

THE ECONOMICS OF THE GRADUATION OF  
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The present article, suggested by the excellent statistics of medical education published annually by THE JOURNAL, is a cold-blooded statistical study of certain problems of supply and demand, bearing quite directly on the ultimate bread-and-butter problem of the profession. Let us start with some statistics from the U. S. Census:

Year.	Physicians.	Population of U. S.	Average clientele.
1870	62,383	38,538,371	618
1880	85,671	50,155,783	585
1890	104,805	62,622,250	597
1900	132,002	76,303,387	568
1910	160,000	91,500,000	572*

\*Estimate, see below.

Roughly speaking, the ratio of physicians to population is about the same as of white to red corpuscles in the blood, but with a moderate leucocytosis.

In the thirty years from 1870 to 1900, the population nearly doubled. In the same period the number of physicians more than doubled; in fact, it increased to about 212 per cent. of its former number. To put it in another way, the average physician had a clientele which was less than in 1870 by 50 persons, or about 10 families. Not only was the clientele smaller, but it included a larger proportion of persons unable or unwilling to pay for services, and it was healthier, notably in regard to tuberculosis, typhoid and pregnancy and the sequelæ of the last disease. So far as can be judged, fees have not increased except for surgical and other special procedures; but these are expected to and usually do prevent the chronic pelvic and other forms of invalidism which formerly made many persons veritable gold mines for the profession. The purchasing power of the dollar in 1900 was probably just about that of the debased current dollar of 1870.

It is plain that, to maintain the same ratio between the medical profession and the total population, the former must increase at a rate which is the sum of its own death rate and the net rate of increase of the non-medical population. As the population is so many times the number of physicians, the non-medical population may be regarded as practically the same as the total population. For the year 1890 the mortality of physicians was 19 per thousand. For the year 1900 I have not been able to find a definite statement, but the general mortality for males over 25 years old was a trifle over 21 per thousand for the registration area. The percentage of physicians under 25 was 5.4 per cent. for 1890 and almost exactly 5 per cent. for 1900. Since then it has unquestionably decreased both on account of the increased amount of preliminary education required of medical matriculants and the addition of a year to the medical course which has fallen within the present decade for probably the majority of schools, and also because the members of the profession already graduated have been increasing in years, while the relative number of new graduates has fallen, except for a couple of years. Moreover, a death rate estimated by ordinary census statistics is less liable to be complete than when estimated by the returns of a "registration area."

The American Medical Association reports place the death rate for the profession at 14 to 15 per thousand. These are probably defective on account of the liability

to lose track of physicians in retirement after they have ceased to practice and to take an interest in medical organizations.

The rate of increase of the general population has gradually fallen as follows:

Years.	Per Cent.
1870-1880	30 +
1880-1890	24 +
1890-1900	22 —
1900-1910	20 — (estimated)

As we are dealing with what are virtually problems in compound interest, an increase of 30 per cent. for 10 years obviously means something less than 30 per thousand for one year. Thus, to keep the average clientele of the physician at the same point, an annual graduation of something less than 5 per cent. would have been permissible in 1870; of about 4.4 per cent. in 1880; of about 4.2 per cent. in 1890; of about 4 per cent. in 1900. As a matter of fact, the graduates of 1880 numbered 3,241, 3.8 per cent. of the total number of physicians, and the average clientele increased by 12 in the next decade. In 1890 they numbered 4,454, 4.2 per cent., and the average clientele fell by 19 in the next decade. But very little dependence can be placed on the results of a single year, nor can the census of physicians for a decennial year be taken as a basis for computations for successive years, and, as a matter of fact, the graduation classes have varied considerably and tended to increase disproportionately until 1904, when the high-water mark of 5,747 was reached.

For comparison with the table of increase of the general population it may be stated that the medical profession increased 37 per cent. from 1870 to 1880, with a decrease in average clientele of over 5 per cent.; 22 per cent. from 1880 to 1890, with an increase in average clientele of over 2 per cent.; 25 per cent. from 1890 to 1900, with a decrease in average clientele of over 3 per cent. So long as the differences in percentage rates are small the clientele will increase or decrease by just about the difference between the percentage increase of the medical profession and the total population — of course, inversely.

The estimate of the numbers of the medical profession in 1910 given at the beginning (160,000) was reached by striking an approximate average between the rates of 22 and 20 per cent. increase. On page 607 of THE JOURNAL (Aug. 15, 1908), however, there is given a list of the graduates since 1900, whose numbers gradually rose to 5,747 in 1904 and have since fallen to 4,741 for 1908. Even an unprecedented increase in medical matriculants can not cause an increase in graduates before 1912, and the estimate of 4,700 graduates has been adopted for each of the next two years. By calculating the mortality of the profession at 21 to 1,000 for 1900, subtracting this from the total and adding the graduates for 1901, and so on for each successive year, the conclusion has been reached that in 1910, the profession will number 154,030. It will be interesting to learn how nearly this estimate coincides with the next census report. If this estimate and that of the total population, 91,500,000, prove to be approximately correct, the average clientele will have increased to 594.

From the experience of various European countries, we know that, without any particular effort to systematize practice, or falling off of the incidence of disease, one physician can easily care for a population of 1,000, and it may be said that if this ratio could be reached,

most of the economic problems confronting the medical profession, and many ethical ones which always arise under the temptations of poverty, would be solved, provided, of course, that there were no corresponding decrease in the demand for medical services.

How slowly any such ratio as 1 to 1,000 can be reached under any conceivable practical conditions may be illustrated as follows: If the rate of increase of total population falls only 2 per cent. more, following the analogy of the decades since 1880, we shall have something like 108,000,000 inhabitants in 1920. The annual mortality of the medical profession in 1910 will be about 3,234. More than this number of physicians was graduated in 1880 and it is scarcely possible that, even by continuing to raise the medical standards, coalescing colleges and discouraging matriculants, the average graduation list can be still further diminished so as merely to keep the profession at its present numeric strength. But suppose that this result could be reached; the average clientele would be increased by only about 10 annually or by direct division of the expected population number in 1920 by the present estimated number of physicians the clientele at that time would be almost exactly 700.

Allowing for a decennial increase of population dropping by 2 per cent. for each decade, the medical clientele would reach 811 in 1930 and 925 in 1940. In other words, we are about thirty-five years in advance of the requirements. This means not only individual average hardship for the medical profession, but a serious economic problem for the whole country.

### *Clinical Notes*

#### A MICRO-ORGANISM WHICH APPARENTLY HAS A SPECIFIC RELATIONSHIP TO ROCKY MOUNTAIN SPOTTED FEVER

A PRELIMINARY REPORT \*

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Since the spring and summer of 1906, bodies which I have referred to in my notes as "diplococcoid bodies," and sometimes short bacillary forms, have been found with considerable constancy in the blood of guinea-pigs and monkeys which were infected with Rocky Mountain spotted fever. They have also been seen in the blood of man but not so frequently. Much more time has been spent on the blood of the experimental animals than on that of man in view of the fact that it could always be obtained in fresh condition.

The form most commonly found is that of two somewhat lanceolate chromatin-staining bodies, separated by a slight amount of eosin-staining substance. The preparations of Giemsa, as furnished by Grüber, has been used almost exclusively, and with variations in the technic the intermediate substance may stain faintly blue.

In spite of the constancy with which these bodies were found, it did not seem justifiable to claim that they represent the microparasite of the disease, for two reasons: (1) the very complex morphology of the blood, especially in febrile states, when various cells and

probably their nuclei are subject to unusual disintegration; (2) because of my inability to cultivate a micro-organism of this character from infected blood by the use of ordinary and some unusual culture media, under various conditions of cultivation, or by other means to obtain it in satisfactory concentration.<sup>1</sup>

#### THE BACILLUS IN THE TICK

Although infected ticks had been examined previously in a more or less cursory manner, their systematic study was not undertaken until recently. In the pursuit of this work advantage was taken of the fact that the disease is transmitted by the infected female to her young through the eggs, as described in a previous report. A repetition of these experiments in the winter of 1907-8, with the help of Dr. Maria B. Maver, resulted in such transmission in 50 per cent. of the ticks used, the fact being determined by allowing the larvæ to feed on normal guinea-pigs. This second series has not been published heretofore.

Female tick No. 40, a *Dermacentor*, from Montana, had produced fatal infections of spotted fever in guinea-pigs 1740 and 1764. A number of eggs from the first day's laying were crushed individually on cover glasses, fixed in absolute alcohol, and stained with Giemsa's stain. Each egg was found to be laden with astonishing numbers of an organism which appears typically as a bipolar staining bacillus of minute size, approximating that of the influenza bacillus, although definite measurements have not yet been made. Various forms are seen depending on the stage of development and the arrangement in which two or more may be found. It is very common to find two organisms end to end, with their poles stained deeply and the intermediate substance a faint blue, resembling a chain of four cocci. When the chromatin is not yet sharply limited to the poles, the somewhat lanceolate forms so often recognized in the blood are seen. Not infrequently delicate bacilli with a uniform distribution of the chromatin are found. These are all interpreted as stages in the evolution of a bipolar organism. They are present in varying numbers in different eggs, but as a rule they are surprisingly numerous, and in some instances they would certainly count into the thousands. Many faintly staining, apparently degenerate forms are encountered.

Examination of the eggs of three dermacentors from Idaho (different specifically from the Montana dermacentor), which were infected from the guinea-pig, showed the presence of the same forms (Ticks 5, 7 and 9).

Conference with zoologic scientists who have made a particular study of the structure of eggs brought out the fact that such bodies are not known as a constituent of the egg of any species of animal.

Although it has not yet been possible to examine the eggs of ticks which are known to be free from spotted fever, the equivalent control has been made through a comparison of the visceral organs of infected and uninfected ticks. The salivary glands, alimentary sac and ovaries of infected females are literally swarming with exactly similar micro-organisms. On the contrary, they appear to be entirely absent from the viscera of the uninfected tick, both male and female.

#### AGGLUTINATION REACTIONS

The most striking evidence of the probable etiologic relationship of this organism to spotted fever is found

\* From the Pathological Laboratory of the University of Chicago

1. Mr. P. G. Heinemann assisted in an extensive series of culture experiments in the spring of 1907.