spell even upon the wedding guest of science; dyspepsia is drugged and studied, and headache is drugged and not studied. All the time spectacle-peddlers fill the land, ruined eyes and lives multiply, the patent medicine disgrace rules legislation, bitters grow more alcoholic, tons of headache powders are sold every year, and the carnival of Eddyism and blatant quackery goes more wildly on. And much if not the most of it all is due to neglect of the physiology of the eye and of its reflex neuroses, and carelessness as to the functional diseases which depend upon eyestrain. The deadliest blow that can be given to quackery in and out of the profession, to the patent medicine and Eddyistic humbugs is to prevent the dyspepsias, anemias, neurasthenias, and headaches which are caused by eyestrain, and whereon battens the multitudinous quack incarnadine.

Not the genius alone, but the common workman and workwoman should be in our mind. One is very likely to get a very distorted, or at least one-sided, idea of the rôle of eyestrain in the world if he sees it only from observing its disastrous effects in the case of great literary and scientific minds. The symptoms and the kind of tragedy it brings to the mechanic and the mechanic's wife; to the sewing-woman, clerk, housewife; to the lonely and distant settlers far from cities and oculists; to the millions of school children and college students; to professional men and women of all kinds—these are different calamities, and they present in each case a separate problem. The one fact common to high and low is that it morbidizes character, doubles suffering and personal burdens, lessens all productive capacity, depreciates the national valour, and validity, and wealth, and delays the advance of civilization. This last is its most evil effect, because every act and product of intellect is intermediated by vision.

Value to Nations and to Civilization of its Great Men.—The most valuable products and assets of a nation are confessedly not its material things, not those measurable in financial terms; they are not discussed in legislative halls, or much thought of by kings or presidents. Worth all of these things are the few literary and scientific geniuses that silently emerge in each century. How inestimably valuable were the men whose clinical lives we have hastily studied! And the amount and character of their intellectual product was limited and qualified by their bad health. Of their atrocious sufferings their contemporaries were incurious, and to them indifferent. The pathos and pity of it is appalling, whether we think of it as a personal matter or from the standpoint of the progress of civilization. How narrowly each escaped absolute failure to deliver his message, how fine the line between utter loss and the saving of even the wreckage; and there is added poignancy when one considers that it was precisely the act of doing their intellectual tasks that brought the suffering, that crippled and morbidized the results, and that brought the danger of absolute failure itself.

We must also remember that not these few only were they that were lost or ruined, or morbidized. By the very nature of the cases, in the vast majority of instances, the records are wanting from which to gather knowledge of the losses or hints of the failures. With only a little search eleven startling examples have been found. The evidence that has come to us in these eleven examples is too indefinite and unscientific as to details, although it leaves no doubt as to the fundamental and essential pathogenic factor. Had we but data concerning de Maupassant and his insanity, if we knew the facts about Swift, Chatterton, Keats, and a multitude of budding or blasted geniuses, many of whose names are unknown to us. For, wherever intellect has sought the solution of the mysteries of our life, wherever reason has attempted to lessen the world's load of suffering and ignorance, there may the eyes have been defective, upon which all results depended, all results to the worker and to the aftercoming workers, who we are. And so it comes to this that the geniuses, the instruments and makers of civilization, depend at last on the medical profession. At last and late we are rising to the measure of our opportunity and our duty.

REGISTRATION OF CONSUMPTIVES IN AMERICA.—An ordinance has recently been passed in Kansas City which provides that all persons suffering from consumption in an infectious stage must be registered at the Board of Health, and must follow the instructions as to isolation and treatment made in each case by the city physician. It is believed that the law is aimed primarily at the negroes, among whom consumption is very prevalent, and who in their conduct on the streets and in crowds are said to show no care for the danger to public safety from the germs of the disease.

REPORT ON AN EXTENSIVE EPIDEMIC OF DIARRHOEA APPARENTLY DUE TO THE POLLUTION OF A PUBLIC WATER SUPPLY.

By JOHN C. THRESH, M.D. Vict., D.Sc. Lond., D.P.H., etc.,
Medical Officer of Health to the Essex County Council; Lecturer on Public Health, London Hospital Medical College.

EPIDEMICS of diarrhoea due to the use of impure water do not appear to be of frequent occurrence. The few with which I am acquainted are referred to in my work on *Water and Water Supplies*, and, of these, some were attributed to the action of suspended mineral matter, and others to the action of bacteria derived from sewage, manure, or decomposing animal or vegetable substances, but none of these outbreaks appear to have been so extensive as the one to which I am about to refer, in which there have been over 1,000 cases and 14 deaths.

The epidemic affected the borough of Chelmsford and the village of Widford, and in order that the nature of the evidence implicating the water may be understood, a brief description of the water supply is necessary.

The town of Chelmsford includes the borough and portions of the parishes of Springfield, Great Baddow, Writtle, and Widford, which are in Chelmsford Rural District. The borough population at the last census was 12,580, and of the town, including the portions of the rural districts above mentioned, about 14,500. The central portion of the town is flat, and lies on the banks of the rivers Cann and Chelmer. During the past summer the recreation ground, near the market and station, and the meadows behind the High Street, have been flooded on two or three occasions. The water supply to the borough and Widford is derived from three different sources. A considerable portion of the town, all that lying to the west of the Shire Hall, is supplied from a spring in Admiral's Park, the remainder is supplied by a mixed water derived from a spring called Burgess well, which is very near the town, and a deep well. The water from the Burgess well is carried by gravitation to a tank at the waterworks, and the deep well water is pumped into the same tank. The mixture is then pumped into a reservoir on high ground just outside the town, and from here it flows by gravitation to supply part of the borough and Widford. The portions of the town situated in the rural district are not supplied with water from the borough mains. Springfield and Great Baddow have a public supply of their own, and the Writtle cottages are supplied by numerous shallow wells. The water mains throughout the borough are continuous, but near the Shire Hall there is a stopcock shutting off the mains to the west of the town, so that all the houses to the west can only be supplied with water from the Admiral's Park Spring, and those to the east can only receive the mixed water from the Burgess well and deep well. The two portions of the town, therefore, have entirely different water supplies, as during the present summer I am informed that the stopcock above mentioned has not once been opened.

The excessive prevalence of diarrhoea in the borough and in Widford came to my knowledge about August 20th, just after my return from my summer holiday, and on the 22nd I commenced a house-to-house visitation in Widford. This was done because I am the acting Medical Officer of Health to the Chelmsford Rural District Council. The results of the investigation showed that the outbreak had a sudden onset about a week before the August Bank Holiday, and July 23rd to 25th appear to have been the dates of the earliest cases. In 54 houses with a population of 250, all deriving water from the Chelmsford mains, cases of diarrhoea, and diarrhoea and sickness, had occurred in 25 houses; and 54 persons, or one-fifth of the entire population, had been attacked. The disease was not the usual autumnal diarrhoea affecting children chiefly, as the majority of the patients attacked were over 5 years of age. The age and sex distribution was as under:

	All Ages.	1 Year.	1 to 5.	5 to 15.	15 to 25.	25 to 65.	65.
Males ...	28	4	3	6	7	6	2
Females ...	26	2	5	8	1	10	0

Two deaths have occurred from "diarrhoea and exhaustion," both infants, one on July 29th and the other on August 26th, both after a few days' illness.

The symptoms described were similar in every case. Without any feverishness or other premonitory symptoms the patients experienced griping pains in the abdomen quickly followed by diarrhoea more or less severe, and lasting for from two to six days. In a few cases vomiting was very troublesome. The stools are described as having been most offensive in character. In some instances the symptoms were suggestive of ptomaine poisoning. Influenza was not prevalent, nor were any of the usual symptoms of that disease observed. The members of a family were usually attacked simultaneously or in rapid succession. Thus in the houses affected in the last week in July, 6 cases occurred in one, 4 in another, and 3 in a third.

Continuing the investigation, eleven cottages and two farms near the infected area in Widford were visited. These derived water from shallow wells. Amongst the inhabitants only one case of diarrhoea had occurred, and the patient was a girl who was in service in Chelmsford, and had been sent home because she was suffering from diarrhoea.

The inhabitants of Widford attributed the outbreak to the water supply, because it has of late frequently been so turbid as to be undrinkable until after long standing. A sample of water was taken from the cistern supplying a house in which three persons were ill and submitted to a bacteriological examination, the results of which will be referred to later.

The results so far obtained certainly were suggestive of the water supply being the cause. I therefore had a house-to-house visitation made in the portions of Writtle, Springfield, and Great Badow, adjoining the borough. In 42 houses in the Writtle portion only one case of diarrhoea had occurred during the previous six weeks, the patient being an infant in the teething stage. In the Springfield portion, which lies very low, and was more likely to have been affected by the recent floods, 70 houses and workshops were visited. In one house there had been 5 cases of diarrhoea; in the remaining 69 houses only three cases, and two of these were infants in arms. Five workmen in the workshops who resided in the borough had suffered from diarrhoea. In the Baddow portion 48 houses were visited, and only two cases of diarrhoea were heard of, and both these were people who worked in Chelmsford.

Omitting the persons working in Chelmsford, in 173 houses in the town, but beyond the limits of the water supply, there had been 9 cases of diarrhoea. Assuming five persons to a house, there were 9 cases amongst a population of 865.

Comparing the attack rate in the portions of the town in the rural districts deriving water from other sources than the borough mains, with the rate in the portion supplied from the mains, the results are as under;

Source of Supply.	Percentage of Persons Attacked.
Borough mains	21.5
Not from borough mains	1.0

In other words, the disease was over twenty times more prevalent amongst the users of the borough water than amongst those not using the water. The possibility of milk or any other article of food being responsible for the outbreak was carefully considered, but no evidence implicating anything but the water could be obtained. It must be remembered also that, although so far my investigations had been limited to my own district, I was fully aware that the outbreak at Widford was only a small part of the epidemic which had recently prevailed in the town. Inquiry made of all the medical men in the district revealed the fact that in no other part of the Chelmsford Union was there any extensive prevalence of diarrhoea.

The borough water supply was gravely implicated, but from the information given me by medical practitioners in the town and by others, there were strong reasons for suspecting that only the eastern portion of the town was affected—that is, the portion supplied with the mixed waters from the Burgess spring and the deep well, nearly all stating that they had had very few cases in the western district. At the industrial school, with 142 boys and 15 officers, not a single case had occurred. This school is in the western area, but is supplied with water from its own wells. On the other hand, in the only other large institution in the town—the workhouse—there had been numerous cases of diarrhoea, and it is supplied, in great part, with water from the implicated source. Suspicion, therefore, was chiefly directed to the mixed supply, and, with the permission of the Mayor, I visited and inspected the waterworks. I examined the deep well and the Burgess spring, and observed nothing indicating a possibility of their pollution, but I found that there was a small uncovered reservoir in the yard into which the water from the deep well had been

pumped, and through which it flowed to mix with the water from the Burgess well in the larger covered reservoir. This small reservoir was not bricked up above ground level, hence during a heavy rain water from the ground around would run into it. Adjoining one end of this reservoir was a patch of garden ground on which flowers were being grown. This I found was manured from time to time with road scrapings. At the time of my visit the tank was not in use and at the bottom of it, on the side adjoining the garden, could be seen a little soil containing an abundance of worms. Further inquiry elicited the fact that this tank was in use until August 21st, when its pollution was suspected and the deep well water was at once diverted and pumped straight into the larger reservoir. There could be no possible doubt that with a very heavy rain soil washings could, and had, gained access to this tank, and such soil washings would contain innumerable bacteria, ova of worms, and other filth. The Widford inquiries elicited the fact that the epidemic commenced there between the 23rd and 25th of July, and a medical man in Chelmsford, who has probably attended the largest number of cases, definitely fixes July 25th as the date of the commencement of the epidemic. Reference to my rainfall records showed that after three rainless weeks 0.56 in. of rain fell on July 17th, 0.45 on the 19th, and no less than 2.1 on the 23rd. The outbreak therefore commenced within a few days of these heavy rains. On August 21st the water was diverted from the uncovered tank, and two or three days after this the epidemic came to an abrupt termination. On September 2nd another house-to-house visitation was made in Widford, with the result that I found the epidemic had entirely ceased, only one case having occurred during the previous week. The medical men also informed me that the epidemic in the town was at an end. The duration of the epidemic, therefore, coincided with the date of the pollution of the tank water, commencing within a day or two of the very heavy rainfall, and ceasing within a few days of the water being diverted from the tank.

Returning now to the sample of water collected at Widford towards the end of the epidemic period, I found this water contained so many bacteria that the gelatine plate was liquefied before I had the opportunity of counting them. As small a quantity of the water as 2 c.cm. produced acid and gas in McConkey's fluid, fermented lactose, curdled milk, etc. That it contained varieties of proteus and of the coli group of organisms, typical of the washings of manured soil, there could be no doubt. On September 2nd I took a sample of the mixed water from the same source, and examined it bacteriologically. This contained very few organisms, and gave none of the reactions which had characterized the previous sample. It was obvious, therefore, that between the date of the collection of the two samples the water had undergone a marked change, a change accounted for by the cutting out of the polluted reservoir.

The conclusion at which I have arrived is that about July 23rd the small reservoir became contaminated with pathogenic organisms from garden soil, that this contaminated water caused the epidemic prevalence of diarrhoea in the district throughout which it was distributed, (the local press estimates that 1,400 cases occurred in the borough, and from my own inquiries I have every reason to believe that this estimate is approximately correct and that the majority were adults), and that the cessation of the epidemic was due to the cessation of the pollution which resulted from the pumping of the deep well water direct into the larger reservoir. The distribution of the disease, the bacteriological examination of the water being used during the epidemic period, and the duration of the epidemic, all point in this direction, and, so far as I can ascertain, in this direction only. That a few cases of diarrhoea occurred outside the epidemic area is only what one would expect at this season of the year. A study of the death returns for the borough and district confirms the above conclusions. From July 1st to July 23rd no death occurred in the borough or district from diarrhoea.

Number of Deaths from Diarrhoea.

Week ending		Chelmsford.		Widford.
July 5th	...	0	...	0
July 12th	...	0	...	0
July 19th	...	0	...	0
July 26th	...	0	...	1
August 2nd	...	1	...	1
August 9th	...	3	...	0
August 16th	...	2	...	0
August 23rd	...	3	...	0
August 30th	...	3	...	1
September 6th	...	0	...	0
September 13th	...	0	...	2

During the epidemic period 12 deaths occurred in Chelmsford, 2 in Widford, and none in the remainder of the Chelmsford Union (see table, p. 761). Nine deaths were of children under 1 year of age, 4 of children between 1 and 2 years, and one of a woman aged 70 years.

In connexion with these deaths it is extremely significant that all occurred in the district to which the implicated water was supplied, no death from diarrhoea occurring in the area supplied by the Admiral's Park spring. I have no means of knowing exactly the population supplied from this source, but I find from the report of the late surveyor, dated March 25th, 1903, that the amount of water supplied from Admiral's Park was exactly half the total amount supplied to the town. This would indicate either that half the population is supplied from Admiral's Park or that one portion of the town is more freely supplied with water than the other. Assuming, however, that only 5,000 persons are supplied from the Park spring, and that the remainder of the borough and Widford village, with a population of 7,700, is supplied from the implicated source, we have:

	Deaths from Diarrhoea during Epidemic.
5,000 persons not using implicated water	...
7,700 persons using the implicated water	... 14
23,000 persons in the remainder of the union not using the implicated water	... 0

It has been suggested that the flooding of the low-lying portion of the town was in some way responsible for the epidemic. There appears to be no ground for such belief, since the low-lying portion of Springfield has not been affected, and the area probably most affected, Widford, is the highest portion supplied with water from the mains and the farthest from the flooded meadows. Against the water theory also has been advanced the argument that cases of diarrhoea have occurred in parts of the town not supplied with the implicated water and outside the borough area, but as I have shown, these are comparatively few, save in Widford, which is supplied with the water, certainly not more than would naturally be expected at this period of the year. Further arguments are that many of the persons attacked, a large proportion of whom are adults, do not admit drinking water, that the infants who died would not be great drinkers of water, and that if the water had been the cause many more people would have been attacked. These arguments are invariably brought forward in connexion with every outbreak of water-borne disease, and it is unnecessary to spend time in again demonstrating the fallacies which underly them.

It might also be urged that as there had been very heavy rainfalls earlier in the year during which soil washings probably polluted the water in the implicated reservoir, that if such soil washings were the cause of the disease, outbreaks of diarrhoea should have previously occurred. Why such was not the case we are not in a position to explain with certainty. Possibly the previous rainfalls had not been sufficiently heavy to carry soil into the tank. Or, again, people are apparently more prone to suffer from diarrhoeal disease in the autumn, and possibly the meteorological conditions which existed immediately prior to, and during, the outbreak had been such as to favour the development in the soil and water of some pathogenic microbe or microbes, or such as to impart to some organism a virulence which at other times it did not possess. In the report of the New York State Board of Health of 1898 there is an account of an outbreak of dysenteric diarrhoea traced to the use of soil-contaminated water, which the investigators attributed to the presence of the bacillus pyocaneus. Unfortunately I have been unable to undertake any investigation for determining what particular organism was the cause of the outbreak.

The Chelmsford water supply is not the only one liable to pollution with soil washings. During the past year I have had to investigate several complaints in different parts of the country arising from species of worms, lumbrici and naides being found in the water, and in each case I have traced these to washings from soil adjacent to tanks and reservoirs. I have seen one such case since the Chelmsford outbreak; but fortunately the soil was not manured, and probably on this account no ill-effects were traceable to the use of this water.

Since the outbreak the Corporation has had the water from each source examined by Dr. B. Dyer, and I am glad to find that he confirms my opinion that these show no signs of contamination.

The primary object of an investigation of this character is to ascertain the cause of the prevalence of disease, in order that, if discovered, it may be removed and be

avoided in future, not only in one particular district, but in all, and in secondary degree it is made to ascertain whether the outbreak was due to negligence. In this particular instance I cannot blame the water authority, the Chelmsford Town Council. The tank which became infected had only recently been constructed under the supervision of a well-known water engineer,* and for a temporary purpose. It would no doubt have been wiser to have raised the edges well above the ground level, but I do not think, under ordinary circumstances, soil washings would enter the tank, but with a rainfall of over 2 in. in twenty-four hours, the conditions were unusual, and, the precaution above referred to not having been taken, led to the catastrophe. It is only right also that I should state that the moment the Water Committee heard that the water was suspected they visited the works, and, seeing that soil had been washed into the tank, had the water diverted from it immediately, and this had been done some days prior to my visit. This prompt action at once stopped the epidemic, and no doubt saved several lives and prevented much suffering. As soon as the turbidity of the water in certain mains was reported, the cause was investigated and steps taken which it is hoped will prevent its recurrence. I feel it likewise due to the Mayor to thank him for his courteous assistance during the investigation.

MEDICAL PRACTICE IN BUSSORAH.

We are indebted for the following interesting communication to Dr. W. R. Scroggin, of Bussorah, Turkish Arabia:

It may interest some of your readers to know something about Bussorah as about every two years a medical man is engaged to serve some of the English firms trading at Bussorah.

Usually a first-class passage is given by the P. and O. Company to Bombay and by the British India Company from Bombay to Bussorah. In some instances £60 has been given to enable the doctor to proceed to Constantinople there to obtain a Turkish diploma to enable him to practise anywhere in the Turkish Empire and the doctor then makes his own arrangement about his voyage or journey to Bussorah with this amount, but I was informed that the expenses then are more likely to be £90 than £60.

Formerly the Turkish Examining Board permitted the services of an interpreter, but now it is necessary that the candidate should pass the examination, which is said not to be difficult, in either the Turkish or French languages. As I did not know either of these languages, my appointment was arranged diplomatically by appointing me as Honorary Physician to the British Consulate at Bussorah, which carries no claim to continuous service, pension, or salary. I therefore had not to proceed to Constantinople to obtain the Turkish diploma. In many respects I consider it is better to obtain the Turkish diploma, which confers the privilege already mentioned, and would enable one to practise in Bussorah or elsewhere in the Turkish Empire if one severs his connexion with the firms or the British Consulate.

The firm of Gray Dawes, of London, negotiates the agreement on behalf of the firms in Bussorah. The salary given by the combined firms is £150 per annum, and a hint is given that the British Consulate may engage you at £80 per annum, and that as steamers call at Bussorah something more can be reasonably expected from them to supplement the salary, besides the private practice of the place. If particulars are inquired about, you will be told that house rent is high, and the wages for servants are high.

A decent house is very difficult to obtain, and the rent is at least £50 per annum. The servants are troublesome in every respect and cost at least £80 a year, so that there is not much left from the two salaries that the doctor can feel certain of. The shipping and the private practice depends upon the captains of the steamers and the doctor himself.

There are six or seven Turkish doctors officially connected with Bussorah, and these have the practice of the Turkish officials and their families. There is also an American medical missionary, who has a dispensary open daily, except Sundays, and enters into private practice also, but there are no general practitioners, though there are numerous quacks.

* Since preparing this report the engineer has submitted to me the plans, approved by him, showing that the brickwork of the tanks should have been carried 18 in. above the ground level. Had these plans been adhered to pollution would have been impossible. The borough surveyor (since dead) prepared the plans and I do not know who is responsible for the altered construction.