

Study of Human Heredity

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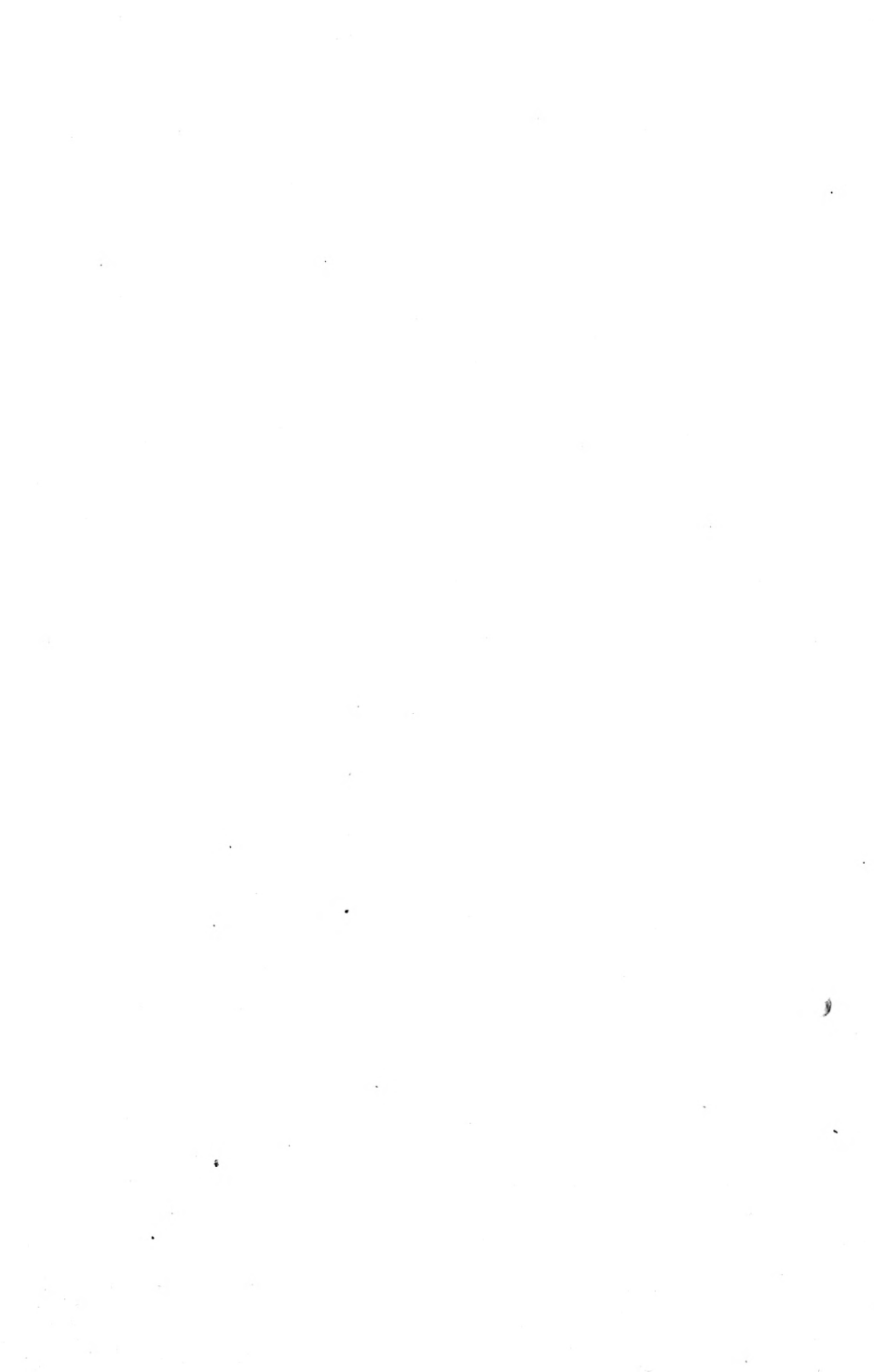
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# Eugenics Record Office

BULLETIN No. 2

## THE STUDY OF HUMAN HEREDITY

Methods of Collecting, Charting and Analyzing Data

BY

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COLD SPRING HARBOR, N. Y.

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## THE STUDY OF HUMAN HEREDITY.

### *Methods of Collecting, Charting and Analyzing Data.*

The following methods are in use at the Eugenics Record Office at Cold Spring Harbor, Long Island, The New Jersey State Village for Epileptics, at Skillman, and The Training School for Backward and Feeble-Minded Children, at Vineland, New Jersey.

#### 1. THE FIELD WORKER.

For many years the better organized Hospitals and Institutions for defectives have kept family histories of the patients. The information obtained from application blanks, physicians' examinations and replies received from letters sent to relatives and physicians have been compiled and tabulated and deductions have been drawn from them. But it has for some time been apparent that such family histories are far from satisfactory and that a better way to get at the method of inheritance of epilepsy, feeble-mindedness and the various forms of insanity and criminality is by means of a field worker, who goes to the homes and interviews persons that can and will give the desired information.

Besides the research work, the field worker performs many of the services that usually fall under the head of purely social worker. In many cases patients who have not heard from friends or relatives in years are brightened by the visit of the field worker and look forward to her return in the hope that she may bring them news of their friends. Discharged patients are visited by the field worker whenever possible in order to keep the Institution in touch with them. Her visits to relatives, physicians and others establish a friendly feeling toward, and an intelligent understanding of, the Institution and its work.

When connected with an Institution, the field worker (who for the purposes of many studies is preferably a woman) first learns all she can about the patient from the material at the office, such as correspondence, application blanks, records of medical and psychological examinations. Addresses of friends and relatives and other information that may be helpful in locating them is recorded and put in form for the worker to take with her. Just before starting out to visit the relatives and friends, the field worker visits the patient in his ward or cottage. This is done in the manner of a friendly visit. She learns

from the patient all that he or she can tell about the friends and relatives, especially with reference to their addresses, etc. The patients enjoy these visits, and are often able to give very useful information.

Everything now being ready for the visit to the home, the field worker, armed with recent personal knowledge of the patient, which assures her cordial welcome, visits the home and interviews the relatives, friends and family physician. To secure satisfactory results, sympathetic and confidential relations must always be maintained. It is better to leave some details to another visit than to have relations at all strained. The field worker's constant endeavor must be to establish a feeling between the family and Institution that will assure her of a welcome at any time with kindly cooperation, and to this end she sacrifices minor details that would naturally come on return visits. The field worker endeavors to see as many relatives as possible. In this way facts omitted or overlooked by one are often recalled and told in full detail by another, and by this means information already obtained is confirmed. Every additional interview is sure to reveal new facts.

Addresses of relatives who live in other sections are recorded to be used later by an investigator in that section. References to foreign countries are also kept, with the town, and wherever possible, the street address. In the case of foreign born parents, an endeavor is made to obtain data relative to the time of immigration, the town from which they came, and other information that may be useful.

Whenever the field worker learns of any defectives who need Institutional care, their names and addresses are obtained, and filed with the other material. By this means useful information is available when application is made for admission to Institutions.

As collected, the data are carefully recorded, and the pedigree chart made of the family. This is then put in permanent form on a sheet of white paper 8 x 10½ inches, with such notes and symbols as have been adopted to designate certain traits. A full description, with all details, is typewritten and filed with the chart.

## 2. THE CHART (Plate I).

The plan of charting adopted is based on the decisions of a committee of the American Association for the Study of the Feeble-Minded held at Lincoln, Illinois, in 1910. This committee consisted of Supt. E. R. Johnstone and Dr. H. H. Goddard, of Vineland,



N. J., and Drs. A. C. Rogers of Faribault, Minn., Wm. Healy of Chicago, Ill., Wm. T. Shanahan of Sonyea, N. Y., and David F. Weeks of Skillman, N. J.

The system is a rectangular one, the symbols for the individuals (*individual symbols*) of a fraternity (full brothers and sisters) being on the same horizontal line, with each later generation placed below the next earlier. Male individuals are indicated by squares, females by circles, suspended by vertical lines (*individual lines*) from the horizontal line. Members of one fraternity are connected by the same horizontal line. The rank of birth in the fraternity is indicated by a serial number placed immediately above the *fraternity line*. When the sex is unknown the square or circle is omitted from the end of the individual line. The fraternity line is connected by a vertical line (*descent line*) to a line joining the symbols of father and mother (*mating line*). The mating line may be a short horizontal one or oblique, passing from one consort to the other as emergencies of space decide. Dotted mating lines are used for illegal unions. When a marriage of one of the individuals of a fraternity who occupies a middle position in the series is to be represented, the consort is placed below and to the right or left of the circle or square and joined to it by an oblique line from which is dropped a *descent line* meeting the fraternity line. In the case of illegitimate children, the descent line is dotted.

For purposes of reference from description to chart each sheet of a pedigree is numbered serially with Arabic numerals. On each sheet the generations are numbered serially at the left margin with Roman numerals (I, II, III, etc.) beginning with the oldest generation. In each generation each individual symbol is numbered with Arabic numerals from left to right. In the text reference is made to an individual on the chart by sheet, generation and individual number. Thus 1, II, 17 means the first sheet, II generation, 17th individual symbol from the left. For the sake of uniformity in charting the families, the paternal side of the family is placed at the left of the chart, the maternal side at the right.

(*For display charts.* As a matter of convenience and as an aid in tracing the patient's immediate family, showing at a glance the lines of paternal and maternal descent of the defect, the descent line connecting the paternal side may be made green. Red may be used for

the lines connecting the individuals on the maternal side. That the patient's symbol may stand out more prominently and make the reading of the chart easier, the fraternity to which he or she belongs may be dropped below the others.)

Besides the lines and individual symbols a nomenclature is used that gives in brief much information for the interpretation of the chart. The following capital letters are used inside or around the individual symbols as follows:

A	alcoholic, decidedly intemperate,	M	migrainous,
B	blind,	N	normal,
C	criminalistic,	Ne	neurotic,
D	deaf,	P	paralytic,
E	epileptic,	S	syphilitic,
F	feeble-minded,	Sx	sexually immoral,
G	gonorrheal,	T	tubercular,
I	insane,	W	vagrant (tramp, confirmed runaway).

An index hand points to the individual whose heredity is being studied.

A line under a symbol indicates that this individual is or has been an inmate of some Institution.

A small black disc at the end of an individual line indicates a still-birth or miscarriage.

When the individual is the subject of several defects or diseases, the additional letters are arranged around the individual symbol. Symbols for traits that are not designated above are written beneath the individual symbol. When no letter accompanies the individual symbol it means that no definite data had been secured at the time the chart was made. The trait—alcoholism, criminality, deafness, epilepsy, feeble-mindedness, insanity, etc.—which the field worker is chiefly studying may be called the primary trait for the chart or pedigree. An individual showing the primary trait is represented by a solid symbol, printed (if desired) in color with the corresponding letter intaglio.<sup>1</sup> These symbols are shown in full size in plate V.

<sup>1</sup> Red is being used for epilepsy, green for insanity, violet for criminality, black for feeble-mindedness. When the individual does not show the primary trait or associated secondary trait he is marked "N," but this does not necessarily mean that he is normal in all respects.

In studies on insanity it is suggested that qualifying lower case letters, used singly or in combination, should, whenever possible, be added to the letter I, e. g.:

- a alcoholic insanity,
- d dementia præcox,
- g general paralysis of the insane,
- m manic depressive insanity,
- p paranoia,
- s senile dementia,
- t traumatic insanity.

On the pedigree chart, b stands for born; m, for married; † or d, for dead or died; † (or d) inf. means died at or before two years of age; † (d) young, means died before the age when the trait normally develops or is detectable; e. g., with feeble-mindedness before six years; with epilepsy before fourteen; with insanity before twenty.

In case other traits or causes of death are given on the chart they may be abbreviated as follows:

- |   |                                      |
|---|--------------------------------------|
| <i>bd</i> Bright's disease,                     | <i>la</i> locomotor ataxia,          |
| <i>ca</i> cancer,                               | <i>md</i> manic depressive insanity. |
| <i>cb</i> childbirth,                           | <i>np</i> neuropathic condition,     |
| <i>ch</i> chorea,                               | <i>obs</i> obesity,                  |
| <i>cr</i> cripple,                              | <i>pa</i> paranoia,                  |
| <i>df</i> deformed,                             | <i>pn</i> pneumonia,                 |
| <i>dp</i> dementia præcox,                      | <i>sh</i> shiftlessness,             |
| <i>dt</i> delirium tremens,                     | <i>sm</i> simple meningitis,         |
| <i>dy</i> dropsy,                               | <i>sb</i> softening of the brain,    |
| <i>ec</i> eccentricity,                         | <i>sco</i> scoliosis,                |
| <i>en</i> encephalitis,                         | <i>sd</i> senile dementia,           |
| <i>go</i> goitre,                               | <i>su</i> suicide,                   |
| <i>gp</i> general paralysis of the in-<br>sane, | <i>va</i> varices, varicose veins,   |
| <i>hy</i> hysteria,                             | <i>ve</i> vertigo,                   |
| <i>id</i> ill defined organic disease,          | <i>x</i> unknown,                    |
| <i>kd</i> kidney disease,                       | <i>?</i> implies doubt.              |

When preceded by a † (or d) the term indicates the cause of death.

In making the charts rubber stamps may be used to advantage. Standard sizes of these may be obtained from Lewis F. Walton, 12

South Fourth Street, Philadelphia. Other lettering may be done with a typewriter. (Plates III, IV.)

### 3. THE DESCRIPTION.

*The full description of an individual*, as herein contemplated, comprises the following thirteen points. It is obtained for each person in the family so far as practicable.

1. Name (maiden name of all married women; method of spelling surname preferred by the family to be ascertained and used. First time field worker uses a surname in her report it is to be written in Gothic capital letters, e. g., **DE BOW**).

2. Sex, if not sufficiently indicated by name (Frances, Francis; Jessie, Jesse; Marion, Marian; etc., frequently confused).

3. Date of birth. (This gives order of birth, age at time of interview, age at death, if dead, etc. Should be accurate to the month. Useful for reference to town and vital records.)

4. Place of birth. (Tells at least where mother was at given date and probably locates entire family; frequently assists in helping to connect with related families in same general locality; locates town where birth records may be sought.)

5. If dead, date of death or age at death approximately. (Essential in getting proportions of affected among those who reach the *age of incidence*.)

6. Cause of death. (Get the best diagnosis possible, inquiring of family physician where practicable and learn if any autopsy was performed. So far as possible use the terms employed in "Causes of Sickness and Death," United States Census Bureau, 1910. Field workers should study this list. Note directions given in paragraph below entitled "Description of Traits and Causes of Sickness and Death.")

7. Place of death. (Useful in comparison with town and vital records.)

8. If immigrant, date of immigration (steamship and port of entry where possible).

9. Mental and physical condition of each person. (Note paragraph, "Description of Traits and Causes of Sickness and Death.")

10. If married, a description with full name of consort, or of consorts, if married more than once; of the children, and of the consort's parents.

11. Occupations, whenever possible.

12. A general description of the home influences, environment and education.

13. For each family, the sources of information. (Names, addresses and relationships to the individual who is being primarily studied.)

*Description of Traits and Causes of Sickness and Death.* The field worker naturally directs inquiries primarily toward the specific trait that is being studied (herein called *primary* trait). But the opportunity is utilized to learn of other traits that may be significantly or incidentally associated with the primary trait. In describing traits, the person interviewed is encouraged to talk freely while the field worker records the essential points in the description. In the case of the primary traits too much detail can hardly be obtained, and even in the associated traits she is not to be satisfied with vague terms if details can be obtained. N. B. Experience indicates that it is not desirable for the field worker to use a printed form in her interviews.

Such vague terms, to be used only when further details cannot be obtained, are: *abscess*, without cause or location; *accident*; *decline*, without naming disease; *cancer*, without specifying organ first affected; *congestion*, without naming organ affected; *convulsions*, without details and period of life; *fever*; *heart trouble* and *heart failure*; *insanity*, without details (when possible distinguish alcoholic psychoses, progressive or general paralysis, senile dementia, softening of the brain, on the one hand, and such forms as manic-depressive insanity, melancholia, paranoia, dementia præcox, on the other); *kidney trouble*; *lung trouble*; *marasmus*; *stomach trouble*. The following data are considered especially valuable as symptoms, and should at the judgment of the field worker be made the subject of inquiry: alcoholism, venereal disease (including gonorrhœa and syphilis), sexual immorality, St. Vitus' dance or chorea, and sick headaches.

The term "normal" should be used only to indicate that, in respect to the *primary trait*, the individual is believed on trustworthy evidence to be like most people. Normal is not to be applied to persons simply because nothing is known to the contrary.

*Limits to Pedigree.* How far among collaterals is it desirable to extend the pedigree? This depends on the nature of the primary trait. If, as in the case of most defects, it is due to the absence of a quality essential to normal development then it will be desirable to learn at

least of the direct ancestors as far back as possible; the fraternities to which the parents belong; the offspring of all members of such fraternities and the parents of each consort when there are children. Likewise, each of the members of the four grand parental fraternities, their consorts and their children, their children's consorts and the children's children. If the patient has brothers and sisters these together with the patient are studied with the greatest possible care; also their consorts and children, if any.

If the trait is one that never appears in the children unless one parent shows it, then it is desirable to carry back the direct line as far as possible and less attention need be paid to the descendants of certainly normal collaterals beyond what is necessary to establish with certainty the law of inheritance.

#### 4. METHODS OF ANALYSIS.

*A brief statement of the Mendelian rules of heredity.* So many traits are inherited in accordance with the Mendelian rules that a brief statement of them is appended. But the field worker is warned against being so prejudiced by these rules that her, or his, judgment is warped. The exact facts are to be sought; their interpretation must come later. So far as possible all statements should be verified. In general a statement may be regarded as verified when made by a second, independent witness.

With this caution in mind the Mendelian rules will be found useful in directing the field worker in her inquiries. First, it is important to disabuse the mind of the popular error that traits are inherited from ancestors. Strictly, traits are not inherited at all; what is inherited is a condition of the reproductive or germ cells which determines the development of the trait—the trait depends on the presence or absence of a *determiner* in the germ cells.

Some defects that the field worker will study, such as albinism and feeble-mindedness, are known as recessive defects, i. e., they are defects due to the absence of the determiner making for normality in respect to these traits. Other defects, such as cataract and brachydactylism, are dominant defects, which means that they are due to the presence of some germinal determiner in addition to all the determiners for normality in respect to these characteristics. Thus, in respect to one character there are three gametic and two somatic types of individuals. Somatically, the individual has or has not the defect;

these are the two somatic types. Gametically the germ plasm of the individual may possess alternately germ cells with and without the determiner studied; an individual carrying such a germ plasm is said to be *simplex* and somatically cannot be easily distinguished from a *duplex* individual in which every germ cell possesses the determiner in question. The third gametic type is said to be *nulliplex* in which none of the germ cells possess the determiner in question. There are thus six types of gametic matings in reference to a single character; these types may be expressed as follows:

- Type 1.  $(D + D) \times (D + D) = 4 DD$   
 " 2.  $(D + D) \times (D + R) = 2 DD + 2 DR$   
 " 3.  $(D + D) \times (R + R) = 4 DR$   
 " 4.  $(D + R) \times (D + R) = DD + 2 DR + RR$   
 " 5.  $(D + R) \times (R + R) = 2 DR + 2 RR$   
 " 6.  $(R + R) \times (R + R) = 4 RR$

D stands for the determiner for the trait studied and R stands for its absence.

The field worker must understand that research, seeking to unravel the laws of inheritance, must work out the gametic nature of each individual studied, hence the necessity of extending the pedigree to all ancestors with collaterals, descendants and consorts of all individuals the make-up of whose germ plasm it is desired to understand. For example, by hypothesis, feeble-mindedness is for the most part a recessive trait and the hypothesis must be tested as follows: The field worker finds a person suffering from feeble-mindedness, a descendant of two normal parents—by hypothesis both of these parents are *simplex*; the field worker must understand that each parent will probably have somewhere in his or her ancestry a feeble-minded person and it is the business of the field worker to make a special search for such person or persons in the pedigree.

*Criticism of an actual pedigree reported by a field worker.* (Plate II.) This study begins with the epileptic boy III—7. The principal thing, of course, is to describe accurately all of the brothers and sisters of the affected person, they, being produced by the union of the same two germ plasms, will throw light on the make-up of such germ plasm. The pedigree is to be criticised from this standpoint. More information should be got concerning III—6, 8 and 9. The field worker at once notes that the mating II—5 and 6 is the most important one

to be studied, in that this mating produced the fraternity just described. The father, described as feeble-minded, should form the basis of an extended study. It is noted that his parents died at an old age but nothing further is known of either of them. If possible, they should be proven to be either normal or nervously affected. If normal, then it will be a profitable expenditure of time to search the ancestry and complete fraternities of each for affected individuals, in order thoroughly to test the hypothesis in this mating. Likewise the mating I—1 and 2 should be studied with a view to determining the nature of I—2; it is apparent that if I—2 is normal all of his five children should also be normal, and if they were so it would not be profitable to spend very much time in tracing further his blood. The fraternities II—1 to 5 and II—6 to 12 should be more thoroughly studied in that a detailed knowledge of each will throw light on the nature of the germ plasm producing II—5 and 6. More should also be known concerning the consort of II—7 and her "blood," inasmuch as this mating was productive of abnormal offspring. The other consorts of the II generation are not so important, if on investigation the offspring prove all to be normal. Likewise the consorts of III are not so important because their children are all very young; however, for study a few years hence it would be highly desirable to have these persons accurately described, and such description should be made if the requisite information can be secured without too great an expenditure of time.

In this pedigree the field worker has charted the males to the right and the females to the left; this should be reversed for the sake of uniformity of practice. Indicate the year of birth on the pedigree only in the case of young children. This pedigree contains few persons marked (N), normal. It is highly desirable that every person studied should be so thoroughly described that he or she can either be safely marked (N) or given a proper mark designating the type of abnormality possessed.



## APPENDIX 1.

## Forms for written Description of the Chart.

## A.

Name	Date	No.
------	------	-----

*Source of information.*

a. name. b. relation to patient. c. address.

*The patient and his home.*

a. Description of the patient.

b. Neighborhood.—good, fair, bad.

c. Housing.—tenement, separate house, number of rooms used, condition.

d. Home treatment.—good, bad, fair, neglected.

e. Number in the household.—adults, number normal, number defective; children, number normal, number defective; number of boarders.

f. Financial condition.—good, moderate, poor, very poor.

g. Education.—time in school, grade attended, reason for leaving.

A description of the individuals on the chart, covering the points mentioned in the text (pages 6 and 7), is written up under the following headings:

*The patient's fraternity.**The patient's father and his fraternity.**The patient's father's parents and their fraternities.**The patient's mother and her fraternity.**The patient's mother's parents and their fraternities.*

## B.

Suggested in the case of extended pedigrees, particularly those made independently of institutions.

*General statement* relating to locality (exact position, topography, density of population and, in rural localities, adaptability to agriculture), housing, social condition, and origin.

Order of personal descriptions. Begin with earliest generation, describe father, mother and all their children. Take the oldest married child (at left hand end of fraternity, describe his consort and their progeny. Next describe their oldest married child, his or her consort and progeny and so on, to the youngest generation. Then return to the next married sib of the next to the youngest fraternity already described, and give an account of his consort and their children, and so continue, working from left to right until all fraternities have been described. For example, in Plate I the following order is followed: I, 1, 2, 3, II 1, 2, 3, II (2), 7, III 1; II (3), 4, III 2, 3, 4, 5, 6, 7, 8, I 4, 5, II (4) 5, 6.

## PLATE I.

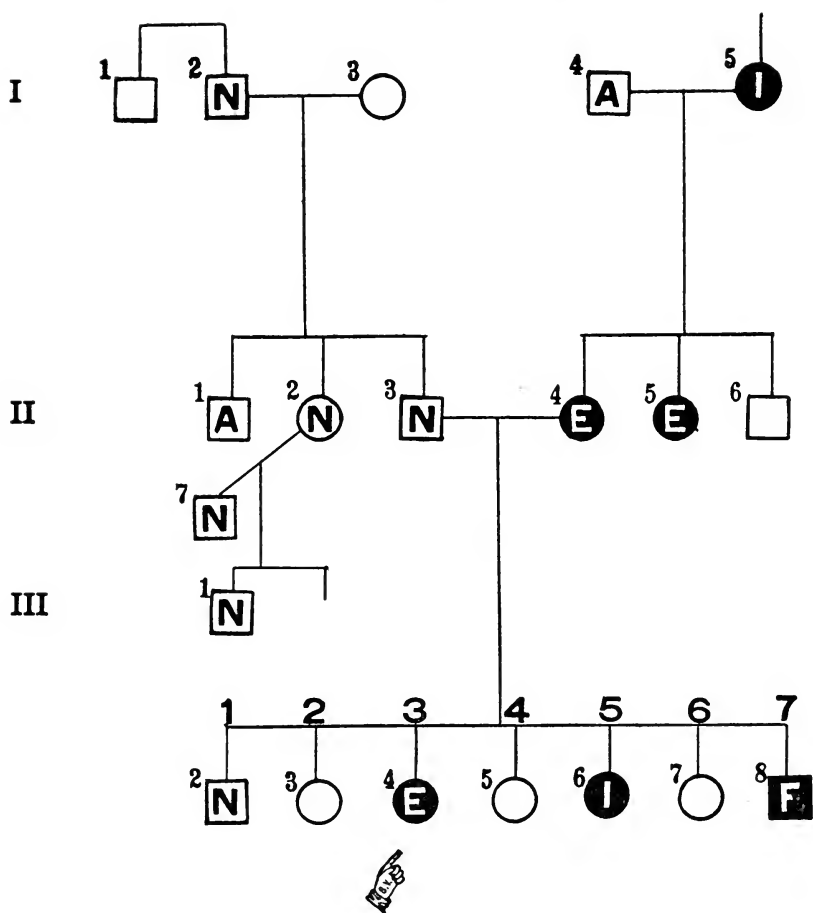
*Example of a simple pedigree chart.*

PLATE II.

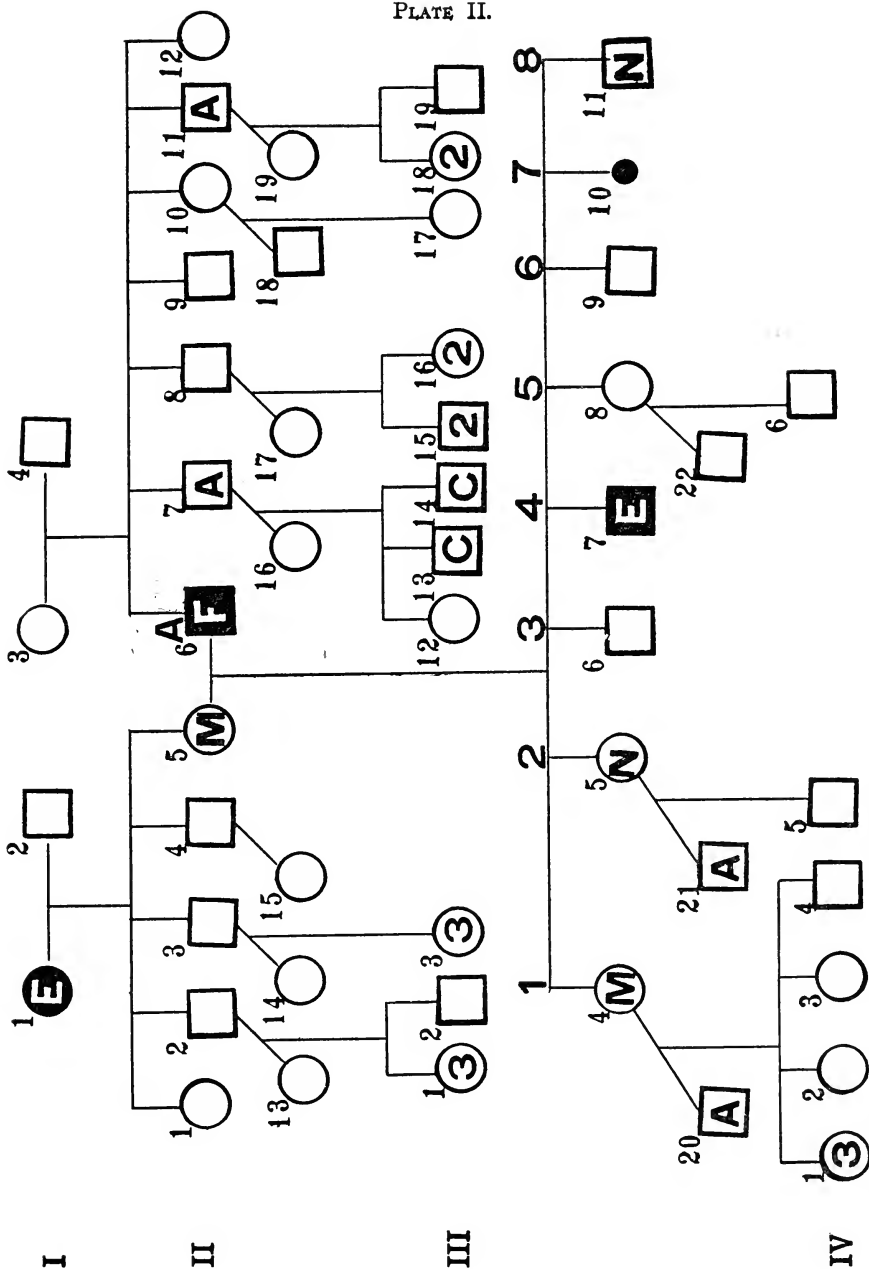


PLATE III.

Hypothetical pedigree, illustrating use of symbols.

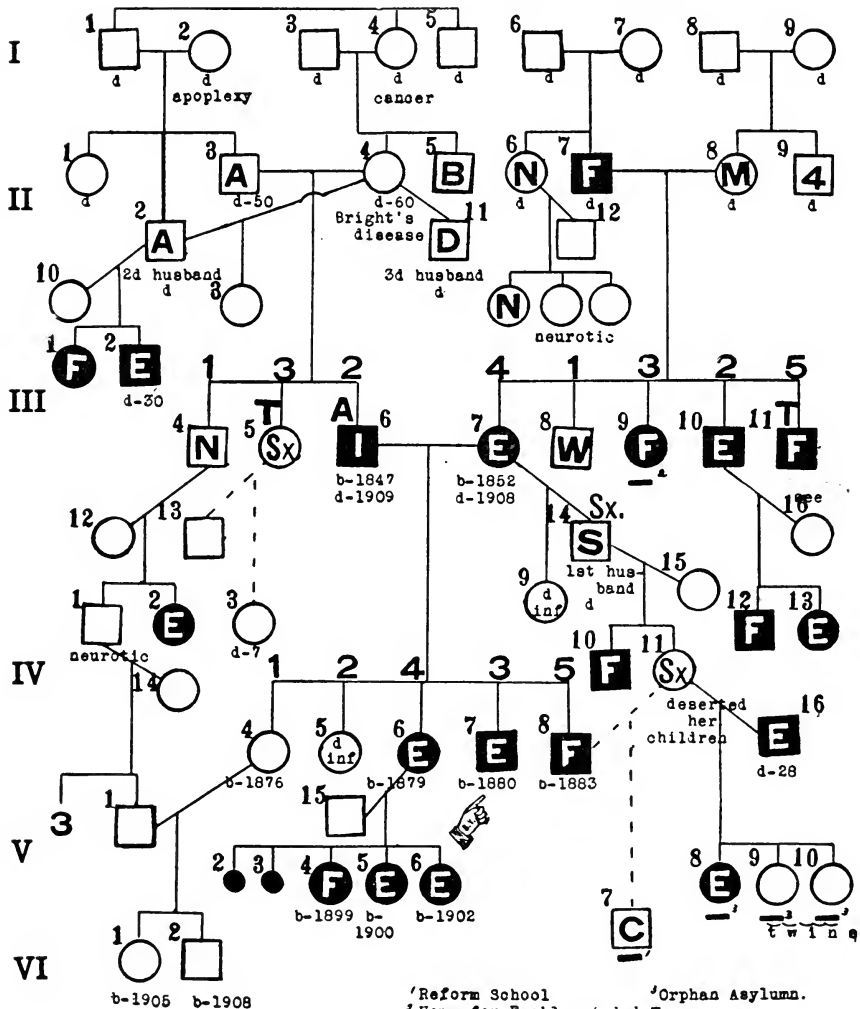
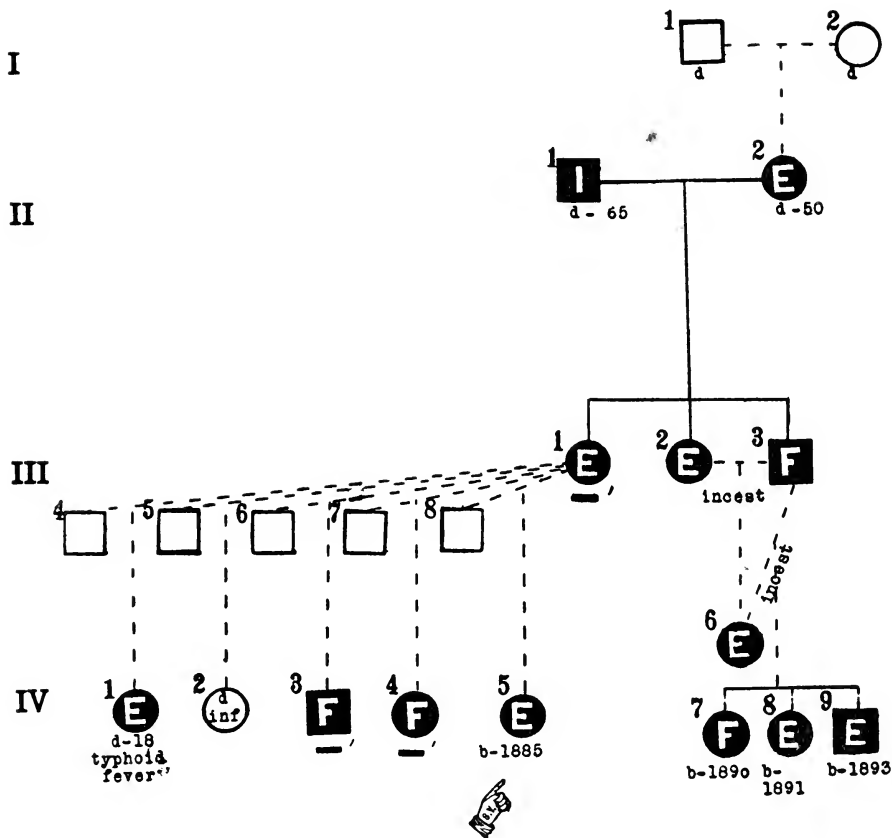


PLATE IV.

*Hypothetical pedigree, illustrating use of symbols.*



Alma House.

PLATE V.

KEY TO HEREDITY CHART.

	Male.	Female.		Other letters used in or around the squares or circles are:
			No Data.	<b>A</b> Alcoholic.
Red			Epileptic.	<b>B</b> Blind.
Black			Feeble-minded.	<b>D</b> Deaf.
Green			Insane.	<b>M</b> Migraneous.
Violet			Criminalistic.	<b>N</b> Normal.
				<b>Ne.</b> Neurotic.
				<b>P</b> Paralytic.
				<b>Sx.</b> Sexually immoral.
				<b>S</b> Syphilitic.
				<b>T</b> Tubercular.
				<b>W</b> Wanderer or confirmed runaway.

FIGURES.

- Above the line—Order in the line of birth.
- Above the square or circle—Individual reference number.
- Below the square or circle—Age at time of death or date of birth or death.
- In squares or circles—Number of individuals of that sex.

SMALL LETTERS.

- b—Born.
- † or (d) Died or dead.
- † (d) inf.—Died in infancy.
- m—Married.

LINES.

- Solid—Connects married individuals and fraternities.
- Dotted—Not married or illegitimate.

For display charts. { Green—Paternal side } of individual under study.  
 { Red—Maternal side }  
 Violet—Connects related charts or individuals on more than one chart.

SYMBOLS.

- Shows patient at institution reporting.
- Miscarriage or stillbirth.
- Institutional care (place under symbol).

## PLATE VI.

## SYNOPSIS OF ABBREVIATIONS ADOPTED.

*To be used with full face symbols.*

<b>a</b> , alcoholic insanity.	<b>p</b> , paranoia.
<b>d</b> , dementia precox.	<b>s</b> , senile dementia.
<b>g</b> , general paralysis of the insane.	<b>t</b> , traumatic insanity.
<b>m</b> , manic depressive insanity.	

*To be written on chart.*

<i>bd</i> Bright's disease.	<i>la</i> locomotor ataxia.
<i>ca</i> cancer.	<i>md</i> manic depressive insanity.
<i>cb</i> childbirth.	<i>np</i> neuropathic condition.
<i>ch</i> chorea.	<i>obs</i> obesity.
<i>cr</i> cripple.	<i>pa</i> paranoia.
<i>df</i> deformed.	<i>pn</i> pneumonia.
<i>dp</i> dementia precox.	<i>sh</i> shiftlessness.
<i>dt</i> delirium tremens.	<i>sm</i> simple meningitis.
<i>dy</i> dropsy.	<i>sb</i> softening of the brain.
<i>ec</i> excentricity.	<i>sco</i> scoliosis.
<i>en</i> encephalitis.	<i>sd</i> senile dementia.
<i>go</i> goitre.	<i>su</i> suicide.
<i>gp</i> general paralysis of the insane.	<i>va</i> varices, varicose veins.
<i>hy</i> hysteria.	<i>ve</i> vertigo.
<i>id</i> ill-defined organic disease.	<i>x</i> unknown.
<i>kd</i> kidney disease.	<i>?</i> implies doubt.









# The Eugenics Record Office

Cold Spring Harbor, Long Island, N. Y.

**E**STABLISHED in connection with the Eugenics Section of the American Breeders Association in 1910, this office aims to fill the need of a clearing-house for data concerning "blood lines" and family traits in America. It is accumulating and studying records of physical and mental characteristics of human families to the end that the people may be better advised as to fit and unfit marriages. It issues blank schedules (sent on application) for the use of those who wish to preserve a record of their family histories.

The Eugenics Section and its Record Office are a development from the former committee on Eugenics, comprising well-known students of heredity and humanists; among others Alexander Graham Bell, Washington, D. C.; Luther Burbank, Santa Rosa, Cal.; W. E. Castle, Harvard University; C. R. Henderson, University of Chicago; Adolf Meyer, Johns Hopkins University; J. Arthur Thomson, University of Aberdeen; H. J. Webber, Cornell University; Frederick A. Woods, Harvard Medical School. The work of the Record Office is aided by the advice of a number of technical committees.

The chairman of the Section is David Starr Jordan; its secretary is C. B. Davenport. The superintendent of the Eugenics Record Office is H. H. Laughlin, Cold Spring Harbor, N. Y., to whom correspondence may be addressed.

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The study of human heredity

