of settlements among neighboring tribes and valuations of their territory as to food supply, allows figures to be set for these other tribes. The figures for the entire district can then be used as a check on estimates made independently from local sources for other districts, due regard being given to variety of geographic conditions. In this way the total is arrived at.

The best early data are those from Spanish sources, which sometimes include approximate counts. Early American figures are usually impressionistic and exaggerated.

A check is furnished by the large Yokuts group. Here Moraga in 1806 computed 3,760 souls in thirteen tribelets, an average of 290. The inclusion of absentees might bring the figure to 350. Nearly 50 such tribes are known among the Yokuts, with a small part of their area unaccounted for. The total population of the stock thus was about 18,000. Its area embraced about one ninth of modern California and seems about average in food-supplying capacity. Multiplying 18,000 by 9 gives 162,000. A deduction of one fifth for the larger blocks of high mountain and desert areas brings the total to about 130,000; a reasonable verification.

Of course, no figure can be more than an approximation; but it seems at least highly probable that the native population fell between 120,000 and 150,000.

Even this total, the lowest ever arrived at, yields the unusual density of nearly one inhabitant per square mile for aboriginal California. Mooney's estimate is about 1,050,000 for the continent north of the Mexican boundary; 846,000 within the limits of the United States exclusive of Alaska.

The latter figure however, seems to contain Merriam's 260,000 for California. Reduced to conform to the new estimate of 133,000, the population of the United States would not much have exceeded 700,000, or one inhabitant per four square miles. In other words, more than a sixth of the Indians of this country were settled in California. A similarly heavy concentration seems to have held good for the Pacific coast of the continent as far north as Alaska.

The decrease of Indians in California has reached fully 85 per cent. in a century and a half. The factor most favorable to heavy decrease has been immediacy of contact with Caucasians and Caucasian civilization. Other factors have intervened to make the result somewhat irregular; but these are too dependent on local circumstances to make their analysis possible here.

A. L. KROEBER

UNIVERSITY OF CALIFORNIA

## THE CENTENARY OF THE BIRTH OF HERMANN VON HELMHOLTZ

SCIENTIFIC men of the twentieth century are so engrossed in their various pursuits (for which, happily, material equipment far in excess of anything dreamed of fifty years ago is provided) that they are in some danger of forgetting, overlooking or even ignoring the work of their predecessors of the nineteenth century.

It is upon fundamental discoveries in electricity and magnetism made during that century, and especially upon the two great generalizations, the law of the conservation of energy and the doctrine of evolution, which together constitute its great glory, that the present generation is building a brilliant, though a somewhat complicated and bizarre superstructure. It may be well, therefore, to remind the group of busy younger men who read the pages of SCIENCE, that one hundred years ago, August 31, 1821, was born one who must always be ranked with the very first—the three or four very first—of those upon whose work twentieth century science rests.

Hermann Ludwig Ferdinand, Baron von Helmholtz, was the son of a professor of philology and philosophy at Potsdam. His mother was a Hanoverian lady, a direct descendant of William Penn.

Exhibiting at an early age a fondness for the study of natural phenomena, the necessity for a vocation by which he could earn a living directed him to the medical profession and his first appointment was as an army surgeon.

At the age of twenty-one years he published his first paper announcing the discovery of nerve cells in ganglia, the beginning of a steady flow of contributions to science from his pen, interrupted only by his death more than fifty years later.

At twenty-six he had produced what was possibly the most important piece of work of his whole career, namely, his famous paper on the conservation of energy. Refused for publication by *Poggendorff's Annalen,* its value was appreciated by Du Bois-Reymond, who presented a copy of it to Tyndall (then a student at Berlin) with the remark that it was "the product of the first head in Europe." This paper fixed his place as one of that immortal trinity, Joule, Helmholtz and Kelvin, to whom we owe the establishment of this great law.

An account of Helmholtz's principal contributions to science was given in this journal not long after his death, together with the leading incidents of his long career.[3]

In one respect he was unique. No other man of his day approached him in the wide range of his intellectual activities, ranking, as he did, among the first of mathematicians, physicists, and physiologists, besides being claimed as "their own" by chemists and musicians. His contributions to the science of astronomy and of theoretical mechanics are of the highest order and in respect to his prodigious learning and the wide scope of his investigations he may be put in the same category with Francis Bacon and his own renowned fellow countryman, Alexander von Humboldt. The enormous extension of the bounds of human knowledge within the past fifty years and the irresistible tendency to specialization make it certain that there will never be an addition to this group.

Helmholtz's intellectual processes were in a marked degree typical of the race to which he belonged. They were not characterized by brilliant sorties but rather by steady advances accompanied by entrenchments so safe and strong that he was rarely if ever obliged to retreat.

There was a certain massiveness of style in both his speech and composition which made his arguments a little more difficult to follow than was the case with his two or three more brilliant contemporaries. The charm of his personality will not be forgotten by those who had the good fortune to come within its sphere. With much dignity of manner he was easy of approach, simple and modest in his mode of life, eloquent in speech in popular addresses on scientific subjects, and to those who had tried to find the man in his published works, unexpectedly delightful in social intercourse.

Physically he was not above the average in height and in figure much like that of the well-bred and well-fed German. The one small disappointment was his head which, though large, did not in shape at once proclaim his intellectual superiority, as did that of von Humboldt.

Personally chosen by the Kaiser to represent the German Empire, he came to the United States at the time of the World's Fair in Chicago in 1893. He was honorary president of the International Electrical Congress, with its "Chamber of Delegates" assembled at that time and through the kindness of friends, official and unofficial, all of whom were glad to do him honor, he was enabled to see the places and things most worth seeing in this country which he had never before visited.

On the voyage back to Germany he met with an accident which resulted finally in his death in September, 1894, mourned, as he had been beloved, by people of every nationality and all ranks of life.

The then youthful Kaiser, who was very fond of von Helmholtz and who two years earlier on the occasion of his seventieth birthday, had placed him at the head of the civil list, judged wisely in selecting him as the "highest product of the Empire" and in pure intellectual power he will always rank with the foremost men of the nineteenth century.

T. C. MENDENHALL

RAVENNA, OHIO

[3] SCIENCE, No. 58, February 7, 1896.