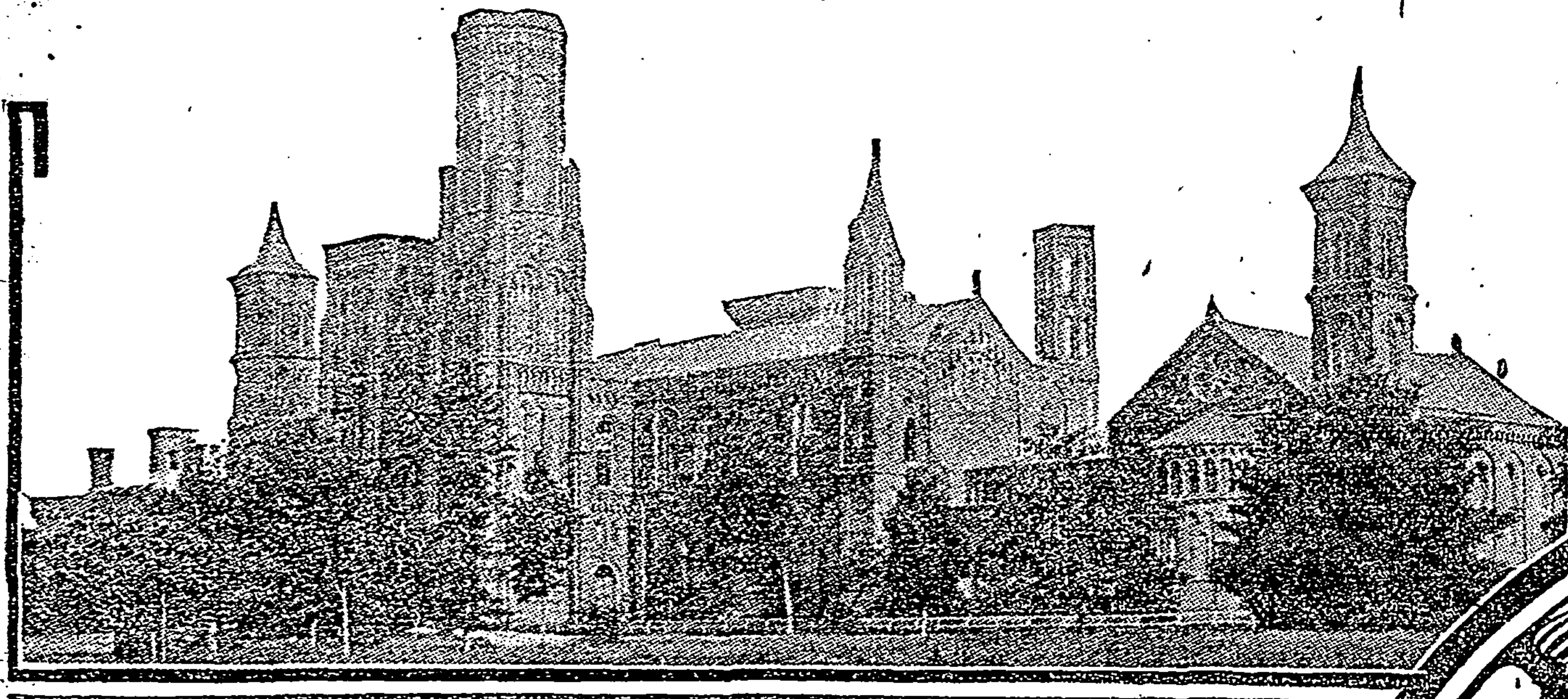
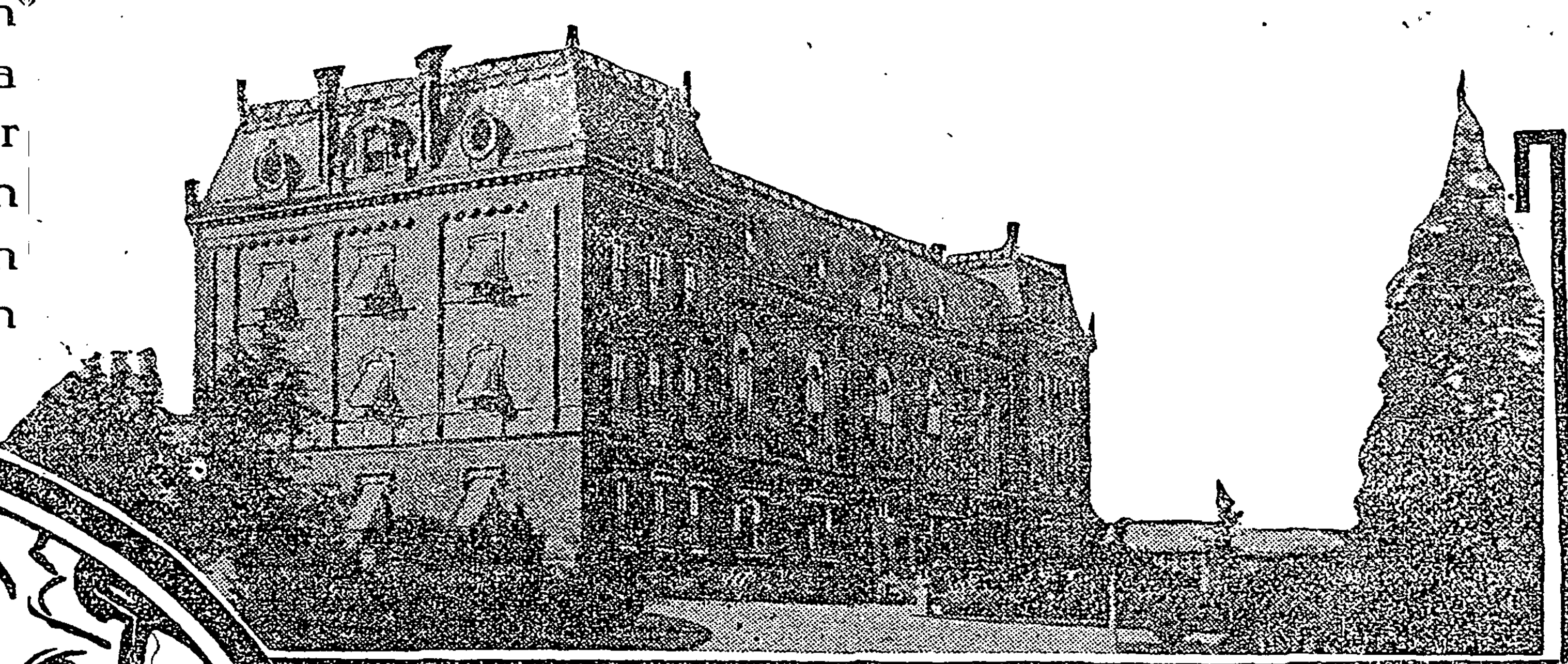


AMERICA'S GREAT SCIENTISTS RAPIDLY DECREASING



The Smithsonian Institute, Washington.

Dr. James McKean
Cattell of Columbia
Says There Are Fewer
Men of Distinction in
Scientific Lines than
There Were Seven
Years Ago.



Department of Agriculture, Washington.

PROF. JAMES MCKEAN CATELL of Columbia University, editor of various valuable scientific publications, has just completed a thorough study of the scientific standing of the universities of this country that is one of the most interesting documents the educational world has seen for many a day. In 1903 Prof. Cattell made a similar study, and the most startling part of his recent announcement lies in a comparison of what the country has been doing along scientific lines since that time.

Prof. Cattell says, in brief, that the United States has to-day fewer men of distinction in scientific lines than it had seven years ago, that the number of scientific men increases only half as fast as the population, and that we are in danger of lowering the standards of the profession until its workers become little better than clerks. We are doing much good routine work, but we are not producing distinguished men, and Prof. Cattell goes so far as to suggest the reason why.

does not keep up the birth rate, and the population has been reinforced by a mass of immigrants who will not for a generation or two be likely to produce scientists. The following is a comparison of the number of scientific men of note born to one million of the population:

	In 1903.	In 1910.
Maine	50	40
Vermont	50	40
New Hampshire	50	40
Massachusetts	109	85
Connecticut	87	57
New York	47	36
New Jersey	42	17
Pennsylvania	23	19
Maryland	38	13

On the other hand the North Central States show an increase:

	In 1903.	In 1910.
Ohio	32	35
Indiana	21	34
Illinois	24	20
Michigan	36	74
Wisconsin	45	54
Minnesota	23	59
Iowa	30	34
Missouri	12	15

Westward the course of intellectual empire seems to be taking its way. Illinois is the only State that shows a falling off, and that is very slight. Especially the great cities have lost ground. The birthrate per million inhabitants on the basis of 1,000 scientific men has fallen as follows:

New York	71 to 33
Philadelphia	49 to 23
Baltimore	94 to 19
Chicago	73 to 17

Is there an explanation for this in the fact that the glitter of our large cities fills a man with a desire for money and forces him from the life of a scholar into the business world, in spite of an inward pull the other way? At any rate, it is a most significant table. Prof. Cattell thinks it is "ominous."

Prof. Cattell turned next to the question of whether or not the States were keeping within their borders the men of note whom they produced. Massachusetts needs twice as many men of science as she produces, and she gets them. Illinois has called men from other States and some of the richest Middle States, Ohio and Michigan among them, have lost many of their men. The Western States add to the number of men they produce. The South has produced more men of note than formerly, but she cannot keep them. "She is losing," says Prof. Cattell, "even the few she had." Only Louisiana has an increase of three.

Thanks to the three great New England institutions, Harvard, Yale and the Massachusetts Institute of Technology, New England makes a fine showing in the matter of new men. Another centre of scientific activity is found in the States of Wisconsin and Illinois, due to the three leading universities. That is, these States keep their own scientists and call others. New York, New Jersey and Pennsylvania have lost more than they have gained. New York has lost 22 and drawn 13; Pennsylvania has lost 12 and drawn 7. "This is a sinister record," says Prof. Cattell, "for this centre of wealth and richly endowed universities." Washington, D. C., has also lost 11 by death and has acquired only one man. "In view of the increasing appropriations by the Government for scientific work and the endowment of the Carnegie Institute, this is not favorable."

Further, he has made a study of the scientific standing of the States, showing a poor record of some of the richest, and notably of the Eastern States outside of New England. The States of the Central North do well, and the Western States, on the whole, rather badly. The South, never well off, is actually losing ground in a "discreditable" manner. As to the universities themselves, several of the front rank have seriously lost in standing, while others are forging ahead remarkably. Columbia, Pennsylvania, and California come in for criticism, the Middle Western universities for praise. Among the States, New York and Pennsylvania, with all their wealth, are poor places of residence for a man of science.

In short, we have made "no increase commensurate with the increase in the instructors, students, and endowments of our universities, with the larger appropriations for scientific work under the Government or the new foundations for research."

Prof. Cattell had the scientists of the country "rated" by the leading men of each science. The average of their replies was taken as indicating a man's standing. The "possible error" was corrected, and every precaution taken, in a manner much too scientific for the ordinary mind to grasp, to make the rating accurate.

The memorandum of instruction sent out observed that "the judgments are possible because they are, as a matter of fact, made in elections to a society of limited membership, in filling chairs at a university, and so forth. By merit is understood contributions to the advancement of science, primarily by research, but teaching, administration, editing, the compilation of textbooks, &c., should be considered." On this basis the leading men of science cooperated with Dr. Cattell, with, as remarked before, the most startling results.

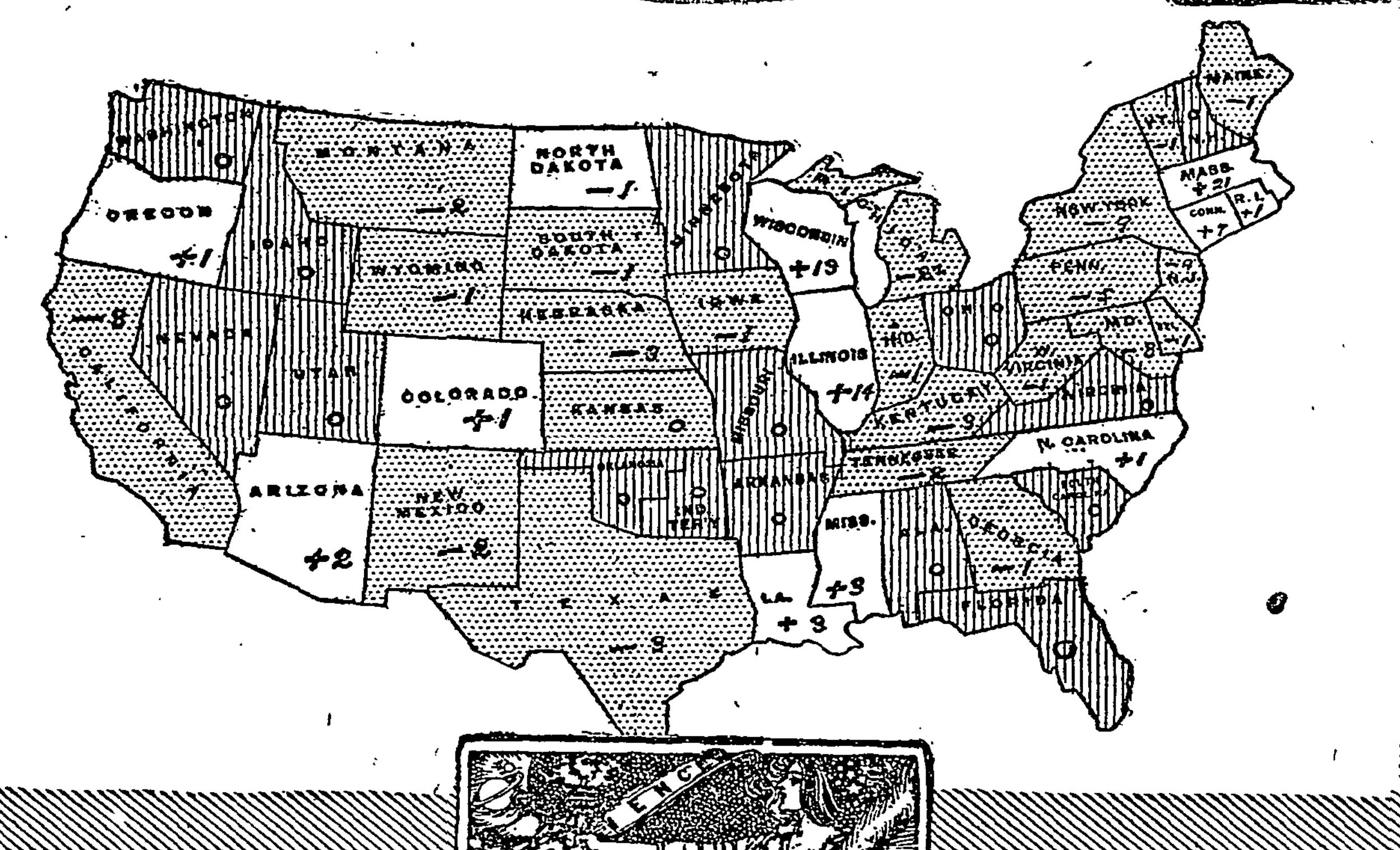
One thousand names were chosen in the departments of chemistry, physics, zoology, botany, geology, mathematics, pathology, astronomy, psychology, physiology, anatomy, and anthropology.

By examining these names and referring to the man's biography, it was possible to discover what sections of the country were producing the greatest proportional number of scientists, what universities had trained them, and, of course, what universities had the greatest number of men of note on their staff.

Since such a roll of honor was drawn up in 1903, fifty-eight of its men have died and ten have left the country. It was therefore necessary to fill the vacancies, and thus it was found from what part of the country and from what universities men were coming to take the places of the older ones. Also, a considerable number of men on the old list were dropped, their places taken by newcomers. So, altogether, 238 men were able to find a place on the roll of honor who did not reach it in 1903, those who came up and those who dropped off both furnishing a vast amount of useful information. Later, a second thousand names of somewhat less eminent men was similarly obtained.

There were 126 foreign-born men of science in this country in 1903. Of these nine have returned to Europe, and there has been but one newcomer. Out of seven million immigrants to this country during this period there has been but one scientist who thought that his fortunes would be bettered by crossing the ocean—and this in spite of the enormous sums spent for the advancement of science in this country.

The State which produced the greatest number of scientists is one which has long held the lead in such matters—Massachusetts. She not only produces, but she calls to her many men of distinction. Her leadership in production is not as marked, however, as it used to be. The explanation of this, taking the fact together with others, would seem to lie not in a weakening of the standard, but because the old stock



Map Showing Net Gains and Losses of Senators in States. The Unshaded Portions Show Gains, the Dotted Portions, Losses, and the Other Shaded States a Standstill with Neither Gain Nor Loss.

The list which shows the net gain or loss runs in part as follows:

State	Gain or Loss	State	Gain or Loss
Massachusetts	+21	Louisiana	+3
Connecticut	+7	Illinois	-14
New York	-22	Michigan	-2
New Jersey	-12	Wisconsin	+13
Pennsylvania	-12	Mississippi	+3
Maryland	-8	Nebraska	-4
District of Columbia	-11	Colorado	+1
Arizona	+1	Oregon	+2
Kentucky	-3	Texas	-3
Tennessee	-2	California	-1

The other Southern and Western States, omitted here for brevity, have remained stationary or have lost one man. In regard to the Southern States it is noteworthy that their leading men of science either find other sections more congenial for work or are attracted, possibly, by rather higher salaries. It is worth remarking, says Prof. Cattell, that a similar state of affairs prevailed once in the North Central States. As these States advanced in general culture they began to keep their distinguished men at

home, and doubtless as the education of the South progresses the same thing will happen there. At present there is an actual decline south of Mason and Dixon's line.

Turning to the specific institutions that have lost or gained, there are some amazing figures. "Columbia, Cornell, and California are the three institutions that have lost the most. Yale and Harvard have about three times as many men who have won a place as have lost it, but Columbia has lost twice as many as she has gained."



The Rockefeller Institute, Brooklyn.

Pennsylvania has lost more than she has gained. The State universities of Wisconsin and Illinois, the universities of Chicago, Johns Hopkins, and Stanford make a good showing, and it is remarkable to find two men of note in the University of North Carolina and Goucher College, when in the seven adjacent States there is not one single man of distinction.

"Among the non-teaching institutions, the Carnegie in Washington has the largest gains, but its showing is not commensurate with its resources. The Department of Agriculture has lost twice as many men as it has gained, and the Smithsonian four times as many." The Rockefeller Institute has done well.

Prof. Cattell very carefully—and always, of course, basing his calculations on the voting of the leading men of science—proceeds to measure the strength of the various universities so far as the sciences are concerned. Harvard stands well at the top of the list. It is the first in four subjects, and Prof. Cattell says that with a very slight change it would be first in several more.

The institutions rank thus: Harvard, first in physiology, botany, zoology, pathology; second in mathematics, geology, anatomy, anthropology, and

psychology; third in chemistry and astronomy. Chicago: First in mathematics and astronomy, second in botany, third in geology, zoology, and pathology. Columbia: First in anthropology and psychology, second in zoology, third in mathematics. Johns Hopkins: First in anatomy, second in pathology, third in physiology and psychology. Yale: First in geology, including mineralogy; second in chemistry and physiology. The Massachusetts Institute of Technology is "easily first" in chemistry. In research the Wistar Institute of biology, affiliated with Pennsylvania, is the most important in its class. The Carnegie Institution has been a "disappointment."

Cornell does not find a place as "first," but it ranks next after Harvard, Chicago, Columbia, Hopkins, and Yale. Then comes Wisconsin, and after it, in order, the Massachusetts Institute of Technology, Michigan, (but it has lost.) California, (also losing in recent years.) Carnegie Institution, Stanford, Princeton, Smithsonian, (lost.) Illinois, Pennsylvania, (lost.) and Clark. The Geological Survey and the Department of Agriculture stand high, but have lost heavily, especially the former.

Prof. Cattell goes so far as to comment on some of these losses. "It is a fact not without significance," he says, "that Columbia and California, in which Faculty control is slight and most of the power lies in the hands of the executive, should have shown such marked losses, while Harvard and Yale, which are democratically governed, have made such satisfying advance." One might well draw from the list the conclusion that democracy in a university was needed—otherwise men of note do not appear to be attracted. The Government institutions which show so severe a loss are also arbitrarily governed, "although in this case the extremely inadequate salaries paid may have something to do with the unwillingness of men of note to enter the service."

It is necessary to be cautious, of course, in making too wide an application of these figures. Some of the colleges which have few men of note have massed them in one or two splendid departments, thinking it wiser to be strong in one direction than mediocre all around—a policy, says Prof. Cattell, that scientific men agree to be judicious.

After making the list of the first one thousand scientists in the country, Prof. Cattell, with the help of the same eminent scholars, prepared a list of the second thousand of the less distinguished. It was found that Massachusetts had far more men in the first than in the second class, so had Connecticut and Wisconsin. New York had a slightly larger number in the second class. The Western States and the Southern have in general more notable men in the second rank.

It was found that the age at which men receive their degrees and go to work at research or teaching is higher than it was. "The average age of the new men was three years higher than the average age in 1903. This," Prof. Cattell points out, "is good so far as it means better preparation, and bad in so far as it keeps them longer from scientific productivity." There is a "small but definite correlation" between the age at which men receive degrees and their subsequent eminence. The more noted the man the earlier he was graduated. It is also interesting to find that the proportion of scientific men of note who have received a thorough university training is increasing. The two most eminent men on the list of 1903, Prof. William James and Prof. Simon Newcomb, had neither of them had a regular college training. It would show that our standards of education are being regulated. While this might hinder originality, it seems to be in the main a good thing.

In spite of the vacancies by death on the list of 1903, there was no great advance made in the positions held by the other men among the first thousand. "Even men of established reputation do not advance as they grow older. The losses tend to increase as the men are of lower rank, but the difference is not considerable." In other words, there is not a regular advance among men who have begun to attain distinction. They do not add to their honors with the increase of years. This, of course, is a bad sign.

There were nineteen women on the list of 1903 and eighteen this year. Prof. Cattell thinks that this is a poor showing. Almost as many women as men receive a college education, he says, and there is no prejudice against their entering on a scientific career. But before pronouncing that this would show a weakness of the sex, he concedes that it is possible women are not yet encouraged to take themselves seriously as scientists, and that, while this feeling would not debar a determined woman, it might deter the wavering from attempting a scientific career.

Prof. Cattell's conclusions are profoundly interesting. He does not think that the present lack of men of genius is altogether peculiar to this country. Nowhere does there seem to be a group of young men ready to fill the places of the giants of the last generation. "This holds good not only for science but for other forms of activity. There is no living peer of Lincoln, Bismarck and Cavour. An Academy of Letters is just now being planned in Great Britain, and its proposed membership is trivial compared with what it might have been in the middle of the Victorian era." But he agrees that it is hardly fair to compare the present day with "the most productive period in all history." "None the less it is ominous for the future that there should be only six men of science of standing in the country who are under 30 years of age and that the number of scientific men should increase more slowly than the population."

The trouble in America seems to be twofold. First, the pay is poor. Second, the man of science is not treated like a person of importance and dignity. It is true that the scientist must work for love as well as for money, and he does, but he should have the money reward which is a symbol of useful service and a dignified position. "If the university President receives three times the professor's salary and the professor's salary depends on the President's favor, the office of professor is degraded. If the scientific man in the Government service receives the salary of a clerk and is subject to the orders of a superior he will be treated like a clerk and in the end will deserve no better treatment."

In Germany the pay, too, is small, but the system is different. "The professorship has been maintained as a high office." Over here, Prof. Cattell says, promotion goes largely according to length of service, possibly even personal favoritism, often through skill in teaching. "It does not follow successful research work. In Germany a man is promoted according to the value of his work as judged by his peers, and the exceptional man receives exceptional honors."

The University of Wisconsin has, through the will of Senator Vilas, ten professorships, with salaries of \$10,000 and freedom from routine teaching. If each university had such a scheme, Prof. Cattell thinks that a comparatively small expenditure would attract men to a scientific career. After all, the life is far more than meat, and small pay might be tolerated if the scientist had a free hand to follow his ideal. Prof. Cattell points out that the investigations of men of science throughout the world may cost \$20,000,000 a year, and that this sum is perhaps one-thousandth of what is saved by the applications of electricity or one-hundredth of what is saved by the use of the phosphorus match. Science is capable of creating, if not a new heaven, at least a new earth. Poverty and disease might be done away with altogether as they have already been checked, and the race might find its golden age, but if the community is to put barriers before the men who do the work of research and clear the way, the great day will be a long while in coming.