

creases. Some parts resist more than others; the osseous parts more than the membranous.

The heart of the germ, then, needs a force proportioned to overcome this resistance. Its force is in its *irritability*, or in the power to contract when brought into contact with a liquid. Augment this irritability, and you augment its impulsive force.

Fecundation increases, without doubt, this force, and it alone can do that: since it is only by its intervention that the germ succeeds in freeing itself from the narrow limits which restrained it in its first stage.

The fecundating liquor is, then, a true stimulant, which, carried to the heart of the germ, excites it powerfully and communicates to it a new activity. This is what we call *conception*. Movement once impressed on this little prime mover is conserved by the unique energy of its admirable mechanism.

But it does not suffice that the heart acquire a force capable of overcoming the resistance of solids: the fluid which it sends them for nourishment must be proportioned to the marvelous fineness of the vessels. A blood such as ours would not circulate. The blood of the embryo at first is a whitish liquid; it turns yellow by degrees and finally becomes red. The impulse of the heart dilates the vessels more, and they admit larger particles, heterogeneous and colored.

The generative liquor is not, therefore, a simple stimulant: it is besides a nourishing fluid, appropriate to the extreme delicacy of the parts of the germ. It fulfilled already in the body of the fertilizing individual the functions of a nutritive fluid: it made the comb and spurs grow and gave strength to all parts. You recall the degeneracy of the capon, and how it differs from the cock. You might have many more proofs that the generating fluid is the first aliment of the germ.

Transported by the arteries to all the parts, it unites with them in a fixed manner, according to the proper nature of each. The chick is not slow to lose its form of tadpole. Wings, legs and feet proceed out of the long tail; everything comes out, fashions itself and arranges itself on a new model. The little animal, stretched out at first in an almost straight line, curves itself more and more. It invests itself more and more with muscles, tendons, bones and feathers, and in 18 or 20 days it is a perfect chick. B.

VACCINATION.

BY J. N. HALL, M.D., DENVER, COLO.

IN view of the periodical crusades against compulsory vaccination by certain enthusiasts opposed to the practice, I have thought that it might be of interest to the readers of *Science* to look at a few of the results to be deduced from recent statistics upon the subject. The reason why no thoroughly scientific study of the anti-vaccination side of the matter has been made would seem to lie in the fact that no scientific mind could view the situation in a judicial way without seeing that all of the facts are upon one side, and that the one of the advocates of vaccination. With this prelude I will allow the facts to speak for themselves.

In 1874 the compulsory re-vaccination law became operative in Prussia. (See Dr. Sykes's "Public Health Problems," London). By its provisions, every infant must be re-vaccinated, and every scholar in public and private schools must be re-vaccinated at the age of twelve years. If we take the average number of deaths from small pox per 100,000 living in Prussia, we find that for the five years preceding the introduction of compulsory vaccination the number was 113+. Since the

law went into effect, in but one year, up to 1883, has it reached 4 per 100,000. The average is much less. I have not at hand the figures since that time, for the whole population, but in the Prussian army, where all the conditions are under better control, the results are so much better that I will quote them. This is easily done, for with the exception of a single death in 1885, the name small pox has not appeared as a cause of death in the annual reports since the law went into effect. It should be borne in mind in this connection that Prussia is constantly exposed upon its Russian and Austrian borders to the disease.

As to the death rate in vaccinated and unvaccinated persons, we may quote the conclusions of Dr. Barry, in his report of the epidemic of 1887-8, in Sheffield, England. Without quoting the figures, it will suffice to present the statement that "the children vaccinated, had, as compared with the unvaccinated, a 20-fold immunity from attack, and a 480-fold security against death from small pox; the persons over ten years of age, once vaccinated, had a 5-fold immunity against attack, and a 51-fold security against death; and the twice vaccinated, a 31-fold immunity from attack, and a 640-fold security against death."

Inasmuch as the objections to vaccination on the ground that syphilis and leprosy may be transmitted may be completely done away with by the use of heifer-virus, we need not discuss the matter. There is, indeed, a certain element of danger in vaccination, as in every other thing of established value, but it is strange that in the face of such evidence as may be obtained from scores of reports of boards of health, medical departments of armies, etc., etc., there are still found those who deny the value of the most beneficent discovery ever made by man. There is good reason for hoping that we may soon be able to control in similar manner many other of the contagious diseases which have in the past made such havoc with our race.

—"The Political Economy of Natural Law," by Henry Wood, which appears from the press of Lee & Shepard, of Boston, is virtually an enlargement of a work published seven years ago under the title, "Natural Law in the Business World." The author's main thesis, that all industrial operations are governed by natural law, is of course nothing new, nor is his presentation of it more scientific than that of the regular economists, but less so; yet there is much in his book that may be useful if it reaches the right class of readers. Those who wish a thorough and scientific formulation of the known laws of economic life will prefer the regular treatises; but those who do not relish the hard study that such treatises require, and who like a more popular mode of treatment, will find in this work some useful lessons on the matters with which it deals. That the law of supply and demand cannot be set aside by artificial restraints, that combinations of laborers are often tyrannous, and combinations of capital tend to overreach themselves, and that socialism, if once established, would carry within itself the seeds of its own dissolution, though familiar truths to well-informed men, are not so widely known in the business world as they ought to be; and Mr. Wood's statement of them may attract readers who would never read the elaborate works of Mill and his successors. Mr. Wood takes extreme ground against legislation on business matters, but makes an exception in favor of the protective tariff, which seems to be a pet measure of his. On the whole, however, he is open-minded and fair, and his opinions in the main are such as the best economists will approve.