all know that it is a by-product highly esteemed as a food for pigs and other domestic animals. All farmers realize its value in poultry feeding, and it is often fed to cows with good results; but they know that the "results" are only in proportion to the amount of the normal constituents of the milk retained after the cream is extracted. Skimmed milk contains the principal part of the nitrogenous constituents of milk, the greater part of the sugar, and a large quantity of its mineral matter which still makes it a valuable food product, lacking only the elements of fat. Were fat-supplying foods, such as nuts, olive oil, etcetera, eaten with skimmed milk, it would be a perfectly balanced food.

The chief objection of the laity against skimmed milk is that it so frequently masquerades as whole milk, as does the Dutch product, and even the new American output; for despite the label which our pure food laws insist upon, the gullible public rarely reads or comprehends this fact. We seem willing to be duped, if we pay a little less for the imposture—quantity rather than quality overruling. False economy is causing much misery in the world.

While European countries are passing through this great crisis, that has already been ruinous to their industrial and financial interests, now is the time for us to fortify against invasion to our own interests. The American dairy-farmer should grasp this opportunity to intrench his business against the foreigner's attack, such as that of the skimmed milk industry. Why let Europe usurp one of our greatest agricultural achievements? Is it not worth protecting and fostering, when we consider that our condensed and evaporated milk industries use about 1,300,000,000 pounds of whole milk each year, which at the average price of \$1.56 a hundredweight paid by the condensers to dairymen gives a \$20,000,000 business to the dairy farmer? According to an authority, our total output of butter, cheese and condensed milk is valued at \$600,000,000. Our total production of orchard fruits is

valued only at \$140,000,000 a year. These figures speak for themselves.

Yes, surely now is the time for the American dairy-farmer to study the condensed and evaporated milk supremacy in Europe and post himself as to our own economic inefficiencies, thus showing us how to protect, foster and intrench before it is too late.

FILARIAL INFECTION—AN INVESTIGATION OF ITS PREVALENCE IN CHARLESTON, S. C.*

By F. B. JOHNSON, M.D.,

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The object of this paper is to emphasize: First, the prevalence of filarial infection in the South; second, the advantage of using a method of concentration of the blood, so that larger quantities may more readily be examined in searching for microfilaria; third, the relation of symptomatic filaria, by general consent called "filariasis," to filarial infection.

Filaria is known to be a common parasite in many tropical and subtropical countries, according to Manson¹, being found indigenous as far north as Spain in Europe and Charleston, S. C., in the United States of America, and as far south as Brisbane in Australia.

In China from 10 to 50 per cent of the people harbor the worm. In India, in one district alone, about one-third carry microfilaria. In Samoa one-half of the natives, and in the Friendly Islands, according to Thorp, 32 per cent harbor the filaria. On the Island of Guam, from an examination of 244 individuals, G. B.

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Crow² found 5 per cent infection. Among the Fijians, Bahr³ states that it is possible that at one time or another nearly every Fijian is the subject of filariasis, because 27.1 per cent were found to harbor microfilaria in their blood, and others were found to suffer from filarial diseases when no microfilaria could be found in the blood; and lastly, in patients under observation, the microfilaria have disappeared from the blood.

The extent of infection shows an unequal distribution in even different parts of the same country, being in general more common along sea coasts and the banks of large rivers, but presenting peculiar circumscribed endemic areas⁴. In Southern Nigeria Foran⁵ found in 543 bloods obtained at night 3 per cent infection with microfilaria bancrofti and 8½ of *M. perstans*. Among 700 Lagos natives of West Africa, A. Connal⁶ found a total infection of 25.22 per cent of either filaria loa or filaria bancrofti; filaria bancrofti alone only accounting for about 4 per cent of the infections.

In Porto Rico, Ashford⁷ showed 12 per cent of the soldiers harboring microfilaria; 20 per cent of the natives having chyluria. In 1890, deSaussure⁸ published the clinical histories of 22 cases of filaria sanguinous hominis seen in Charleston, S. C., from 1886 to 1890. Various reports have been made from time to time of cases of filariasis in the South, far too numerous to mention. No direct reference can, however, be found by me in regard to the percentage of filarial infection that occurs.

Recent examinations that I have made of 400 individuals in the city of Charleston, S. C., show 19.25 per cent harboring microfilaria in their blood. The majority of those examined were from the wards of the Roper Hospital, taken in order of admission and without regard to the disease for which admitted; a certain number were from the emergency departments and others from outside, apparently in good health. While it is admitted that those examined include only a few of the bet-

ter class of people, 19.25 per cent of infection among them is sufficient to show that it is extremely prevalent.

In 1909, by the use of a method of placing four large drops of blood upon a slide and covering with another thin slide, ringed with vaseline, microfilaria were found by me in 9.8 per cent of 131 bloods examined.

For this last series of 400 examinations, a method for finding microfilaria in the blood as advocated by Rivas and Allen J. Smith⁹ was adopted. This consists in adding 1 c.c. of blood to 9 c.c. of 2 per cent acetic acid, shaking thoroughly and centrifuging. The erythrocytes become hemolyzed and only a small amount of sediment is found in the tube; all of this is spread upon one or more slides and examined microscopically. This method of concentration enables one to examine larger quantities of blood, and the embryo are more readily found.

Those examined may be classified as shown in Table I.

Table I.
Results of the Examination of 400 Individuals in Charleston, S. C., for Microfilaria.

	No. Exam-ined.	No. Infect- ed.	Per cent Infect- ed.
White females	50	14	28
White males	50	9	18
Colored females	150	29	19.3
Colored males	150	25	16.7
Total	400	77	19.25
White males and females...	100	23	23
Colored males and females...	300	54	18
Females, white and colored.	200	43	21.5
Males, white and colored...	200	34	17

It is seen that the highest percentage of infection occurred among white females, of whom 50 were examined and 28 per cent were found to have microfilaria in their blood. Of 150 colored females examined, 19.3 per cent were infected. Fifty white males showed 18 per cent, and in colored males the lowest percentage of infection was found, i. e., of 150 examined, 16.7 per cent were carriers of microfilaria.

The white race showed a higher percentage of infection than the colored; the total percentage for the whites being 23 per cent, that for the negro being 18 per cent. All females, including white and colored together, showed 21.5 per cent having microfilaria, and all males of both races taken together showed 17 per cent infection. Connal¹⁰ in finding 25.2 per cent of infection among the Lagos natives of West Africa, found only one female infected out of 43 examined.

The higher percentage of infection in the white race over that of the negro may possibly be explained, that infection in the negro has been for a longer period of time and they have acquired greater resistance, the general opinion being that filaria was introduced into this country by the negro from Africa.

The blood for these examinations was taken from the ear or finger usually between the hours of 10 and 12 p.m. In 30 cases showing microfilaria at this time, another examination was made at about 11 a.m. to ascertain the value of the method described for the detection of the embryo in the peripheral blood during the daytime.

These 30 cases, as seen in Table II, showed a marked variation:

Table II.
Comparison of Day Examinations to Night Examinations in Thirty Cases of Filarial Infection.

Case No.	Night 11 P.M. No. per c.c.	Day 11 A.M. No. per c.c.
		1479
1	2114	1188 ²²
		346
2	1650	325 ²²
		154
3	1583	147 ²²
		108
4	1464	98 ²²
5	1254	40
6	1060	46
7	808	10
8	745	45
9	476	26
10	454	25
11	340	14
12	220	15

13	160	0
14	140	2
15	60	3
16	60	2
17	52	0
18	50	17
19	48	4
20	46	3
21	41	0 ²²
		0
22	40	1
23	28	0
24	24	0
25	20	0
26	11	1
27	6	0
28	4	0
		0
29	3	0 ²²
30	3	0

In the number of microfilaria found at night, varied from 2114 per c.c. in Case 1, to 3 c.c. in Case 30. In all but 10 of these cases microfilaria were found during the daytime. The number found in the day varied in approximate proportion to the number found at night; *i.e.*, the embryos were found during the day in all cases that showed 220 per c.c. or over at night, and only in 2 of 10 cases showed 41 per c.c. or less at night.

In six cases, as also shown in Table II, a comparison was made of the number of microfilaria in the capillary and venous circulation during the daytime. In four of the cases the number was nearly the same, the capillary blood showing a slightly larger number than the venous; in the other two cases no embryo were found in either capillary or venous blood during the day.

From appearance and measurements given by Low¹¹, the microfilaria found were the embryos of filaria bancrofti. These embryos were not, however, identified by measurements in each particular case. It is, of course, possible that other species of filaria exist here, but I was unable to find any other species in the blood of man. Braun¹² seems to think that dirofilaria immitis may possibly be found

²²Blood taken from vein at elbow.

in man. This is a very common infection of the dogs around Charleston, and if infection occurs there would be good opportunity of observing it here.

In three cases an investigation was made in regard to the length of life of microfilaria in the blood after being withdrawn, four large drops of blood being placed upon a slide and covered with a very large cover glass, ringed with vaseline to protect from drying out. On slides kept at room temperature embryos were seen motile for ten and ten and a half days. In one of the specimens placed in the refrigerator at about 9°C. microfilaria were found alive up to thirteen and a half days. The specimens placed in the incubator at 37.5°C. lived only about two and a half days. No actual development was observed in any of the microfilaria, though in one of the refrigerator specimens, after ten days, an absence of outer sheath was observed.

Of the 77 cases of filarial infection found in my examinations, in only 20, or 25.9 per cent, could a history of filariasis be obtained. Nine had had chyluria or hemato-chyluria; one of the cases of hematochyluria had also a pleural effusion, in which microfilaria were found in the fluid after aspiration. Three had elephantiasis: one of these cases had elephantiasis of both legs—gangrene of one leg occurred for which the leg had to be amputated, later the other leg had to be removed also. Two cases had lymphscrotum, one of which showed ulceration and sloughing. One case was a hydrocele, presumably chylocele, though I was unable to examine the contents of the sack and demonstrate microfilaria therein. One case of filarial phlebotasis, or varix, of both legs was also found. This man had also a cardiac valvular lesion and nodular masses, about the size of a pea, along the course of some of the superficial veins, resembling phleboliths, but not attached to the vein. One case of chyluria had also a synovitis on the back of one of his hands that became inflamed intermittently; the contents of the sack were examined for microfilaria, but they were not found. A

case whose history bears going into more fully was that of a man on whom a diagnosis of syphilitic cirrhosis of the liver was made, having a strong positive Wassermann; two and a half gallons of ascitic fluid withdrawn from the abdomen showed the presence of many live microfilaria and also contained fat and a few blood cells. Another case that may be mentioned was that of a woman who showed a marked general lymph-glandular enlargement and gave a history of frequent attacks of lymphangitis, occasional abscesses, and nodular, inflamed areas under the skin, disappearing in three or four days. These areas felt hot and were painful. I have not had the opportunity of seeing these myself, but the history is that of calabar swellings. Microfilaria bancrofti were found in her blood both day and night and no embryo of loa loa. Castellani and Chalmers¹² state that there are possibly other species of filaria or allied genera besides loa loa, which may produce calabar swellings.

Microfilaria were found in the blood of the three cases of elephantiasis mentioned, but in the examination of three other cases of elephantiasis no microfilaria were found; also in one case of hemato-chyluria no embryo were found in either blood or urine.

The ages of those examined were from four days old, an infant whose mother had filariasis and which was negative, to that of a man 103 years old, whose blood showed microfilaria. The youngest age at which I found the embryo was in a boy 6 years old. The highest percentage of cases was found in those past middle life.

The diagnoses on which those examined from the Roper Hospital were admitted, included practically all the diseases one usually finds in a Southern hospital. Forty diseased conditions were represented in those showing filarial infection. There appears to be no special relation, than already mentioned, of these diseases to filariasis. On account of the presence of other conditions in the majority of those examined, the value of blood counts on these cases of filarial infection is open to ques-

tion. Parasitic infections and suppurative conditions occurred in several. The highest eosinophilia found, however, was 9.5 per cent.

Besides these examinations made in Charleston, thirty bloods obtained during the day at Plantersville, a rural district near Georgetown, S. C., through the cooperation of Dr. A. B. Clark, were examined for microfilaria. No embryos were found in any of these cases. Dr. Clark has given me, however, histories of several cases of filariasis that he has seen in his practice, so these thirty examinations are not sufficient, in my opinion, to exclude filarial infection in that neighborhood. Infection would appear, though, to be more prevalent in more thickly populated centers than such rural districts as the one mentioned.

In answer to the question, "What is the approximate number of cases of filariasis that you have seen in your entire practice?" the sum total from fifty physicians (representing about two-thirds of the physicians in Charleston) was 494 cases: chyluria, 244; elephantiasis, 213; both chyluria and elephantiasis, 8; other symptoms, 4; not stated, 25. In considering the report of these cases, allowance will have to be made for some of them being seen by more than one physician and therefore reported more than once, as names and addresses could be obtained in only a few to prevent this repetition.

Even this number of cases in proportion to population would give less than 1 per cent having had symptoms of filariasis, while in comparison, my report of finding twenty cases of filariasis in the routine examination of 400 individuals, would give 5 per cent. The disparity between these two percentages cannot be explained.

The following conclusions may be made:

1. Filarial infection is extremely prevalent in Charleston, S. C.; there is no reason for assuming this to be the only place in the South showing such a high percentage of infection.

2. The acetic acid method offers the most serviceable way of detecting microfilaria in the

blood; in most of the cases it being possible to demonstrate them in the blood during the day, as well as at night.

3. In the majority of cases of filarial infection no symptoms may be produced by the worms. The finding of 19.25 per cent of filarial infection and 5 per cent filariasis in 400 routine examinations is sufficient to show that even filariasis is more common than general reports would lead one to believe. Filariasis cannot be classed as a harmless parasite, for, as already mentioned, certain types of infection have a decided pathogenic effect.

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2. Crow, A. M. A., Vol. LV, No. 7, p. 591.
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DISCUSSION.

Dr. C. C. Bass, New Orleans: I desire to express my appreciation of the very valuable contribution that has been made to this subject. It is one of the best original pieces of work I have seen in a considerable length of time. It calls our attention to the existence of a condition or infection and actual disease that, in all probability, is very prevalent throughout the entire country. It simply serves to remind us again of the fact that we are pursuing diseases to the limit. We have been seeing these cases for many, many years; they are widely distributed and still absolutely unrecognized. We can recall only a few years ago, when the first cases of hookworm disease had been recognized, in discussing the subject with a doctor or a group of doctors, and describing and presenting cases, one doctor would say, "I believe I have had cases of that disease in my practice." He would recall a family in which maybe one child had the disease. As a matter of fact, seventy-five per cent of all his patients had that disease. Later study has taught us so. It is quite possible that the same idea may be applied to some extent to such a disease as filariasis. This paper is a call to all to begin to look for filarial infection. There is no doubt that there has been more or less unsystematic and not

extensive search made for filaria, usually without success. Occasionally cases have been found in other sections besides Charleston, in the South, but the technic employed, as shown by Dr. Johnson's work, would not have permitted finding a large number of cases. Recently my attention was called to the technic employed in our laboratory in looking for filarial embryos in cows. All cows in the South have filaria apparently. It is a universal infection with cows. The technic employed was to take ten c.c. of blood, defibrinate it, and then centrifuge. The filariae go to the top of the cell mass, and then that is skimmed off and examined. It was found in several instances that ten c.c. of blood often contained only one, two or three filaria. I would not be surprised if one c.c. would not fail to demonstrate filaria in many instances in the blood of man when a larger quantity would show them.

Again I congratulate the essayist on his valuable and instructive contribution.

Dr. James V. Freeman, Jacksonville, Florida: In the first place, I desire to express my appreciation of this excellent paper, and in the second place, to speak of a curiosity we found in our service at St. Luke's Hospital the past year in a case of bilharziosis. These cases are so uncommon in this country that they can be counted on the fingers of the hand. The interesting point about this particular case is that this woman never lived outside of the United States. She had lived in two cities, Chicago and Philadelphia. She had this bilharzia infection seven or eight years. The earliest manifestation was a pneumonic process, which ran quite an atypical course, and the features of the case were such that we suspect she had a bilharziosis of the lung. Under our observation she showed irritation of the rectum, the vagina and bladder. The ova were found abundantly in the urine. She had an erosion of the cervix, and was sent in as a case of epithelioma of the cervix uteri.

Dr. F. B. Johnson, Charleston, South Carolina (closing): I wish to express my thanks to the gentlemen for their remarks and also to tender my thanks to the physicians, nurses and other individuals through whose co-operation this investigation was made possible.

That the percentage of filarial infection proved to be higher in the white race than the colored came as a surprise to me. This is also shown in the symptoms produced; that is, of the whites infected thirty per cent showed symptoms, and of the colored twenty-four per cent; also from the fact that in the five per cent showing symptoms, of the four hundred examined, the relation of white to colored is seven to four. Chyluria appears to be the most frequent manifestation of infection, though elephantiasis occurs quite frequently. In whites the elephantiasis affects most frequently the legs; in the negro women the vulva is more frequently affected than other parts. We have several cases operated upon every year; that is, removal of the labia because of the elephantoid condition. White females showed about ten per cent infection of symptomatic filaria, or filariasis, and colored females about five per cent. This disease appears here to have spread to the

white race, and, finding a more fertile field, is showing more of the symptomatic manifestations.

I believe if this simple technic of examining for microfilaria is carried out, even in the daytime, we would find a great deal more of filarial infection and the associated conditions in the Southern States than we do at present.

AUTHORS' ABSTRACTS.

Tropical Diseases and Public Health.

Impounded Waters. By J. A. A. Le Prince, United States Public Health Service, Washington, D. C. Public Health Reports, February 12, 1916, pp. 473-481.

After water was impounded by the dam near Lock No. 12 on the Coosa River, Alabama, many cases of malaria were reported to the State Health Officer. The existing conditions were studied during October and November, 1914, to determine to what extent this impounded water increased Anopheles and the spread of malaria. The company using the water had cleared certain large areas to prevent mosquito production, but were unaware of the proper method of procedure for Anopheles control in flooded areas. The examination showed *Anopheles quadrimaculatus* to be developing in but two limited areas, while *Anopheles punctipennis* in all stages of development were present and numerous in many of the wind-protected inlets. Adult *Anopheles* were found in natural resting places near propagation areas. Apparently at that season two important factors aided *Anopheles* propagation in the lake. First, the marked scarcity of top-feeding minnows; second, the presence of floating pine needles, particularly in wind-protected inlets. The larvae were invariably present in collections of pine needles and frequently absent in other collections of floating debris. The elimination of brush, floating pine needles, small twigs, etc., is of greater importance than the removal of large standing trees or logs.

A New Bacterial Disease of Rodents Transmissible to Man. By William B. Wherry, Cincinnati, Ohio. United States Public Health Reports, December 18, 1914.

A plague-like disease of California ground squirrels was described by McCoy and Chapin (Public Health Bulletin 43, United States Public Health Service, Washington, 1911; *Ibid.* No. 53, 1912, and *Jour. Infect. Dis.*, 1912, Vol. X, p. 61), to be caused by a very minute bacterium which they named bacterium tularense. Wherry reviews the reports, made by himself and B. H. Lamb, on two cases of human infection with this virus. (*Jour. Infect. Dis.*, 1914, Vol. XV, pp. 331-340, and *Jour. Amer. Med. Assoc.*, 1914, Vol. LXIII, p. 2041.) Both cases exhibited ulcerative conjunctivitis, and regional lymphadenitis, accompanied by marked prostration; and gave histories of having dissected rabbits shortly before the onset of the disease. Two rabbits, found dead on a farm near Vevay, Ind., were proven to be infected with the same virus. They suggest that the disease is probably widely distributed among rodents and that infection among those