separate type of infection or disease is not inherited directly by a gene or genes, but that a weak constitution is the inherited factor. This constitutional weakness is expressed by widely varying clinical conditions in different individuals of the same family.

Reports of family histories of coronary disease by Coombs\(^10\) (1930), and Musser and Barton\(^11\) (1931) led them to believe that heredity as a cause for coronary disease is growing in importance.

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10 Carey F. Coombs, "Observations on the Aetiological Correspondence between Anginal Pain and Cardiac Infarction," Quarterly Journal of Medicine, XXIII (April, 1930), 233-239.

Contrary to the belief of Rosenbloom, Weitz, O'Hare, Walker and Vickers, Allan\textsuperscript{12} (1933) pointed out the fact that cardiovascular disease is so common that the familial occurrence proves nothing regarding inheritance.

Lenz\textsuperscript{13} (1934) stated that a dominant heredity is indicated in forms of heart failure which are sequels of valvular inflammation of the heart, in arteriosclerosis, and in heart attacks during the sixth decade of life.

Another investigator, Ayman\textsuperscript{14} (1934), supported Rosenbloom, Weitz, and others in the belief that heredity is a factor in hypertension.

In a study of cardiaes and non-cardiaces, Pearl and Giocco\textsuperscript{15} (1934) and Giocco\textsuperscript{16} (1936) found that obesity of the cardiaes as compared to the non-cardiaes was due largely to overeating and lack of exercise rather than to a basic constitutional weakness.

\textsuperscript{12}Em., Allan, "Heredity in Hypertension," Archives of Internal Medicine, LII (December, 1933), 954-958.

\textsuperscript{13}Edwin Baur, Eugen Fischer, and Fritz Lenz, Human Heredity, translated by Elian and Cedar Paul, Ch. IX, 219-22.

\textsuperscript{14}David Ayman, "Heredity in Arteriolar (Essential) Hypertension," Archives of Internal Medicine, LIII (May, 1934), 792-802.


Another writer, Hines\textsuperscript{17} (1937), contended that the probable trait of hypertension is inherited as a dominant characteristic.

Two members of the Mayo Clinic, Goldsmith and Willius\textsuperscript{18} (1937), claimed that hereditary influences play a much more important part in coronary disease than is generally admitted.

Contrary to Hines, Lenz, Goldsmith, Willius and others, Sheinfeld\textsuperscript{19} (1939) said heredity has so far been closely indicated as a dominant influence for the cause of rheumatic heart disease, and that there is a presumption of heredity in high blood pressure but no adequate proof had been established at the time of publication.

An inheritance of a weak heart, or constitution less resistant to heart and blood diseases, has been indicated by Ciocco\textsuperscript{20} (1941).

Draper, Dupertuis, and Caughey\textsuperscript{21} (1944) have indicated a time point specific for each family at which susceptibility to disease may appear.


\textsuperscript{18}Grace A. Goldsmith and Frederick A. Willius, "Bodily Build and Heredity in Coronary Thrombosis," \textit{Annals of Internal Medicine}, X (February, 1937), 1161-1186.

\textsuperscript{19}Amram Sheinfeld, \textit{You and Heredity}, Ch. XXI, 119-129.

\textsuperscript{20}"Tendency to Die of Heart Disease Runs in Families," \textit{Science News Letter}, XL (October, 1941), 254.

Another writer to substantiate the belief that heredity is important in incidence to the cardiovascular diseases of hypertension and the anginal syndrome was Dunbar\textsuperscript{22} (1945).

In agreement with Dunbar, Gates\textsuperscript{23} (1946) also adds to the above belief that transmission of cardiovascular diseases is direct with dominance indicated.

Statement of the Problem

A geneticist expresses a need for more case studies pertaining to human heredity when he says:

Much of human heredity is still to be investigated, and much of his investigation depends on the interest and cooperation of the physician. Adequate family histories must be available and in many instances these are only obtainable by the physician.\textsuperscript{24}

Because the many physicians and students of heredity have not been closely associated in finding that the causes of cardiovascular diseases might lie, in a large measure, to an inherited predisposition, this study has been undertaken; first, to contribute several more case studies of cardiovascular diseases to the knowledge of heredity; second, to find if there is a possible successive occurrence of cardiovascular diseases in generation after generation; and third, to determine a possible mode of transmission from parents to offspring by an analysis of nine genealogies.

\textsuperscript{22}Flanders Dunbar, "Hypertensive Cardiovascular Disease," \textit{Psychosomatic Diagnosis}, Ch. V, pp. 248-365.


\textsuperscript{24}Snyder, \textit{op. cit.}, XXIX, p. 708.
Definition of Terms

Since several heart conditions are shown in the genealogies, and in order that the reader may understand the type of heart disease affecting the individuals, the terms must be defined.

Cardiovascular diseases are those that pertain to the heart and blood vessels.\(^\text{25}\)

Coronary thrombosis means the formation of a clot in a branch of the coronary arteries which supply blood to the heart muscle resulting in the obstruction of the artery and infarction of the area of the heart supplied by the occluded vessel.\(^\text{26}\)

Coronary occlusion is another name used to refer to the closing of the coronary artery by an embolus.\(^\text{27}\)

Coronary infarction is an area of coagulation necrosis in a tissue due to local anemia resulting from obstruction of circulation to the area.\(^\text{28}\)

A stroke is a sudden and severe attack of apoplexy or paralysis.\(^\text{29}\)

Cerebral apoplexy is caused by hemorrhages which occur through sudden rupture of a degenerated blood vessel.\(^\text{30}\)


\(^{26}\)Ibid., p. 1516.  \(^{27}\)Ibid.  \(^{28}\)Ibid., p. 720.

\(^{29}\)Ibid., p. 1406.  \(^{30}\)Ibid., p. 130.
Hypertension (essential) is a term employed to indicate the existence of abnormally high systolic and diastolic arterial blood pressure.\textsuperscript{31}

Arteriosclerosis leads to the loss of elasticity, causing thickening and hardening of the arteries.\textsuperscript{32}

Angina pectoris is a physiologic condition characterized by pain which is substernal or immediately to the left of the sternum and which occurs in attacks precipitated by effort, excitement, heavy meals, or exposure to cold.\textsuperscript{33}

Cardiac asthma (or asthmatic heart) occurs when the lungs become more filled with blood and coagulation sets in. Because normal function has been impaired by disease, the left ventricle is unable to increase its output sharply enough to clear the lungs. This engorgement, then is produced by a temporary imbalance between the outputs of the right ventricle and left ventricle wherein the right exceeds the left.\textsuperscript{34}

Myocarditis means inflammation of the heart from some unknown cause such as hypertension or arteriosclerosis.\textsuperscript{35}


\textsuperscript{32}\textit{Ibid.}, p. 1285.  \textsuperscript{33}\textit{Ibid.}, p. 1279.  \textsuperscript{34}\textit{Ibid.}, p. 1142.

\textsuperscript{35}\textit{Ibid.}, p. 1169.
CHAPTER II

ANALYSES OF GENEALOGIES

Each genealogy concerning cardiovascular diseases is important because it adds needed information about the hereditary transmission of a predisposition to cardiovascular diseases, and because each one reveals a specific heredity for definite cardiac disturbances.

With the permission of a cardiologist, one hundred sixty-five of the medical records of his patients were examined; first, to obtain family groups for this study of cardiovascular diseases; second, to ascertain groups in which there occurred two or more generations of cardiac trouble; third, to get a proper diagnosis of the heart disease of the present generation; and fourth, to seek families for personal contact and to interview them concerning their prior generations.

Records were found to contain no information beyond the previous generation, but no accurate data on the exact types of heart disease for the parents of the medical patients were shown. The heart condition was generally referred to as heart trouble, heart attack, or heart disease. Four of the persons interviewed knew something of their grandparents' personal history; hence a more complete analysis of those four family groups can be given.
Analyses of Two and Three-Generation Families

The first five genealogies showing hereditary transmission of cardiovascular diseases are typical of the study made from the medical records.

Figure 1 shows a family pedigree for a suddenly fatal type of heart disease. The man (I-1) died at seventy with heart trouble. His son (II-4) had had slight attacks, but at fifty-nine died with coronary thrombosis. Both deaths could have been caused by the same type of heart disease. A dominant gene for a specific type of cardiac predisposition seems to be indicated. No information was obtained concerning other members of generation II.

Figure 2 is a two-generation genealogy showing coronary heart disease. The woman (I-2) died at sixty-four of heart failure. Her son (II-4) at forty-seven has coronary thrombosis heart disease. No history was given for others in the sibling group. Since coronary trouble is evident in the second generation, coronary disease could have caused the death of the generation-I individual. A predisposition to coronary disease as a dominant factor seems to be indicated by this study.

Figure 3 shows a genealogy of three generations with heart diseases in the first two generations. Death of the first individual (I-2) was attributed to myocarditis hypertension at seventy-seven. The second individual (II-3) died suddenly at fifty-seven of coronary thrombosis. At the time that the history was obtained, his two brothers were not
Fig. 1.—A two-generation pedigree showing coronary heart disease.

Fig. 2.—A two-generation pedigree showing coronary heart disease.
Fig. 3.—A pedigree of three generations showing cardiac diseases.
affected with heart trouble. The wife (II-4) of this individual has been added because she has hypertensive heart disease and her hereditary genes along with that of her husband add additional predisposing factors for the members of the third generation who have not reached the age when heart disease becomes apparent in the individuals of this genealogy.

Whereas no members of the third generation are known to have heart disease, it seems probable that a simple dominant gene has caused the condition, for the son (II-3) of the affected mother (I-2) shows the heart condition.

Figure 4 represents a family of three generations, two of which show heart disease. Both members of the first generation died of cardiovascular disease, (I-1) with a heart attack at seventy-three, and (I-2) with hypertensive paralysis at seventy. One member (II-5) has hypertensive heart disease at the age of sixty. No history was obtained about other members of generation II. Four of the six individuals in generation III have died, two of accidental deaths and two during childhood from some diseases other than heart disease. The two remaining members (III-5) and (III-6) show no evident cardiovascular disease perhaps because their age is below the sixty to seventy age level when cardiovascular disease becomes apparent in this family. This study shows again that there is dominance in inherited predisposition to cardiac disturbances.

Figure 5 represents inheritance of hypertensive heart disease in two successive generations of three-generation
Fig. 4.--A three-generation pedigree showing cardiovascular disease.
Fig. 5.--A pedigree of three generations showing hypertension.
family. At seventy individual (I-1) died of a hypertensive stroke. The woman (I-2) died earlier of some disease other than cardiovascular disease. One son (II-1) died suddenly of a stroke, no age being known. A daughter (II-6) has had hypertension for fifteen years beginning at fifty and now has hypertensive heart disease. Children of II-6 in the third generation show no evidence of hypertension or heart disease because their age is lower than the age level of this family group for hypertensive heart disease. Since two members of generation II showed cardiovascular disease, a dominant gene carrying the predisposing factor for hypertension and hypertensive heart disease has been transmitted through two generations.

Analyses of Four-Generation Families

Figure 6 shows a pedigree of arteriosclerosis and accompanying heart disease in two generations with other types of cardiovascular diseases in two succeeding generations. Most of the individuals in this study were rural people whose occupation was farming; however, a high percentage of persons in the fourth generation is following professions such as medicine, teaching, and nursing. Little was known concerning the first generation except that the male parent (I-2) died suddenly when he was past sixty years of age, and that he was known to have had a brother (I-1) to die of a heart attack. His wife (I-3) had no known heart disease, but did have a sister (I-4) to die of smothering spells which today would
Fig. 6.--A pedigree of cardiovascular diseases in...
Female with hypertension and hypertensive heart disease
Female with arteriosclerosis and angina pectoris with coronary infarction
Female with coronary heart disease

A four-generation family.
indicate heart disease. In the second generation the mother (II-1) and grandmother of the next two generations was known to have had arteriosclerosis for many years prior to her death which was caused by coronary failure. A brother (II-7) at the age of sixty died suddenly, possibly from a like coronary failure. All other members of this generation died from causes other than heart disease.

In generation III there is multiple incidence of cardiovascular disease. Since there was no history of heart disease in her husband's (II-2) family, the mother (II-1) transmitted to her offspring the predisposition to heart diseases as a dominant factor. This is shown by the incidence of three out of five siblings being affected by cardiac disease. Individual III-1 had her first coronary attack at the age of sixty-two, and now her heart trouble has been diagnosed as angina pectoris with coronary infarction. A sister (III-9) of the sibling group has had hypertension for several years, and her cardiac trouble is myocarditis, which became apparent after her sixtieth year. A brother (III-5) in the sibling group has asthmatic heart trouble. A sister (III-14) died while still young of appendicitis and a brother (III-7) died from a disease other than heart disease. Another brother (III-10) has no evident heart disease, but he married a woman (III-11) who died of hypertensive heart disease. She has been added to show the possible heredity of a son (IV-19) who died suddenly following an appendectomy. All persons in generation IV have not reached the age level of sixty years which seems to be the age limit
for heart disease to incapacitate or cause death in the afflicted individuals in this particular family group. The death of (IV-19) was attributed to shock, but from a hereditary point of view there is this following probable explanation: Since his death at twenty-eight was a much younger age than the others in the preceding generations became affected by heart disease, a possible dominant gene for heart weakness from his mother (III-11) plus the possible predisposition for coronary disease through his father (III-10) from the grandmother (II-1) caused his heart to fail under adverse conditions.

In this familial group a dominant hereditary predisposition to arteriosclerosis with accompanying coronary disease is evident in the first three generations as six out of fourteen persons have been victims of heart disease.

In the pedigree of four generations of one family, illustrated by Figure 7, there is heart disease in three generations with a skip in the second generation. Occupations of the first two generations were not known, but some of the members of the third and fourth generations were directly or indirectly in the medical profession.

In the first generation the woman (I-2) was found dead at the age of about thirty-four. The man (I-1) was not known to have had any heart disease. No history of the second generation was known except that there was no diagnosed or known heart disease in either of the parents, II-1 and II-2, nor in any of their brothers and sisters. Since neither of these
Fig. 7.—A pedigree showing cardiovascular disease with a skip in the second generation.

- Normal female
- Normal male
- Female with coronary heart disease
- Male with coronary heart disease
- Female with hypertension and hypertensive heart disease
- Female with arteriosclerosis with angina pectoris and coronary infarction
- Sex unknown
parents exhibited heart disease, there is a possible expla-
nation here that the gene for the predisposition was present
but was prevented from expression by an inhibiting gene. The
genes transmitted by the parents to the children in the fourth
generation must have been a single dominant gene as there was
one hundred per cent incidence of occurrence of some type of
heart disease in the third generation. The woman (III-3) at
eighty-five suffers from arteriosclerosis with angina pectoris
and coronary thrombosis infarction. A brother (III-5) suffered
a fatal attack of some unknown heart disease upon finding his
own son (IV-5) dead of a heart attack. The brother was past
sixty at his death, but his son (IV-5) was about thirty-five
or forty years old. Each death could have been caused by
either coronary insufficiency, coronary occlusion, or coronary
thrombosis as these are the most frequent causes of heart
failure. The third member (III-3) of this generation is a
woman past seventy years of age who has hypertensive heart
disease. Individuals (III-2) and (III-4) married into this
family group and were not known to have had cardiac disturbances.

In the fourth generation there is still high incidence of
cardiovascular diseases as three out of five persons are affected.
Individual (IV-1) has hypertensive heart disease which became
apparent after she was fifty. The second person (IV-3) is a
man whose occupation causes him to travel constantly. He
"passes out" from some type of heart attacks and must be hospi-
talized. Individual (IV-5) has been mentioned above. The
women (IV-2) and (IV-4) are younger than the age level for occurrence of heart disease in this generation.

Because of the high percentage of incidence in this family genealogy, the premise of a simple dominance can be drawn. The third generation shows complete dominance, and as the fourth generation grows older, there is a possibility of complete dominance.

Figure 8 shows a genealogy for hypertensive heart disease through three generations of a four-generation family. All persons represented by this pedigree were farmers and farmers' wives. Age incidence of death was past sixty for the first two generations; but was much lower, being between forty to fifty, for the third generation. Each individual known to have had hypertensive heart disease died suddenly of a stroke. Three members, (III-4), (III-6), (III-7) died from other causes.

The two men (IV-1) and (IV-2) are below the age when hypertension and hypertensive heart disease appear in this family group.

This pedigree shows that hypertensive heart disease is hereditary and has passed from generation to generation as a dominant factor.

A four-generation family exhibiting coronary heart disease in each generation is illustrated in Figure 9. All members of the first two generations were rural people and necessarily worked hard. The first individual in this genealogy to show
Fig. 8.—A pedigree showing hypertension and hypertensive heart disease in three generations of a four-generation family.
Fig. 9.—A pedigree showing coronary heart disease in four successive generations.
evidence of any heart trouble was (I-1) who had to cease working for the last two years of his life as exertion caused him to have weakness. At seventy-one years of age he died suddenly, possibly of coronary occlusion. His wife was not known to have had any heart disease and was young when she died. His daughter (II-2) at fifty-two had never had any heart attacks until her death which was sudden like her father's. Her death was attributed to coronary thrombosis. Her husband (II-1) died when he was in his thirties, but not from heart trouble. Her brother (II-3) died suddenly when he was fifty-five years of age of a heart attack. Since his death was so similar to that of his sister's and father's, it could have been a like coronary thrombosis. The children of (II-2) were reared on a farm, but (III-1) moved into a city after his marriage and has done some kind of public labor since that time. (III-3) married when she was about sixteen and had done nothing except house work until her death at thirty-five. She had begun to smother and death followed instantly. The physician's diagnosis was coronary occlusion. Her death shows a fourth specific or similar type of heart disease in this genealogy. The third individual (III-2) in this sibling group is past thirty and has not suffered from any heart trouble yet. She lives in a rural area and does nothing except house work.

Children of (III-3) are less than twenty-five years of age, but the daughter (IV-3), now twenty, has had one slight attack of coronary thrombosis.
This family group shows a tendency for a specific type of cardiovascular disease, coronary heart disease. A dominant gene for a predisposition to coronary heart disease seems to have been transmitted successively through four generations. Four individuals (I-1), (II-2), (II-3), and (III-3) have died of like coronary diseases and all deaths were sudden. There can be no stated age limit as each succeeding generation was younger than the first when the heart attack occurred. However, others in this family group, as they reach an older age, may become afflicted with coronary heart disease or their deaths may be caused by heart attacks similar to others in this genealogy.
CHAPTER III

DISCUSSION OF GENEALOGIES

The nine genealogies analyzed show that a hereditary predisposition to cardiovascular diseases has been transmitted from generation to generation. Genealogies 1 and 2 show transmission of coronary heart disease through two generations, in the first instance from father to son and in the second instance from mother to son. A family tendency to the same type of disease is shown by Figure 6 in which there is direct transmission through three generations. A father transmits the predisposition to a daughter and a son. In the third generation, a daughter of the second-generation mother shows the same heart condition. Other members of this third-generation group have other forms of heart disease such as asthmatic heart disease and hypertensive heart disease.

Here is evidence to substantiate Draper, Allan, and Sprock in their belief that a basic constitutional weakness is expressed by varying clinical conditions in different individuals in the same family.

A fourth genealogy showing hereditary transmission of coronary heart disease is Figure 7. A mother who has the disease does not transmit the coronary heart disease directly to her son because, in him, there was a probable inhibiting
gene which prevented expression. However, in the third and fourth generations there is direct transmission from parent to offspring.

Definite heredity is shown in Figure 9. A father transmits to his two children a predisposition to coronary heart disease as both of them were affected by the same type of disease as the father. A daughter of the second-generation mother shows the same heart condition. A fourth-generation member in direct succession shows a similar family trait.

Therefore, this study adds more direct evidence to the inference that a predisposition to cardiovascular diseases is inherited. This is substantiated by a study of one case by Musser and Barton\(^1\) and other cases by Goldsmith and Willius.\(^2\) They believe that there seems to be a dominant predisposition to coronary heart disease transmitted from generation to generation.

Reference to Table 1 shows that thirty-nine individuals in these genealogies have one type or another of cardiovascular disease. Of the twenty individuals affected by coronary heart disease, fifteen are males and five are females. This would seem to indicate that males are more susceptible to coronary heart disease than females.

\(^1\)Musser and Barton, *op. cit.*, VII, pp. 46-47.

\(^2\)Goldsmith and Willius, *op. cit.*, X, pp. 1181-1186.
TABLE 1

NUMBER AND SEX OF INDIVIDUALS IN EACH FAMILY GROUP SHOWING DIFFERENT HEART DISEASES

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<th>Family Groups</th>
<th>Type of Heart Disease with Sex of Individual Affected</th>
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<td>Coronary Heart Diseases</td>
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| 3             | ... | ... | ... | ... | ... | ... | ... | ...
| 5             | 5 | ... | ... | 2 | ... | 2 | ... | ...
| 7             | 3 | 1 | ... | 1 | ... | 2 | ... | ...
| 8             | ... | ... | ... | ... | ... | ... | ... | ...
| 9             | 2 | 3 | ... | ... | ... | ... | ... | ...
| Total         | 15 | 5 | ... | 3 | 4 | 11 | 1 | ...

Genealogies 4 and 5 show the transmission of hypertension and hypertensive heart disease through two successive generations. Figure 8 is an additional study showing the direct transmission from parent to offspring of hypertension through three generations.

Rosenbloom\(^3\) in a two-generation case, O’Hare, Walker, and Vickers\(^4\) in two two-generation cases, Allan\(^5\) in four

\(^3\)Rosenbloom, op. cit., VIII, 681.
\(^4\)O’Hare, Walker, and Vickers, op. cit., VIII, 682.
\(^5\)Allan, op. cit., 955.
hundred eighty two-generation cases, and Ayman in eighteen
three-generation cases substantiate the above study and
belief that a predisposing factor for hypertension is trans-
mitted from generation to generation.

Reference again to Table 1 shows eleven females and
four males of the thirty-nine affected by hypertension. It
would seem to be a dominant hereditary characteristic more
for females than males. This is almost a reverse of the
numbers 15-5 for coronary heart disease in males and females.

Genealogy 3 shows cardiovascular diseases in two gener-
ations, but neither generation has the same heart trouble.

In this study only three females were afflicted by
arteriosclerosis with accompanying angina pectoris.

Only one male shows asthmatic heart condition and his
occupation of carpentry could have been a direct causative
agent.

A study of Table 2 shows that the age incidence for onset
of cardiovascular diseases is greatest during the fifty-seventy
year span of life.

Only five individuals are in the age levels below fifty,
and six are above the seventy age level.

Draper, Dupertius, and Gaughey stated that there is
an age specific for each family at which susceptibility to
diseases will appear. There is no proof from this study

6Ayman, op. cit., LIII, 793.
<table>
<thead>
<tr>
<th>Type of Cardiovascular Disease</th>
<th>Age of Males and Females in Families</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Below 40</td>
</tr>
<tr>
<td></td>
<td>M</td>
</tr>
<tr>
<td>Coronary Heart Disease</td>
<td>1</td>
</tr>
<tr>
<td>Arteriosclerosis Angina</td>
<td>...</td>
</tr>
<tr>
<td>Hypertension Heart Disease</td>
<td>...</td>
</tr>
<tr>
<td>Asthmatic Heart</td>
<td>...</td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
</tr>
</tbody>
</table>

that such is the case in the onset of the cardiovascular diseases affecting each family group.

Occupations seem to have had little effect on the individuals of this study as the laborer, professional man or woman, farmer and housewife were all equally affected.

Unlike the physician who would say environment is the causative agent of most cardiovascular diseases, the writer, a student of heredity, maintains heredity has been more important in the incidence of cardiovascular diseases in these nine cases than any other factor, and that a dominant gene seems to transmit the predisposition from generation to generation.
CHAPTER IV

SUMMARY AND CONCLUSIONS

Two two-generation genealogies, three three-generation genealogies, and four four-generation genealogies were analyzed and discussed. A mode of transmission for each family group was determined.

Of the one hundred thirty-three individuals in this study, thirty-nine had cardiovascular diseases while ninety-five were not afflicted by heart disease. Twenty had coronary heart disease, three had arteriosclerosis with angina pectoris, fifteen had hypertension, and one had cardiac asthma. Twenty were males and nineteen were females.

Age level for onset of the heart disease was greatest in the fifty-seventy year level, but no exact age for onset of the disease in each family could be determined.

Concensus of opinion among the writers was that heredity was an important factor in the production of cardiovascular diseases.

As a result of this study of cardiovascular diseases the following conclusions can be drawn:

1. A hereditary predisposition to cardiovascular diseases seems to be transmitted from generation to generation.

2. The mode of transmission is by a dominant gene.
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