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## Iowa's Contribution to American Men of Science

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## IOWA'S CONTRIBUTION TO AMERICAN MEN OF SCIENCE

H. E. ZABEL

The latest edition of the Biographical Directory of Scientists lists 2623 who are now in Iowa or were formerly here. For every twenty-one of the present North American scientists, two are or were Iowans. Of these Iowans, 1110 were born in Iowa. Only six states have a larger number of native scientists. Of the outstanding or "starred" scientists, fifty-nine are native Iowans, a number exceeded by only five states. There is a native Iowa scientist for every 2275 of Iowa's present population, a ratio exceeded only by two states, each with a much smaller population, namely, Vermont and Utah.

Perhaps the significance of these general and survey statements and others of this character can better be visualized with the help of graphs. (Fig. 1.)

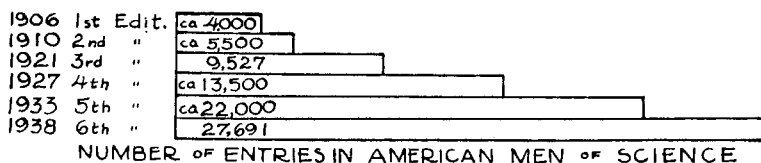


Figure 1

There are various biographical directories of separate groups of scientific workers, such as medical, surgical, and educational. The general directory is called "American Men of Science," edited by Dr. J. McKen Cattell and Jaques Cattell. Six editions have appeared to date.

The editors emphasize repeatedly that about the same standards are represented throughout and that the totals approximate the relative numbers at the respective dates, only a very small part of the increase being due to more efficient collecting of information.

To appreciate the significance of the rapid increase shown here, we need to recall some of its background. After the close of the World War we find in this country another "Revival of Learning" in the field of science. This may be seen in the building of college science laboratories, in the organization of research in commercial and industrial firms, in increased publications, as well as in more

and larger college classes. America began to assume leadership in science. Perhaps the Nobel science prizes may illustrate this revival. Up to 1920, fifty-two Nobel science prizes were granted. Of these America received three, one each in Medicine, Physics and Chemistry. America was tied for the 5th to 7th places with Sweden and Switzerland. Germany alone had amassed eighteen prizes followed in order by England, France and Holland.

Since 1920 forty-six science prizes have been bestowed. Drs. Einstein and Franck joined the Americans to put the United States in the lead with nine and one-half prizes. The contrast is: 3 out of 52 and 9.5 out of 46.

In most every field of science America can now claim leadership. We may typify these changes and the part that the individual states are playing by comparing the 1921 and 1938 records. This spans the period of the most rapid changes. The comparison on the basis of place of birth gives the best geographical survey and we shall begin with that. In the next five slides the geographical comparison will refer to places of birth. (Fig. 2.)

The blank bars represent the 1921 figures and the entire line the present totals. The black bar gives the increase from 1921 to 1938. The comparison of the two indicates the rate of increase. Iowa's increase is from 333 in 1921 to 1110 in 1938, an increase of 233 per cent. The increase for the United States is 190.4 per cent.

New York and Pennsylvania together have a population almost ten times that of Iowa and they naturally also lead in total number of scientists. Iowa now has about the number New York state had in 1921. Iowa has overtaken Indiana and is drawing ahead of Wisconsin and Michigan. New York has 2828 and Nevada has 14. (Fig. 3.)

For a clearer comparison of trends, the states may be combined into the groups as used by the United States census reports. The segments represent percentages of the entire United States for each section of the country and also compare the 1921 and 1938 percentages for each section. The increase for the United States is 190.4 per cent. Any section of the country that did not increase its number of native scientists by 190.4 per cent failed to maintain its relative standing. This we see is the case in the Middle and North Atlantic regions and in the East North Central sections. All other sections gained faster than the average. The most striking gain, however, was in the West North Central region which has raised its relative proportion from 12 per cent to 16.7 per cent. These states have more than quadrupled their number of scientists,

from 987 to 4,021. While New England's scientists increased 89 per cent, the West North Central scientists increased 308 per cent.

Combining still farther, the Middle and North Atlantic region 18 years ago had produced 43.5 per cent of the scientists, while the North Central states had only 40 per cent. Now the combination gives 33.2 per cent compared to 43.5 per cent for the North Central region, with its total of 10,400 scientists. These two areas have about an equal population.

The average age of the native New England scientists is greater,

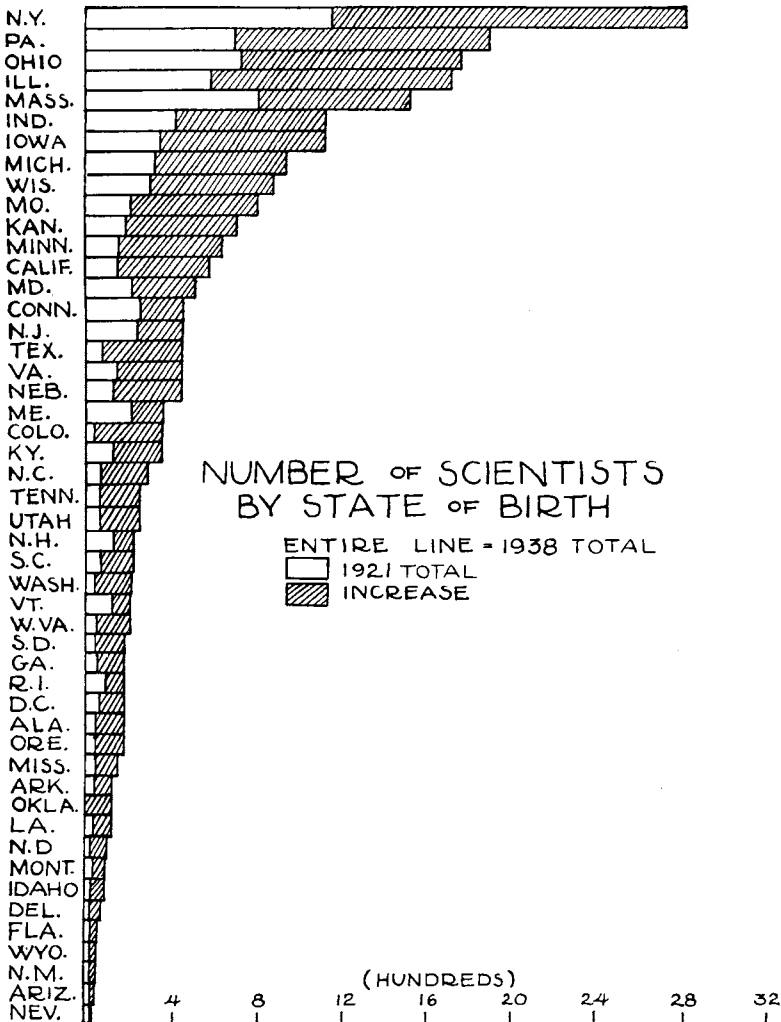


Figure 2

and these states are apparently approaching a leveling off and their totals will presumably ultimately approach a stationary level.

There is not only a consistent considerable increase in the southern states, but actually a slight proportional increase in all three sections of the South. This southern improvement is not as large and involves smaller numbers. The 16 southern states and the District of Columbia have produced fewer scientists than the 7 West North Central states.

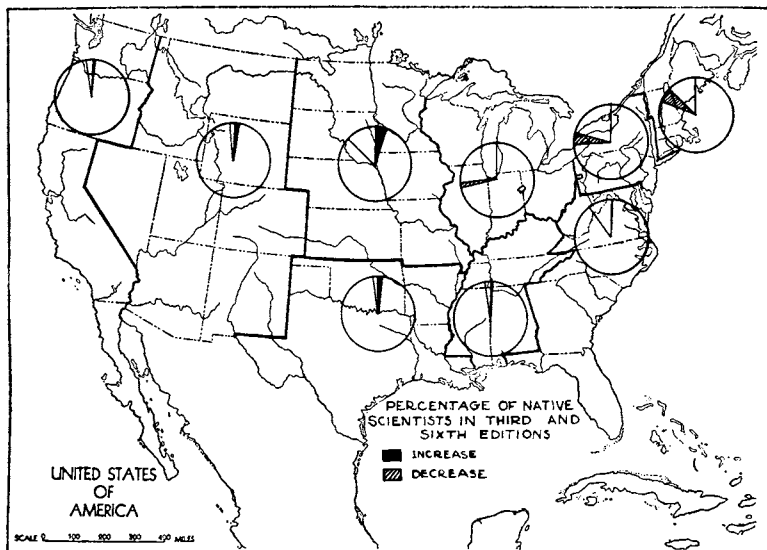


Figure 3

From the standpoint of the production of scientists, the center of the United States has moved westward by leaps and bounds during the past 17 years, — approximately from Newcastle, Pennsylvania, to Muncie, Indiana. Meanwhile the center of population has remained practically stationary. The western agricultural states are furnishing scientists more rapidly than the eastern industrial states, and it promises to be but a short time until our “scientific” center will be west of the population center.

In Canada there has been only a slight westward movement.

We have already noted that the states of very large population have the largest total. (Fig. 4.) Before we congratulate any state on the number of its scientists, we may make a comparison with its total population.

Iowa has one native scientist for every 2275 of its present population and is second only to Vermont and Utah. Of the five lead-

ing states Iowa is the only one that has a population of over a million. Iowa has a rural county in which the ratio is twice as large as in Vermont.

In general the southern states are near the bottom of the list.

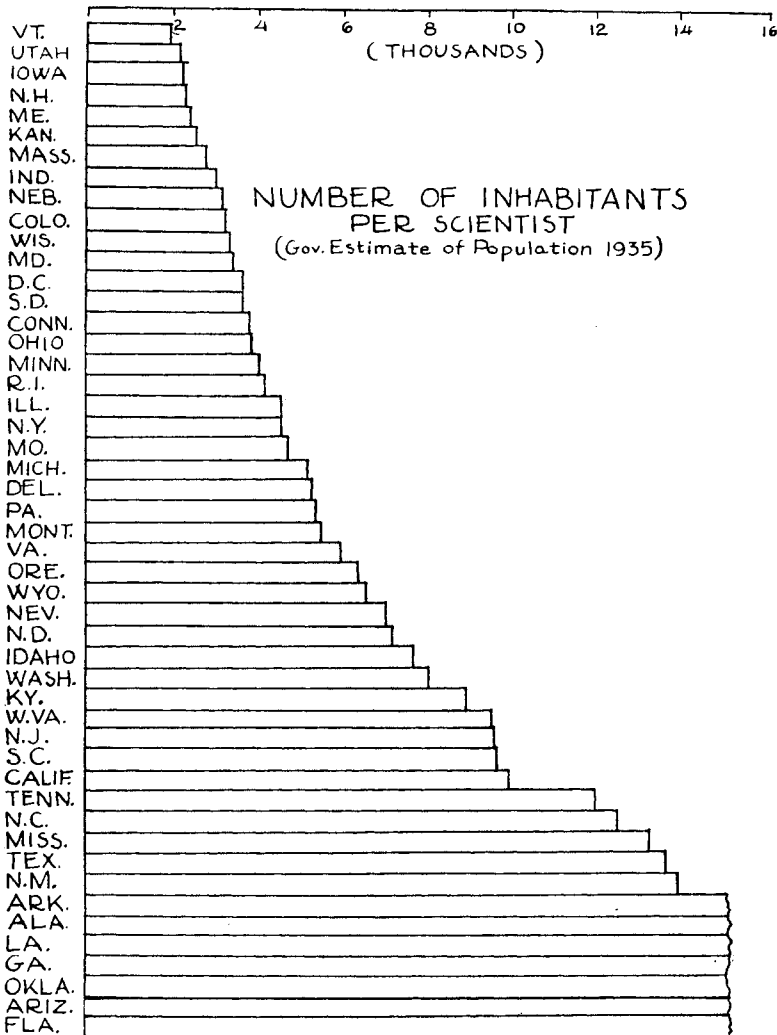


Figure 4

In a practical sense the colored people have not had an equal opportunity for scientific training and so there are comparatively few colored scientists. Iowa has a number of colored scientists including one of the most famous, Dr. G. W. Carver, formerly of Ames.

Then, too, the scientists were born from one- to three-quarters of a century ago. (Fig. 5.)

We may arbitrarily compare the number of scientists with the white population as given in the 1900 census. This shows a much more even contribution of scientists. On this basis, too, Iowa ranks very high,—one scientist for 1992 of the 1900 census. All but about 20 of the states, however, fall within a rather narrow range. (By the way, if in the course of the next generation the

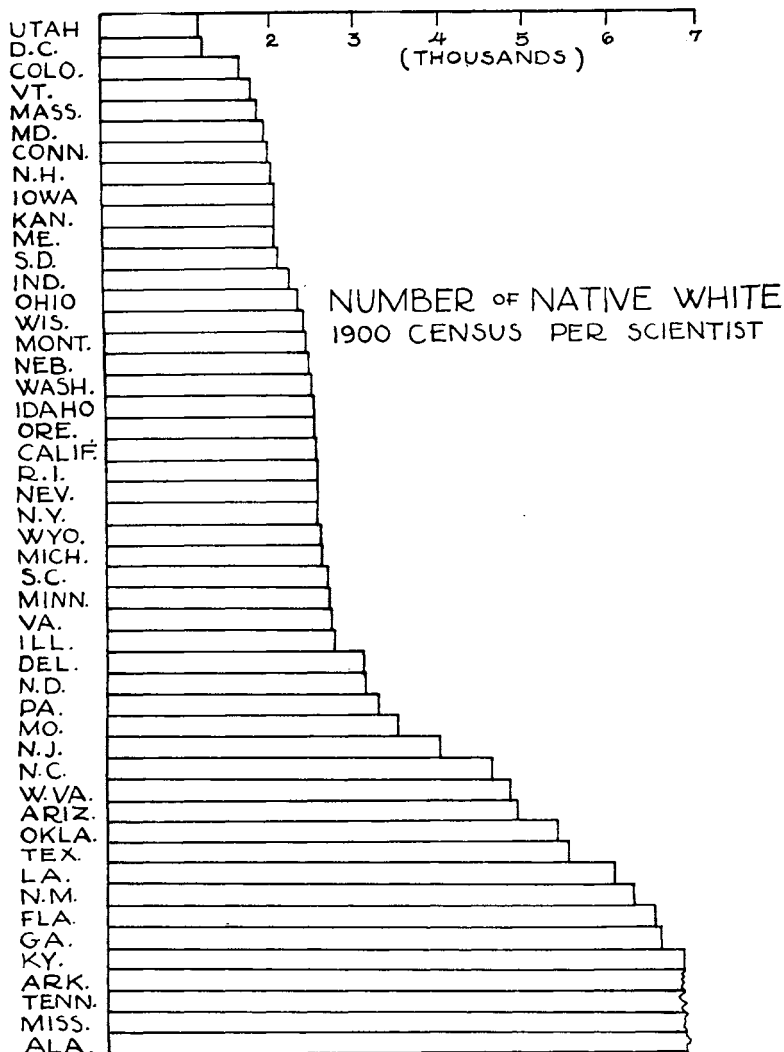


Figure 5

ratio of the scientists to our present population for the entire country were to attain the Iowa level, their total number would increase threefold.)

What conditions are typical of Utah, Colorado, certain New England states, Iowa, Kansas, and South Dakota, to put them at the head of the list?

All of them have a fairly stable total of population, few or no large cities, normally little poverty, a lack of boom days and easy money, a preponderant native population. Perhaps hard work and the old-fashioned virtues provide the severe training that is important in developing scientists.

Why is the District of Columbia near the top? We find in the District of Columbia one of the greatest concentration of scientists, and especially of outstanding starred scientists, of our time. In

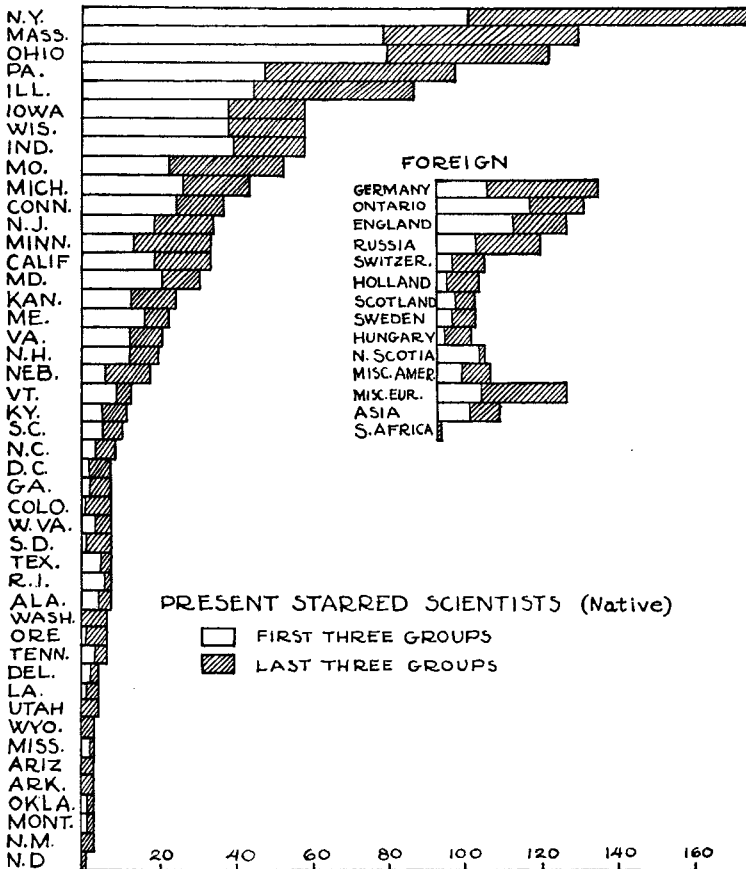


Figure 6



terms of starred scientists the District of Columbia has 150 out of a total for all of the United States of 1573, roughly 10 per cent. This is about half again as many as are found in metropolitan Chicago, about equal to those of metropolitan Boston and within a score of those found in metropolitan New York. The proportion of scientists in the families of scientists is very large. Where there is a great concentration of scientists, there gradually appears a high ratio of native scientists. The influence of this concentration of scientists and that of nearby Johns Hopkins is no doubt responsible for the very high ranking of Maryland ahead of any other state in Dixie.

The great industrial states are average in this rating, coming between the low southern states and the high northern agricultural states. Ohio has been raised above its expected level by her fifty small colleges. California rates higher than her southern neighbors, in part, because of the good showing of northern and central California. So far no distinction in the rating of scientists has been considered. (Fig. 6.)

The most exclusive organization of American scientists is the National Academy of Science, a self-perpetuating organization of scientists, incorporated in 1863 by Act of Congress for investigating and reporting on any subject of science or art whenever called on by any department of the United States government. There are 295 members according to the 1937 report printed a year ago. The membership is self-perpetuating. Iowa has ten native sons in this group.

Dr. Cattell has devised a means of recognizing outstanding scientists from time to time on the basis of a secret vote of a large number of men best qualified to appraise the work in the various fields. This meets most of the limitations inherent in the National Academy as a means of doing honor for a certain measure of success in scientific research.

We must note, however, that the vote is limited upon the scientists of the United States, and that it does not include the applied sciences: agriculture, engineering, medicine and education. A scientist in agriculture, for instance, would be included only if his work in the basic sciences such as botany, zoology or chemistry received the necessary consideration.

The number of scientists starred in the various basic sciences was apportioned roughly according to the number of scientists listed in that directory for the various fields. The first list included 1000, and the starred scientists are sometimes referred to as the

"one thousand leading scientists." A total of 2380 have been so honored in the six editions, of whom 1573 were still living at the time of issue of the recent edition.

Iowa is credited with being the native state of 59, a number which is exceeded by only five states. Generalizations on the basis of this table are more difficult and can not be as definite. One-third of the states have only one-half dozen or less, and Florida, Idaho, and Nevada are unrepresented.

The North Central states have a slightly larger proportion than they have of all scientists, 43.7 per cent as compared with 43.5. The changes in the distribution are also rather similar to those shown in the graph for all scientists.

The increasing number of foreign scientists who obtain a star is striking. Foreign scientists contributed 13.9 per cent of the first three groups and 19.9 per cent of the last three groups. A closer analysis, however, indicates that the increase is quite general from European scientific centers. It applies more or less proportionately to England, Switzerland, Holland, and Sweden, as well as to totalitarian states. The prominence given to refugee scientists as competitors of American scientists is not warranted. The attraction and competition of foreign scientists is due rather to the preeminence of American science, the favorable and congenial conditions for research work and better remuneration.

Competition for honors is becoming keener. Since 1906 the number of American scientists has increased 823 per cent, while the number of starred scientists increased but 57 per cent. In the first directory, one out of four of the scientists was starred; now one for every 17.7 is starred. It represents a definitely higher distinction to be starred in the latest edition than in some of the earlier ones.

In noting the rather marked decrease in starred scientists in Maine, Dr. Cattell, in the appendix to the 4th edition, raises the question whether this is not an indication of a coming decline in American Science. The more recent data indicate that the decline in New England starred scientists is due primarily to keener Midwest and foreign competition and very slightly, if at all, due to less favorable social and economic conditions in New England. Scientists are increasing in every state of the Union. Because of the small number involved in the starred groups, there are many fluctuations from edition to edition. Pennsylvania and New Jersey, for instance, recently show a marked increase in spite of keener competition. (Fig. 7.)

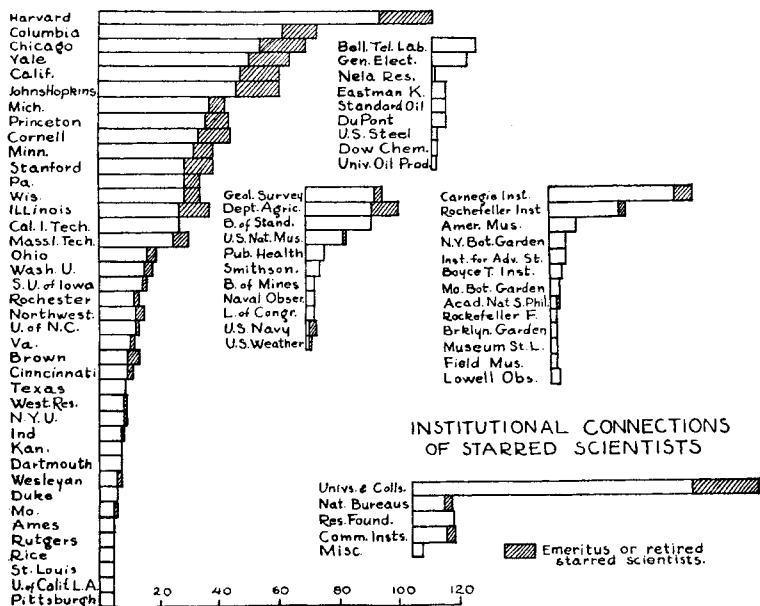


Figure 7

A glance at the institutional connections of the starred scientists indicates that although the universities still dominate the field, very significant increases are shown in the research foundations, commercial institutions, and the national bureaus. The number at Bell Telephone Laboratories (13), General Electric (11), Eastman Kodak (4), compare with some of the large universities. Nine of the 22 geologists recently starred are in the government service.

The Mid-West universities and colleges have been losing their starred scientists, or those about to be starred, to richer universities. In some cases, certain eastern universities have on their rolls a considerable number whose main activity is outside the university. Some of the eastern universities have lax retirement regulations compared with severe regulations that prevail in the Mid-West. In spite of these facts, the Mid-West makes a fine showing and the State University of Iowa, with 15 starred scientists, ranks 19th. Iowa State College, (where so many of the faculty are in the applied sciences that are not included), has four starred scientists, and leads the separate agricultural colleges.

The slide shows only the leading of the 194 institutions that claim starred scientists.

There are some striking similarities in the present order of the

universities according to their starred scientists and the famous analysis of four years ago by Dr. Embree, "In the Order of Their Preeminence." He considers the State University of Iowa with four other universities for the 12th place among the great universities. (Fig. 8.) (Atlantic Monthly, June, 1934.)

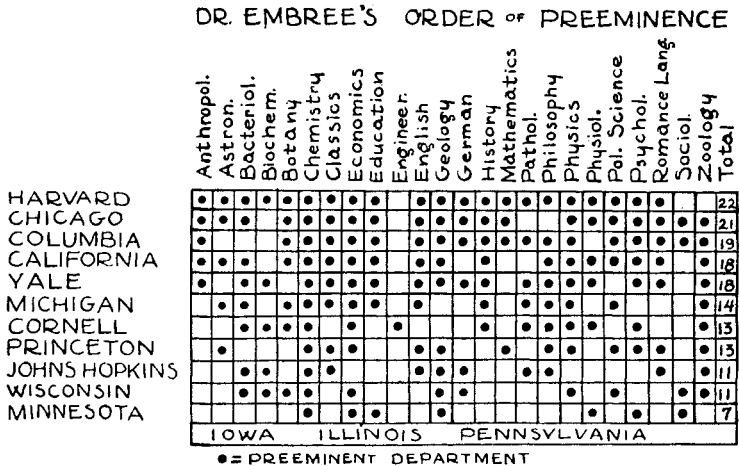


Figure 8

At first sight the slide showing the places of birth of Iowa's native scientists looks like a population density map. There are, however, some interesting variations. The cities fail to reach the average proportion. The exceptions are Keokuk, Burlington, Ames, and Iowa City. The following counties have about twice as many native scientists as we would expect from the state average: Van Buren (leading), then Keokuk, Johnson, Adams, Guthrie, Wayne, Montgomery, Story, Mitchell, Mahaska, Madison, Warren, and Page. (Fig. 9.)

Johnson and Story apparently owe their rating to the state institutions. Most of the other counties that rank so high in the number of scientists lie in the moderate or severe sheet erosion area and rank among the poorer counties according to property valuation. This may be assumed to indicate a more severe training that helped to develop scientists.

Van Buren county may claim more than six times the proportion of scientists that we have for the entire United States. Lee, Scott, Jackson, Marshall and Winneshiek and Polk counties may well be proud of their number of outstanding scientists, having three or more each.

In examining the list of alumni of the various colleges who are scientists, we must remember that only a partial story is given here. If a school has a large number of scientists, we see that it has done good work in science. If another school has fewer scientists, it may or may not have done as good work in science. Much of its work may have been done with premedics or with other applied

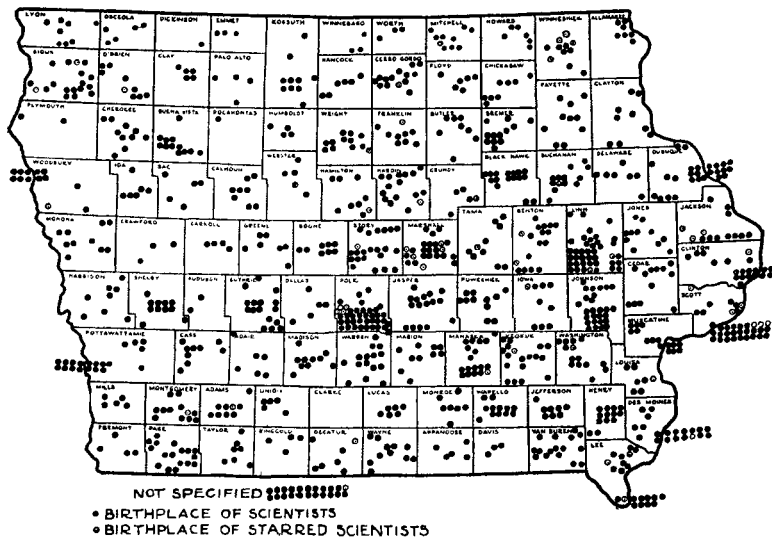


Figure 9

scientists who did not take up research. If a small school starts a student off especially well in any science, he may cover the available courses by the end of his junior year and finish in a larger school, and the directory would not credit the former. The graphs reflect the work up to about five or ten years ago rather than to the present time, and do not represent graduate students. (Fig. 10.)

Iowa State's alumni reach the very high total of 285 listed scientists. Their margin above the State University is largely represented by the greater number from out of the state. The State University has the larger number of outstanding scientists.

Some of the small colleges have a surprisingly large number of alumni scientists, led by Cornell with 54, followed by Grinnell and Drake. Simpson and Morningside are tied with 31 each. An even better showing is made by the starred scientists—Grinnell 5, Morningside 4, Cornell 3, Drake and Luther 2 each, and Coe, Iowa Wesleyan, Upper Iowa, and Central with one each. Although the State schools have half again as many alumni scientists, they are

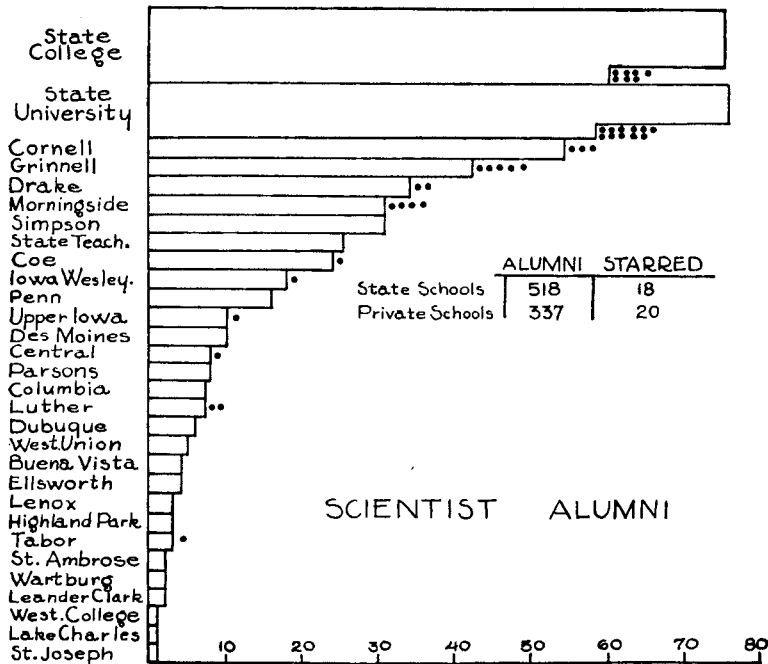


Figure 10

surpassed by the private colleges in the number of starred scientists. This graph does not include graduate students.

Whence did Iowa get her present 466 scientists? Only one-third of them, 146, are alumni of Iowa's own colleges. These include: State College 52; State University 34; Drake 11; Grinnell, State Teachers, Morningside, and Coe, five each; and 14 other colleges with a smaller number. The remaining 320 scientists are alumni of 139 colleges and universities of the United States and of 10 foreign colleges. If next June, Iowa's 466 scientists were to attend simultaneously their college class reunions, they would scatter to 170 colleges and universities in every state of the Union, and the District of Columbia, excepting only six states, Arizona, Delaware, Georgia, Louisiana, Nevada, and North Carolina. Some of the larger groups would meet as follows:

- |                |                         |
|----------------|-------------------------|
| Wisconsin, 15  | Minnesota, 7            |
| Chicago, 14    | Missouri, 7             |
| Ohio State, 13 | Oregon State, 6         |
| Kansas, 9      | Purdue, 6               |
| Illinois, 9    | Kansas State, 5         |
| Nebraska, 8    | Pennsylvania, 5         |
| Cornell, 8     | Penn State, 5           |
| Michigan, 8    | Colorado Col. of Agr. 5 |

Ninety-four of the institutions would have only one of Iowa's present scientists at their reunion. (Fig. 11.)

The significance of this lies in the breadth of viewpoints and understanding and the scope of training that these scientists repre-

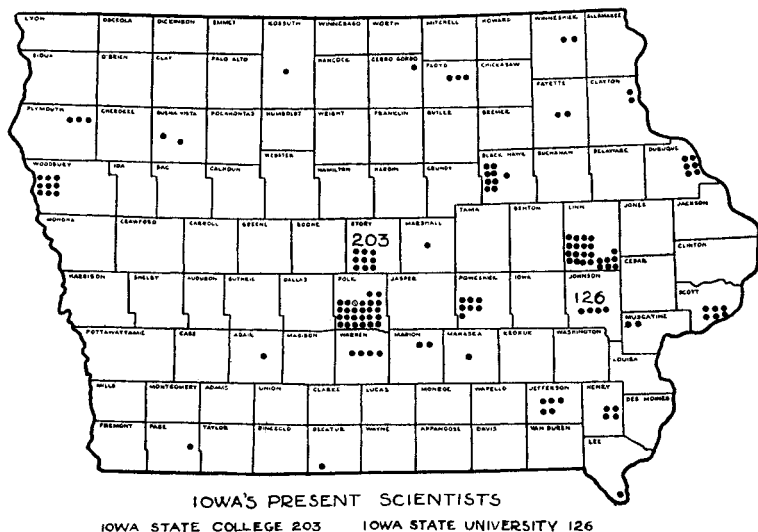


Figure 11

sent. It is important for the solving of educational, economic and political, as well as scientific, problems.

The map of the location of Iowa's scientists is quite a contrast to the previous map. We have a great concentration geographically and as to fields. Seven out of eight are in educational institutions. Government scientists are mainly at Ames, Des Moines, and Sioux City; commercial scientists at Des Moines, Cedar Rapids, and Charles City.

As the schools dominate the field of science in Iowa so completely, the graphs on the specialties of Iowa scientists has no surprises for one thoroughly familiar with Iowa colleges. We note the strength of chemistry and the applied sciences, and the well balanced proportion in the usual college departments—mathematics, psychology, physics, zoology and botany. (Fig. 12.)

In the next slide we have added to the previous study, the record of the other scientists (native and with Iowa degrees) who may be termed Iowa's contribution. The chemists have run wild. Four hundred have been produced as compared with 74 still in the state. Next in line are the applied sciences: agriculture, en-

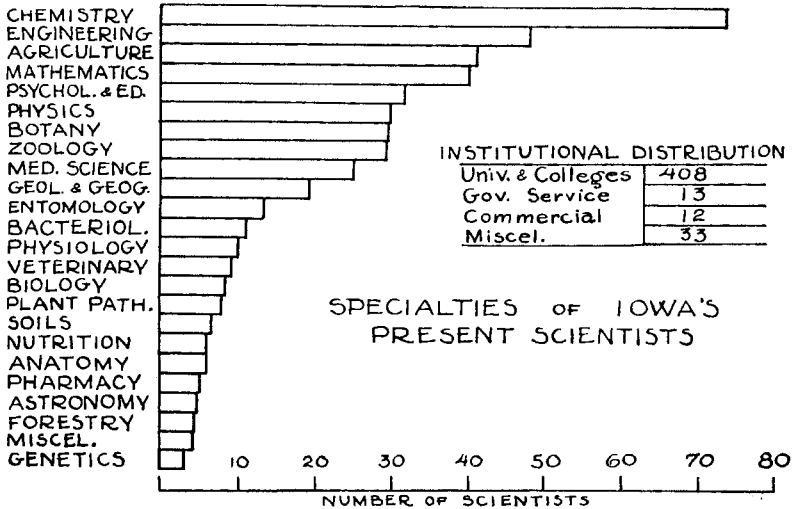
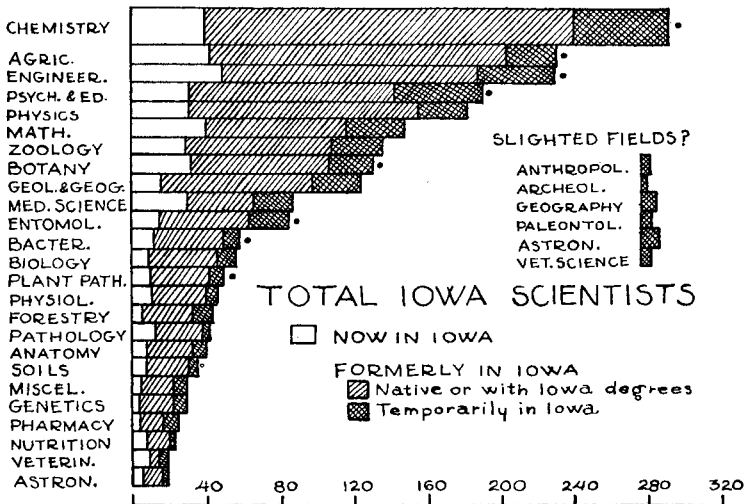


Figure 12

gineering, entomology, plant pathology, and forestry. Of the basic sciences, psychology, physics, botany, zoology, and geology have prominence about in the order given. A comparatively large number of anatomists were furnished. (To personify these graphs somewhat, we may call attention to Iowa anatomists who include the heads of anatomy departments in medical schools at Minnesota, Illinois, Utah, Colo. and St. Louis University.) (Fig. 13.)



Dots indicate fields to which Iowa's contribution may be considered outstanding.

Figure 13

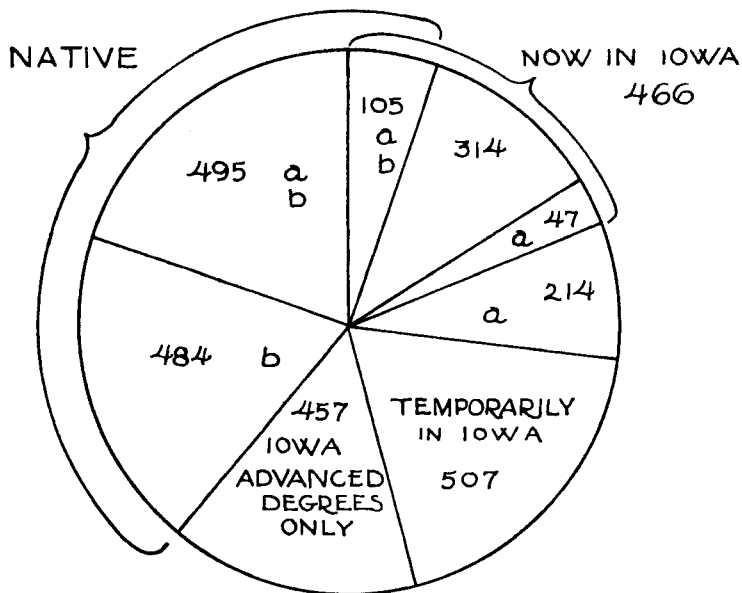


If we now add to this list the scientists who were in Iowa for a longer or shorter time, we have a summary of the 2623 Iowa scientists. These temporary Iowans would be called labor turnover in industry or commerce. This turnover is especially large in psychology — (there may be a psychological explanation); it is small in the applied sciences but especially so in the medical sciences, and physiology, anatomy, bacteriology and pathology.

To make it possible to present this summary in one survey related sciences have been combined. These scientists list their main field of research under 175 different headings such as 12 different fields of engineering, 15 fields in chemistry, etc.

Fields that might be considered slighted would depend upon what basis one wished to stress, practical importance of the field, comparison with other states, or comparison with number of students or teachers in the state.

The total number of Iowa scientists, 2623, is more than five times the number now working in Iowa, 466. Of those 105 are the old faithful native sons of Iowa, alumni, and still working here; 314 have come from 42 states and the far ends of the earth;



TOTAL IOWA SCIENTISTS	2,623
NATIVE IOWANS (b)	1,110
IOWA ALUMNI (a)	871

Figure 14

47 came from other states, took their college work here, liked Iowa, and stayed on. 214 came, got their college work here and left sooner or later. (Fig. 14.)

Although Iowa's schools furnished college education to 871 scientists, they failed by 223 to be adequate for the undergraduate requirements of Iowa's native scientists. A large number of advanced degrees on the other hand are to the credit of Iowa schools. Two for every 21 of the North American scientists are or were Iowans.

Iowa, long proud of her tall corn, her fertile rolling prairies and her well-managed farms, has been overlooking what may well be an object of state-wide pride, as it is a most important contribution to our times, the work of her scientists.

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