one-half this amount, showing thereby its organic origin.

It is very probable that the amount of suspended matter in dross-washings varies, not only at the different pits, but also at the same pit from time to time. In twelve of the samples examined, however, the amount of suspended matter is sufficiently large to cause serious pollution. This is also very evident from an examination of the polluted streams, which, for several miles below the pits, are of a black inky colour, while the bed and margins of the streams are covered with black debris, in some places to the depth of several inches.

Whether the nature of the pollution is such as can be dealt with under the Rivers Pollution Prevention Act, depends upon the interpretation of the words which occur in Part 3, Sect. 5, of the above Act—"Noxious or polluting liquid matter"; and again under Sect. 20—"Polluting shall not include innocuous discolouration." In the application of these words to dross-washing, I would venture the opinion that dross-washings is a noxious and polluting liquid, inasmuch as it renders the stream unfit for primary purposes, including watering of cattle, support of animal life, domestic use, &c. It is not a mere innocuous discolouration.

In support of the opinion that dross-washing is a noxious liquid and comes within the scope of this Act, reference might be made to the Commissioners' Fifth Report, or to more recent experience in a neighbouring county, where compensation has been paid to more than one farmer for loss of cattle, which they alleged died through drinking water from a stream polluted with coal-dross washings.

The standard of purity to be aimed at, although not determined, should probably be an effluent with not more than ten grains of suspended solids per gallon. Besides the six collieries on the list there are several others in the Middle Ward where the effluent contains less than this quantity of suspended solids, and it would be unfair to those owners who have obtained such results to accept less from others. In these collieries the means of purification used was settling tanks or ponds, and it is seldom that more than six hours *complete* rest has been required for the purpose—the time suggested by the Commissioners in their Fifth Report. In nine of the collieries on the list the "return" system was employed, in which the amount of water used for washing is reduced to a minimum.

Finally, I would observe that the nature of the polluting liquid is such that it can be easily purified by the simple process of settling, provided the tanks are of sufficient capacity, and carefully attended to, or by filtration through refuse bings, which are "practicable and reasonably available means" for rendering the pollution liquid harmless.

THE SMALL-POX EXPERIENCE OF BIRMINGHAM, 1893-95.

BY

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EIGHT deaths were registered during 1895 from small-pox, of which disease just 100 cases were notified to me. The year 1895 witnessed the end of the great epidemic which commenced in 1893, the last case reported having occurred on June 29th. From that date to the end of the year the city was entirely free from small-pox. Of the 100 cases notified, 85 were vaccinated, 14 unvaccinated, and 1 doubtful. Two of the deaths registered during 1895 were in-patients reported in 1894, so that out of the 100 fresh cases there were 6 deaths, all of them, strange to say, amongst the vaccinated. This is an interesting example of the danger of drawing inferences from a small number of observations. For these figures would appear to show that the case mortality is much higher amongst vaccinated than amongst unvaccinated patients. But the real facts as to vaccination will be seen from the following figures, which deal with the total number of cases notified from the beginning to the close of the epidemic, that is, from the commencement of 1893 to the middle of 1895.

	No. of Cases.	No. of Deaths.	Proportion of Deaths to Cases.
Vaccinated ...	2,701	121	4.5 per cent.
Unvaccinated ...	343	107	31.2 "
Doubtful ...	109	20	18.3 "

Thus the mortality amongst the unvaccinated cases was really seven times as high as amongst the vaccinated.

As the question of vaccination is just now exciting a good deal of interest, I have thought it desirable to look into the above figures a little closely in order to see what is the exact effect of the prophylactic on health and life. I have therefore prepared the following table, the headings of which explain themselves:—

AGE PERIODS.	Cases.			Deaths.			Case Mortality. per cent.		
	Vaccinated.	Unvaccinated.	Doubtful.	Vaccinated.	Unvaccinated.	Doubtful.	Vaccinated.	Unvaccinated.	Doubtful.
Under 1 year	0	55	1	0	38	1	—	69	—
1 to 5 years ...	12	65	7	0	25	0	—	38	—
5 to 10 years...	84	74	12	0	5	1	0	7	—
10 to 15 years	264	40	5	1	3	0	0	7	—
15 to 25 years	1095	57	30	20	12	2	2	21	7
25 to 45 years	1042	41	35	79	19	11	8	46	31
45 and upwards	204	11	19	21	5	5	10	—	—

* From Dr. A. Hill's Annual Report for 1895.

The first point I wish to call attention to is the practical immunity from small-pox enjoyed by vaccinated children under 10 years old. We are often told that even if vaccination lessens the probability of a fatal issue—a fact which few find it possible to dispute—it certainly does not reduce the liability to an attack. But the experience of Birmingham proves this to be quite a fallacy. There are in the city something like 118,000 children under 10 years old. The vaccination returns for the last few years show that about 85 per cent. of the children born were successfully vaccinated shortly after their birth; how many more were vaccinated later in life I cannot tell. But at any rate it may safely be assumed that at least 85 per cent. of the children under 10 years of age are vaccinated, so that there must have been about 100,000 vaccinated and 18,000 unvaccinated children in the city during the recent epidemic. Of these 100,000 vaccinated children under 10 years of age 96 took small-pox, giving a proportion of 1 case per 1,000 children living at that age period; amongst the unvaccinated there were 194 cases, giving a proportion of 11 per 1,000. Thus the unvaccinated children under 10 suffered 11 times as heavily from attacks of small-pox as the vaccinated. It is obvious from these figures that for the first 10 years after it has been performed, vaccination affords a large degree of immunity from an attack of small-pox. And for the first 5 years the degree of immunity is much greater, inasmuch as only 12 vaccinated children under 5 years old were attacked out of about 48,000 living at that age, or only about 1 in every 4,000. But amongst the 9,000 unvaccinated children under 5 years, 1 out of every 75 took small-pox. The experience of Birmingham therefore shows that vaccination confers almost absolute immunity from an attack of small-pox for the first 5 years, and practical immunity for the first 10 years.

I come now to the question of immunity from death, and here the beneficial results of vaccination are still more marked; for amongst the 96 vaccinated small-pox patients under 10 not a single death occurred, while amongst the 194 unvaccinated cases there were 68 deaths. It appears, therefore, that for 10 years after its performance vaccination conferred absolute immunity from death from small-pox, although amongst the unvaccinated of all ages the disease had a mortality of over 30 per cent., that is to say, by means of vaccination within 10 years from the time of an outbreak the deaths of 30 per cent. of the persons attacked may be prevented.

The city of Birmingham having been pointed to as being a well-vaccinated town which has suffered heavily from small-pox, I should like to say that although the recent epidemic lasted for two years and a half, the total number of cases at all ages was only equal to a rate of about 6 per 1,000 for the whole period. In contrast with this, I may say

that in Gloucester, which is a stronghold of the opponents of vaccination, and where the compulsory powers of the Vaccination Acts have been suspended, there had already been 916 cases in the first three months of the present year, giving a rate of over 22 per 1,000, or nearly four times as many in three months as occurred in Birmingham in the whole two and a half years; moreover the epidemic, so far from showing any signs of subsiding, was distinctly on the increase. In the week which ended on April 4th, there were 210 cases in Gloucester, which, making allowance for the difference in population, would be equivalent to over 2,500 cases in one week in Birmingham. One wonders how, after such a lesson as the present Gloucester epidemic teaches, anybody can be found to throw doubt on the value of vaccination, and to oppose the practice of it. Even the popular demand for a Commission of Enquiry appears by the light of it to have been totally unnecessary, and, indeed, injurious in temporarily impairing the efficiency of the Vaccination Acts, and exposing communities to avoidable danger, disfigurement, and death.

THE HYGIENE OF FLOUR AND BREAD.

BY

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A. CORN AND FLOUR.

1. *Structure of Corn.*—To understand the milling processes, it is necessary to examine shortly the structure of the "corn-fruit," consisting of the seed and its coverings. The most remarkable fact is that the seed-coat is adherent to the seed-vessel, and that the nitrogenous matter of the seed is found to increase towards the coverings. The finer structure of the coats consists mainly of cellulose. The inmost layer of the seed-coat, called the perisperm, consists of a single row of squarish cells, wrongly called gluten cells ("German Kleberzellen"), as they contain no gluten at all, but proteid grains (known as aleurone), phosphates, fat, and a hydrolytic ferment called cerealine. Within the endosperm we find the embryo or germ richer in fat proteid matter and phosphates than any of the other parts of the grain. The average weight of the envelopes is $5\frac{1}{2}$ per cent. of the entire grain. The perisperm, or ferment layer, is of special interest to the corn, not only to its growth and storage, but also to the bread-baking. This tissue absorbs the moisture from the soil, and by means of the cerealine the endosperm is transformed into the first nutrition of the new plant (germ). It also influences the colour of the bread, when the cells are finely comminuted or when decomposed by the acids of leaven.

2. *Cleansing of Corn.*—The investigation of what is separated from the corn by the cleansing-works