

THE FATE OF THE MAMMALIAN TUBERCULOSIS BACILLUS IN SPARROWS AND CHICKENS*

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In an experiment in which a number of common sparrows were fed with tuberculous material of mammalian origin, it was observed that after a time the animals would succumb in a markedly emaciated condition but almost entirely free from any gross lesions resembling tuberculosis.

The material used was derived from cavia which had died of tuberculosis and which had been used for the propagation in vivo of 3 strains of mammalian bacilli, 2 of bovine and 1 of human origin. In the experiment with sparrows the various strains were also kept strictly separate, and the birds received only one meal of tuberculous material. The sparrows, which had been kept in captivity for several weeks, completely consumed the material offered. The cages were then cleaned and disinfected.

In Series 1727 (bovine) a cavia succumbing to the eighth passage of bacilli was used for material; in Series 1747 (bovine) one dying as a result of the fourth passage of the bacilli was used, while in Series 1775 (human) a cavia dead with tuberculosis caused by a second passage of the virus, was used. In Series 1747 a number of sparrows were fed with material from a cavia injected with material from a sparrow of the first lot used in the experiment.

After the first few deaths, especially in view of the unusually marked loss of flesh in the sparrows, the question of a possible survival, if not propagation, of the mammalian bacilli introduced, presented itself. In order to find our answer to this question the organs of the dead sparrows, notably the livers, were carefully examined for bacilli, while material from the livers of a number of the birds, was injected intraperitoneally into guinea-pigs, and in a few instances also into ordinary barnyard fowls. In the latter case the injections were made intravenously.

Table 1 permits a review of the results obtained in these inoculation experiments.

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TABLE 1

RESULTS OF EXPERIMENTS TO PROVE THE SURVIVAL OR PROPAGATION OF TUBERCLE BACILLI

Sparrow	Died After Days	Lesions	Bacilli in Organs	Transmitted to Cavia	Result of Transmission	Remarks
SERIES 1727. USING MATERIAL FROM CAVIA C ^s						
2658	14	None	None			
2659	63	Small nodule in liver	Present			
2657	70	None	Present	2656 2655		Both caviae were lost
2654	93	None	None	2635 2626	Tuberculosis Tuberculosis	
2620	147	None	None	2622 2621	Negative Negative	
2623	148	None	None	2624 2625	Negative Negative	
SERIES 1747. USING MATERIAL FROM CAVIA B ¹						
2764	52	None				
2844	72	None	None	2831 2845	Tuberculosis Tuberculosis	
2874	74	None	None	2859 2858	Tuberculosis Tuberculosis	
2876	111	None	None	2878 2877	Negative Negative	
2875	122	None				
2824	20	None	None	2825 2826 2810	Negative Negative Negative	
2838	35	None	None	2842 2841 2840 2839	Negative Negative Negative Negative	Infectiousness of chickens was not checked
2833	39	None	None	2837 2836 2835 2834	Negative Negative Negative Negative?	Had some bacilli in liver
2832	190 Killed	None	None			
SERIES 1775. USING MATERIAL FROM CAVIA B ²						
2745	40	None	None	2744 2743	Tuberculosis	
2731	129	None	Present	2730 2730a	Tuberculosis Negative	
2725	136	None	None	2724 2723	Negative Negative	
2722	137					Material lost
2721	141	None	None	2720 2719	Tuberculosis	
2706	187	None	None	2702 2703 2704 2705	Negative Negative Negative Negative	

In all there were fed thus 21 sparrows, which, with only one exception (Sparrow 2832), died in an emaciated condition. Only in Sparrow 2659 was there any suggestion of tuberculous disease. This consisted of a very small nodule in the liver and in this nodule typical tubercle bacilli could be demonstrated microscopically.

The fact that the sparrows possibly died as a result of the ingestion of tuberculous material of mammalian origin is not the most striking feature of the findings recorded in the preceding table. It is rather the more or less persistent survival of mammalian tubercle bacilli in the body in birds which attracts our attention. While not all animals in the series were examined with this point in view, the persistence of the bacilli was manifest in a sufficient number to arouse interest.

The organ examined, from which material for the inoculation of guinea-pigs was taken, was the liver in all cases. In but 3 cases (Sparrows 2659, 2657, and 2731) could the organism be demonstrated microscopically in such manner as to leave no room for doubt.

In 6 cases we succeeded in causing tuberculosis in caviae by the intraperitoneal injection of small amounts of emulsions of sparrow livers (Sparrows 2654, 2844, 2874, 2745, 2731, and 2721). The material was collected 93, 72, 74, 40, 129, and 141 days, respectively, after the ingestion of the infective meal, so that it appears the mammalian tubercle bacillus may maintain itself for long periods in the organs of a bird without losing its vitality or its original virulence.

These observations suggested further inquiry with a view to determining whether or not a similar survival of the mammalian tuberculosis bacillus takes place when it is introduced into the body of common barnyard fowls. If such were the case, it would be well within the range of possibility that the common chicken, through its omnivorous habits and intimate contact with farm animals, with their ejecta and offal, might become a carrier of mammalian tuberculosis.

In the subsequent experiments designed to demonstrate this possibility, use was made of the same tuberculous materials as were used in the previous trial of sparrows. Most of the material was from caviae which had become tuberculous as a result of injection with emulsions of sparrow livers. In one series we used material directly from sparrows that had been fed with other sparrow material, and in another series, material from sparrows fed with mammalian tuberculous matter.

In the investigation under consideration all the chickens were injected intravenously, and the control caviae intraperitoneally. In checking up the infectiveness of chicken material, emulsions of the liver were used, with the exception of a few instances when emulsions of the spleen were also used. In the selection of cavia material such parts were taken as most warranted the assumption that they contained tubercle bacilli.

Tables 2 and 3 permit a review of the details of these experiments.

TABLE 2

RESULTS OF EXPERIMENTS TO PROVE THE SURVIVAL OF TUBERCULOSIS BACILLI OF BOVINE ORIGIN IN CHICKENS. SERIES 1727

Chicken	Source of Infection	Died After Days	Lesions	Bacilli in Organs	Transmitted to	Results of Transmission
2638	Cavia 2635	36	None	+	Cavia 2639 Cavia 2640 Chicken 2642 Chicken 2641	None Tuberculosis
2647	Cavia 2635	113	None	+	Cavia 2651 Cavia 1650 Chicken 2653 Chicken 2652	Tuberculosis Tuberculosis
2642	Chicken 2638	30	None	None	Cavia 2646 Cavia 2645 Chicken 2644 Chicken 2644a	None None
2641	Chicken 2638	146	None	?	Cavia 2933 Cavia 2934 Chicken 2931 Chicken 2932	None None
2653	Chicken 2647	228 Killed	None	None	Cavia 3269 Cavia 3270	None None
2652	Chicken 2647	228 Killed	None	None	Cavia 3271 Cavia 3272	None None
2644	Chicken 2642	244 Killed	None	None	Cavia 3267 Cavia 3268	None None
2644a	Chicken 2642	246 Killed	None	None	Cavia 3277 Cavia 3278	None None
2931	Chicken 2641	179 Killed	None	None	Cavia 3306 Cavia 3307	None None
2932	Chicken 2641	148 Killed	None	None	Cavia 3239 Cavia 3240	None Tuberculosis
2629	Cavia 2626	326 Killed	None	None	Cavia 3246 Cavia 3247	None None
2630	Cavia 2626	19	None	+	Cavia 2633 Cavia 2624 Chicken 2632 Chicken 2631	Tuberculosis Tuberculosis
2632	Chicken 2630	323 Killed	None	None	Cavia 3279 Cavia 3280	None None
2631	Chicken 2630	296	None	None	Cavia 3214 Cavia 3215	None None

In the group recorded in Table 2 there were 4 chickens which received each an intravenous injection of an emulsion prepared from the lesions of a cavia that had become tuberculous as the result of inoculation with material from sparrows carrying tuberculosis bacilli in the liver. Of these, 3 (2638, 2647, and 2630) died 36, 113, and 19 days, respectively, after inoculation, and guinea-pigs injected with

TABLE 3

RESULTS OF FURTHER EXPERIMENTS TO PROVE THE SURVIVAL OF TUBERCULOSIS BACILLI OF BOVINE ORIGIN IN CHICKENS. SERIES 1747

Chicken	Source of Infection	Died After Days	Lesions	Bacilli in Organs	Transmitted to	Results of Transmission	Remarks
2847	Cavia 2845	89	None	+	Cavia 2851 Cavia 2850 Chicken 2849 Chicken 2848	Tuberculosis Tuberculosis	
2846	Cavia 2845	145	None	+			
2849	Chicken 2847	268 Killed	None	?	Cavia 3285 Cavia 3286	None None	
2848	Chicken 2847	177	None	None	Cavia 3092 Cavia 3093 Chicken 3094 Chicken 3095	None	
3094	Chicken 2848	111 Killed	None	None	Cavia 3308 Cavia 3309		Cavias died of sepsis
3095	Chicken 2848	85	None	None	Cavia 3261 Cavia 3262	None Tuberculosis	
2869	Cavia 2869	89	None	None	Cavia 2870 Cavia 2871 Chicken 2872 Chicken 2873	None	
2867	Cavia 2859	358 Killed	None	None	Cavia 3248 Cavia 3249	None None	
2860	Cavia 2859	120	?	?	Cavia 2866 Cavia 2865 Chicken 2862 Chicken 2861	None None	
2872	Chicken 2869	265 Killed	None	None	Cavia 3237 Cavia 3238	None None	
2873	Chicken 2869	81	None	?	Cavia 2892 Cavia 2893 Chicken 2894 Chicken 2895		Cavias died of sepsis
2862	Chicken 2860	18	None	+	Cavia 2864 Cavia 2863	None None	
2861	Chicken 2860	93	None	None	Cavia 2949 Cavia 2950 Chicken 2948 Chicken 2947	None None	
2894 2895							Material lost through sepsis
2948	Chicken 2861	46	None	None	Cavia 3049 Cavia 3050 Chicken 3047 Chicken 3048		Sepsis
2947	Chicken 2861	20	None	None			Injected animals died with sepsis
3047	Chicken 2948	22	None	None	Cavia 3106 Cavia 3107	None None	Cavias died with sepsis

TABLE 3—Continued

RESULTS OF FURTHER EXPERIMENTS TO PROVE THE SURVIVAL OF TUBERCULOSIS BACILLI OF BOVINE ORIGIN IN CHICKENS. SERIES 1747

Chicken	Source of Infection	Died After Days	Lesions	Bacilli in Organs	Transmitted to	Results of Transmission	Remarks
3048 2850	Chicken 2948 Cavia 2858	7 183	None None	None None	Cavia 2945 Cavia 2946 Chicken 2943 Chicken 2944	None None	Sepsis Cavias died with sepsis
2857	Cavia 2858	328 Killed	None	None	Cavia 3250 Cavia 3251	None None	
2943	Chicken 2856	173 Killed	None	None	Cavia 3310 Cavia 3311	None None	
2944	Chicken 2856	172 Killed	None	None	Cavia 3304 Cavia 3305	None None	
2826	Sparrow 2824	75	None	None	Cavia 2830 Cavia 2829 Chicken 2828 Chicken 2827	None None	
2810	Sparrow 2824	43	?	None	Cavia 2822 Cavia 2823 Chicken 2817 Chicken 2811	None None	
2828	Chicken 2826	88	None	None			
2827	Chicken 2826	93	None	None			
2817	Chicken 2810	59	None	None	Cavia 2821 Cavia 2820 Chicken 2818 Chicken 2819	None None	
2811	Chicken 2810	83	None	None	Cavia 2816 Cavia 2815 Chicken 2814 Chicken 2813 Chicken 2812	None None	
2818	Chicken 2817	76 Killed	Tuber- culosis	+			
2819	Chicken 2817	76 Killed	None				
2814	Chicken 2811	24	None	+			
2813	Chicken 2811	39	None				
2812	Chicken 2811	43	None				
2840	Sparrow 2838	183 Killed	None				
2839	Sparrow 2838	183 Killed	None				
2835	Sparrow 2833	149 Killed	None				
2834	Sparrow 2833	149 Killed	Tuber- culosis	+			

material from their livers developed tuberculosis in due course of time. In all three cases the bacillus could be demonstrated in liver smears. The fourth (Chicken 2629) was killed 326 days after inoculation, and both by microscopical examination and by injection into a cavia was proved to be free from infection.

Material from the three chickens which proved to be infective for guinea-pigs was injected into 6 other chickens, with the result that 3 (2642, 2641, and 2630) died 30, 146, and 296 days after the injection; the remaining three (2653, 2652, and 2632) were killed after periods of observation of 228, 228, and 323 days respectively. In none was it possible to show the existence of tuberculous infection by direct examination or by transmission to caviae, altho in the liver of Chicken 2641 some acidfast debris suggestive of the tuberculosis bacillus was found.

From 2 of the six, material was injected into 4 other chickens (2644, 2644a, 2931, and 2932). None died spontaneously. They were killed after 244, 246, 179 and 148 days, and material from the livers injected into guinea-pigs proved noninfective, with the exception of that taken from Chicken 2932, which produced tuberculosis in one of 2 caviae injected.

In none of the chickens used in Series 1727 could any lesions suggestive of tuberculosis be observed, but all the birds dying spontaneously showed a most marked state of emaciation.

In the trials made with materials of Series 1747, we were unfortunate in losing several caviae, either on account of an apparently unavoidable acute septic infection or as a result of certain toxic materials associated with the chicken material used.

Seven chickens (2874, 2846, 2869, 2867, 2860, 2856, and 2857) were injected with virulent cavia material. Of this number 5 (2847, 2846, 2869, 2860, and 2856) died 89, 145, 89, 120, and 183 days, respectively, after the injection, while 2 (2867 and 2857) were killed while in apparently good health after 358 and 328 days.

Of the number injected only 2 showed the tuberculosis bacillus. In Chicken 2847 this was demonstrated both by inoculation and direct examination, while in the other the result of the microscopical examination of material taken from the liver left no doubt in regard to the presence of the organism mentioned.

Only in Chicken 2860 of this group of seven could anything resembling a tuberculous lesion be detected at autopsy. This lesion consisted of a questionable nodule in the liver, in which also some acidfast debris was found on microscopical examination. The caviae injected with an emulsion of this material, however, escaped infection.

Two chickens were injected with material from Chicken 2847, the one which had proved infective to caviae. One, 2848, died 177 days after inoculation and material taken from it and inoculated into guinea-pigs failed to produce the disease. The other (Chicken 2849) which was killed after 268 days, also proved to be free from tuberculosis infection, altho in its liver some questionable acidfast debris was found.

From certain of the noninfective members of the group of seven, transfers were made to 6 other fowls. Three of the latter (2873, 2862, and 2861) died 81, 18, and 93 days after inoculation, while the remaining three (2872, 2943, and 2944) were killed in apparently good health 265, 173, and 172 days after inoculation. Neither from the birds which died, nor from the ones that were killed, could tuberculosis be transmitted to caviae. In one of the former (2873) questionable organisms were found in the liver and in another (2862) tuberculosis bacilli could be demonstrated in the same organ. As the caviae escaped infection, it must be assumed that the bacilli found were dead. In Chicken 2873 it was impossible definitely to prove or disprove the infectiousness of the material because of the loss of the caviae from sepsis.

From Chicken 2848 injected with material which had proved infectious to caviae and which this bird apparently failed to retain in virulent form, material was injected into 2 other chickens (3094 and 3095). One died 85 days later, and the other was killed after 111 days. The latter's infectiveness could not be established, the caviae injected being lost through sepsis, but 1 of the 2 guinea-pigs injected with material from the former developed the disease in an unmistakable manner.

Of 2 more chickens (2948 and 2947) inoculated with material taken from one of the group of 5 birds mentioned (2861) the infectiousness could not be ascertained because of the loss of the caviae used. Both died after 46 and 20 days.

Six chickens in Series 1747 were inoculated with sparrow material. The sparrows (2824, 2838, and 2833) had been fed with tuberculous guinea-pig organs, but material taken from them after death was not infective for caviae.

Two of the six (2826 and 2810) died after 75 and 43 days. The remaining four (2840, 2839, 2835, and 2834) were killed 183, 183, 149 and 149 days after inoculation. In one (2810) some nodules were found in the liver, but the presence of the tuberculosis bacillus could

not be demonstrated either by microscopical examination or by animal inoculation. In another of this group (2834) 3 small nodules were found in the liver, containing typical tubercle bacilli in large numbers.

From the two which died spontaneously (2826 and 2810) material was injected into 4 healthy chickens (2828, 2827, 2817, and 2811). All died spontaneously 88, 93, 59, and 83 days after the injections. None showed lesions or other evidence of infection.

From 2 of the four chickens a group of 5 other fowls were injected. Two of these (2818 and 2819) were killed after 76 days, one of which showed lesions and bacilli in the liver. The remaining three (2814, 2813, and 2812) died 24, 39, and 43 days after the inoculation. None showed lesions, but one (2814) had some bacilli in the liver.

From a sparrow in this series (2706) which after being fed with tuberculous material had failed to carry infective material until its death, material was injected into 2 chickens (2704 and 2705). The former died after 215 days, and the latter was killed while in good health 308 days after the inoculation. These two birds were free of lesions, and bacilli could not be demonstrated either by animal inoculation or by direct microscopical examination. Two chickens (3068 and 3069), injected with liver emulsion from the one chicken which died spontaneously, and killed 134 and 142 days afterward, also were free from lesions and bacilli.

Seven chickens in this series were injected with infective cavia material. Five (2742, 2732, 2737, 2729, and 2715) died 112, 295, 125, 137, and 23 days, respectively, after the inoculation, while the other two (2728 and 2716) were killed in normal condition after 150 and 331 days. Of this entire group only one animal (2715) contained bacilli in the liver.

From the seven chickens liver emulsions were injected into 6 normal fowls (2740, 2741, 2735, 2736, 2712, and 2711). Three (2740, 2741, and 2711) died spontaneously after 243, 159, and 74 days; the remaining three (2735, 2736, and 2712) were killed while in good health after 246, 230, and 296 days. In only one of the six (2711) could bacilli be demonstrated.

Of this last group, 2 fowls (2741 and 2711) furnished material for further inoculations into 4 other chickens; of these only one died spontaneously (2709), after 163 days; the other three (3064, 3065, and 2710) were killed while in good health, after 129, 121, and 222 days. In none of the four could tuberculous infection be demonstrated.

TABLE 4

RESULTS OF EXPERIMENTS TO PROVE THE SURVIVAL AND PROPAGATION OF TUBERCLE BACILLI OF HUMAN ORIGIN IN CHICKENS. SERIES 1775

Chicken	Source of Infection	Died After Days	Lesions	Bacilli in Organs	Transmitted to	Results of Transmission	Remarks
2704	Sparrow 2706	215	None	None	Cavia 3066 Cavia 3067 Chicken 3068 Chicken 3069	None None	
2705	Sparrow 2706	308 Killed	None	None	Cavia 3257 Cavia 3258	None None	
3068	Chicken 2704	134 Killed	None	None	Cavia 3314 Cavia 3315	None None	
3069	Chicken 2704	142 Killed	None	None	Cavia 3338 Cavia 3339	None None	
2742	Cavia 2743	112	None	None	Cavia 2738 Cavia 2739 Chicken 2740 Chicken 2741	None None	
2732	Cavia 2743	295			Cavia 3137 Cavia 3138	None None	
2737	Cavia 2743	125	None	None	Cavia 2733 Cavia 2734 Chicken 2735 Chicken 2736	None None	
2740	Chicken 2742	243	None	None	Cavia 3236 Cavia 3235	None None	
2741	Chicken 2742	159	None	None	Cavia 3062 Cavia 3063 Chicken 3064 Chicken 3065	None None	
2735	Chicken 2737	346 Killed	None	None	Cavia 3283 Cavia 3284	None None	
2736	Chicken 2737	230 Killed	None	None	Cavia 3229 Cavia 3230	None None	
3064	Chicken 2741	129 Killed	None		Cavia 3340 Cavia 3341	None None	
3065	Chicken 2741	121 Killed	None	None	Cavia 3312 Cavia 3313	None None	
2728	Cavia 2730	150	None	None	Cavia 3121	None	
2729	Cavia 2730	Killed 137			Cavia 3122	None	Lost
2716	Cavia 2719	331 Killed	None	None	Cavia 3281 Cavia 3282	None None	
2715	Cavia 2719	23	None	+	Cavia 2714 Cavia 2713 Chicken 2712 Chicken 2711	Tuberculosis Tuberculosis	
2712	Chicken 2715	296 Killed	None	None	Cavia 3241 Cavia 3242	None None	
2711	Chicken 2715	74	None	+	Cavia 2707 Cavia 2708 Chicken 2709 Chicken 2710	Tuberculosis None	
2709	Chicken 2711	163	None	None			
2710	Chicken 2711	222 Killed	None	None	Cavia 3265 Cavia 3266	None None	

TABLE 5
RESULTS OF FEEDING EXPERIMENTS WITH TUBERCLE BACILLI

Chicken	Source and Date of Infection	Lesions	Results of Feces Examination				Results of Liver Examination			
			Date	Bacilli in Smears	Cavia Inoculation		Date	Bacilli in Smears	Cavia Inoculation	
					Cavia	Results			Cavia	Results
2937	Cavias, Series 1775,* 1/22/15	None	2/ 8/15	?	2973	Negative	7/22/15	None	3327	Negative
					2974	Negative				
			2/22/15	None	3000	?				
					3001	?				
			3/ 8/15	None	3080	Negative				
			4/ 6/15		3081	Negative				
					3112	Negative				
		3113	Negative							
		3186	Negative							
		3187	Negative							
		3318	Negative							
		3319	Negative							
2938	Spleen, Series 2919 (hog), 1/22/15	None	2/ 8/15	Acid fast debris	2975	Negative	7/22/15	None	3325	Negative
					2976	Negative				
			2/22/15	None	3004	Negative				
					3005	Negative				
			3/ 8/15	Acid fast debris	3082	Doubtful				
			4/ 6/15		3083	Doubtful				
					3114	Negative				
		3115	Negative							
		3188	Negative							
		3189	Negative							
		3316	Negative							
		3317	Negative							
2935	Cavias, Series 1727, 1/22/15		2/ 8/15	None	2969	Negative	7/22/15	None	3331	Negative
					2970	Negative				
			2/22/15	None	3002	Negative				
					3003	Negative				
			3/ 8/15	Acid fast debris	3026	Negative				
			4/ 6/15		3027	Negative				
					3106	Negative				
		3109	Negative							
		3182	Negative							
		3183	Negative							
		3322	Negative							
		3323	Negative							
2936	Cavias, Series 1747, 1/22/15		2/ 8/15	Present	2971	Positive	7/22/15	None	3329	Negative
					2972	Negative				
			2/22/15	None	2998	Negative				
					2999	Negative				
			3/ 8/15	None	3028	Negative				
			4/ 6/15		3029	Positive				
					3110	Negative				
		3111	Negative							
		3184	Negative							
		3185	Negative							
		3320	Negative							
		3121	Negative							

* First five caviae died of sepsis.

In addition to the trials described, some further experiments were made in which chickens were given one meal of infectious material and in which the feces were examined from time to time for the presence of bacilli. The chickens in this experiment were permitted to live for 6 months, after which they were killed so that the liver could be examined for bacilli. While, unfortunately, lack of room limited

the number of animals used and this small number does not permit definite conclusions, it seems well to make mention of this trial in connection with the work already described.

The material taken from caviae belonging to Series 1727, 1747, and 1775 was fed to 3 chickens, while that of Series 2919 from a tuberculous hog spleen was given to a fourth fowl. Table 5 permits a review of this experiment.

From Table 5 it is apparent that in only one of the four chickens fed with tuberculous material, was it possible to show that the feces contained virulent bacilli for some time after the material was fed. This was Chicken 2936, the ejecta of which proved virulent 17 and 45 days after the infective meal. In one (2938) the results were doubtful when feces passed after 45 days were examined. In the other two fowls (2935 and 2937) the results were negative.

At the time the fowls were killed, they were apparently in good health, altho one of them had lost considerable flesh during the first month after the feeding. This chicken, however, recovered and showed no further evidence of illness.

In a number of caviae, representing all the series, some doubtful nodular formations were encountered in certain organs, but in none could the existence of tuberculosis be definitely shown.

Summarizing the results obtained we find as follows:

{ Sparrows fed with virulent mammalian material and examined.....	18
{ Sparrows found to contain tubercle bacilli after from 40 to 141 days....	8
{ Chickens injected with virulent mammalian material and examined.....	17
{ Chickens found to contain tubercle bacilli after from 19 to 145 days.....	6
{ Chickens injected with material from sparrows fed with virulent mam-	
malian matter	8
{ Chickens found to contain tubercle bacilli after 149 days.....	1
{ Chickens fed with virulent mammalian material.....	4
{ Chickens the feces of which contained virulent bacilli after 45 days.....	1

In addition to the groups of chickens summarized, there were injected with material from them 25 other fowls, of which only 2 proved to be infective after 18 and 74 days.

From some of these twenty-five chickens material was injected into 17 healthy fowls, in 4 of which tubercle bacilli were demonstrated 24, 76, 85, and 148 days, respectively, after the inoculation.

An interesting feature of our experiments is that in a series of transmissions there was one or more animals in which no infection could be shown and yet animals inoculated with material furnished by them again were proved to contain tubercle bacilli, either by microscopical observation or by positive results in caviae. Table 6 shows the history of these transmissions and their results.

Table 6

Original Tuberculous Material	Transmission to	Results	Transmission to	Results	Transmission to	Results	Transmission to	Results	Transmission to	Results
Cavia, Series 1747	Sparrow 2833	Negative	Chicken 2834	Positive						
Cavia, Series 1747	Sparrow 2824	Negative	Chicken 2810	Negative	Chicken 2811	Negative	Chicken 2814	Positive		
Cavia, Series 1747	Sparrow 2824	Negative	Chicken 2810	Negative	Chicken 2817	Negative	Chicken 2818	Positive		
Cavia, 2859	Chicken 2860	Negative	Chicken 2862	Positive						
Cavia, 2845	Chicken 2847	Positive	Chicken 2848	Negative	Chicken 3095	Positive				
Cavia, Series 1727	Sparrow 2654	Positive	Cavia 2635	Positive	Chicken 2638	Positive	Chicken 2641	Negative	Chicken 2932	Positive

We have no definite data to indicate precisely the cause of this phenomenon and merely suspect it to be due to the smallness of the number of bacilli which survived in the body of the birds and which caused them to be missed either in the microscopical preparations or in the emulsions injected.

In regard to the mortality among birds which either ingested or were injected with mammalian material, the results may be summarized as indicated in Table 7.

TABLE 7
SUMMARY OF RESULTS AS REGARDS MORTALITY

Animals	Source of Material Injected or Fed	Died	Killed	Remarks
Sparrows.....	Caviae.....	17		
Sparrows.....	Sparrows.....	3	1	
Chickens.....	Caviae.....	14	9	
Chickens.....	Sparrows.....	3	5	
Chickens.....	Chickens.....	23	22	Including all groups

Practically all birds which died after inoculation became greatly emaciated near the end, while all those which were killed at a considerable period after inoculation were without exception in a perfect state of health and nutrition.

CONCLUSIONS

A considerable number of birds into which mammalian tuberculosis bacilli are introduced, either by ingestion or by inoculation, die in a highly emaciated state.

As a result of the incorporation of such bacilli into the bodies of birds, the latter may retain the organisms for long periods with their pathogenic characteristics fully preserved.

In consequence it is well within the range of possibility that birds may serve as intermediary carriers and transmitters of mammalian tuberculosis.*

* Our results confirm, at least in part, certain observations made by Auclair in pigeons (*Arch. méd. exper. et d'anat. path.*, 1897, 9, p. 277). Auclair observed that 3 pigeons injected intraperitoneally with pure cultures of human bacilli died after from 1 to 3½ months, without showing any sign of tuberculosis. In a second series, pigeons were infected in a similar manner with tubercle bacilli from human sources. At the 6th, 7th and 14th day afterward, the pigeons were killed and the livers, lungs, and blood injected into cavia. A few of the latter died without any evidence of tuberculosis. Only 2 died of local tuberculosis.

Auclair concludes (1) that pigeons infected with human bacilli die without any tuberculous changes; (2) that tubercle bacilli may retain their vitality and virulence in the body of the pigeon for at least 14 days; (3) that tubercle bacilli localize themselves in the pigeon by preference in the liver and the lungs, but not, so far as could be shown, in the blood; and (4) that the tubercle bacilli passed through the pigeon give rise in the cavia to a slowly developing local tuberculosis.