and pulmonary capillaries, 200 actively motile larvae, dissected out from the cysts and suspended in dogs' own blood, were injected respectively into one lung of one dog and the liver of another, everything being kept at body temperature to prevent the coiling up of the larvae. The blood coming out of these organs contained not a single larva, but in the lung and the liver mashed and digested for 3 to 4 days in 1% pepsin solution, 148 and 135 live larvae respectively were recovered.

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Treatment of Dirofilariasis Immitis with Concentrated Fouadin.

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Dirofilaria immitis, a viviparous filarial worm living in the right chambers of the heart, the pulmonary artery and its branches, is very prevalent in China, 7.7% of dogs in Canton and 27%* of dogs in Peiping being infested. No cure for the parasite was known until Itagaki *et al.*[1] and Wada[2] reported some success by using sodium antimony tartrate and neostibnal respectively. "Fouadin", a proprietary antimony compound was found to give highly satisfactory result by Philipp[3] and by Underwood and Wright,[4] who gave it a very thorough trial. Hays[5] also reported favorably on a double salt of antimony. Since the salts of antimony have given promising therapeutic result, the authors began in the winter of 1934 to test the efficacy of another complex antimony compound called "Concentrated Fouadin"† against this worm. A preliminary notice of the results is here given.

As subjects of experiment, naturally infected dogs were em-

* From the records of Physiology Department, Peiping Union Medical College, Peiping, China.

[1] Itagaki, S., and Makino, R., *J. Japanese Soc. Vet. Sci.*, 1927, **6**, 1.

[2] Wada, K., *Scient. Rep. Gov't Inst. Infect. Dis., Tokyo Imp. Univ.*, 1927, **6**, 525.

[3] Philipp, F. G., *China J. Sci. and Arts*, 1931, **14**, 42.

[4] Underwood, P. C., and Wright, W. H., *J. Parasit.*, 1932, 180.

[5] Hays, J. M., *Vet. Med.*, April, 1933. Original not seen.

† Contains "11% Antimony III—pyrocatechin—disulphonate of sodium and calcium" supplied by 'Bayer'.

ployed. To have an idea of the degree of infestation, the average of at least 3 consecutive daily counts of microfilariae in 0.025 cc. of dried and dehaemoglobinized blood obtained from the ear-vein at 4 p. m., was ascertained. For treatment, 16 dogs were divided into 2 groups. To Group I comprising 10 dogs, an intramuscular injection was given daily except Sundays until the microfilariae disappeared from the peripheral blood. The initial dose varied according to the size of the animal, generally 0.5 cc. for a dog under 10 kg. and 1 cc. for one weighing between 10 and 15 kg. For subsequent injections, the dose was gradually increased with the object of pushing the drug to the limit of tolerance as rapidly as possible. The 6 dogs of Group II were also injected intramuscularly, but after the first 2 consecutive daily doses corresponding to 0.05 cc. of Concentrated Fouadin per kg. body weight the third and the following injections were given on alternate days with a dose equal to 0.10 cc. per kg. body weight until the same result was achieved. As a 'follow-up' the same quantity of ear blood taken at 4 p. m. every 10 days was examined for the reappearance of microfilariae. When the dogs died or were sacrificed, searches for the adult worms were made in the heart and pulmonary arteries and in the nodules of infarcts in the lungs. Their viability was tested in warm normal saline. The uteri were cut open near the vulva and the condition of the escaping microfilariae and ova was noted. Microscopic sections were also made of any nodules found in the lungs.

Results. Group I. Of the 10 dogs given daily injections: (a) 2 died of poisoning 2 days after receiving a total amount of 0.65 cc. and 0.38 cc. per kg. body weight of the drug spread over 4 and 5 days respectively. Autopsy findings: worms in right cardiac chamber and pulmonary artery still alive; those in hemorrhagic infarct nodules in the lungs (posterior lobes) dead. Other relevant data were: weight, 5.7 and 14.4 kg.; number of microfilariae per 0.025 cc. = 48 and 81. (b) The remaining 8, weighing from 6.7 to 15.4 kg. with microfilaria counts from 7 to 72 per 0.025 cc. were found free from microfilaria after 4- to 6-day courses of injections totally 2.5 cc. to 5.5 cc. They all appeared in a better condition than before treatment and gained weight, except one of the 2 dogs in which the larvae reappeared 11 days after treatment and which was not retreated. Three of them died from 3 weeks to 1 month after treatment as the result of surgical operation. They had received a total amount of 0.43 cc. and 0.50 cc. per kg. body weight. In 2 in which autopsy was done, the adult worms in the heart were still active. Two of the remaining 5 were killed, 78 and 86 days

after the disappearance of microfilariae. Sixteen motile Dirofilariae were recovered from the hearts: 4 males and 6 females in the one and 2 males and 4 females in the other. The microfilaria counts before treatment were 24 and 12 per 0.025 cc. respectively. The total amount of Concentrated Fouadin used per kg. body weight was 0.26 cc. and 0.56 cc. The 3 survivors, except the one noted above, have been in good health and 141 days free from microfilariae up to the end of March, 1935.

Group II. Six dogs (weights from 8.8 to 16.4 kg.; microfilaria counts: 3 to 115 per 0.025 cc.) were treated on alternate days and the blood was rendered sterile from 11 to 14 days with a total dosage of 5.5 cc. to 10.10 cc. of Concentrated Fouadin. (a) Two were sacrificed 23 days and 110 days after treatment with total cc. per kg. body weight of 0.63 and 0.71 respectively and found to have firm infarcts in the periphery of the upper and lower lobes of both lungs; and one to have 5 pairs of living worms in the right auricles and the other, 15 males and 10 females in the same situation. The lung nodules contained dead worms. One female worm, 26 cm. in length, from each dog still had motile embryos *in utero*. (b) The remaining 4 dogs are still under observation and 3 of them have been negative for 136 days and the fourth for 170 days.

In one dog kept for control, the microfilariae have never disappeared from the circulation during the last 6 months.

Thus it is evident that by bringing the infected dogs under the toxic influence of Concentrated Fouadin as rapidly as possible through daily intramuscular injections, it was found possible to destroy the microfilariae but not all the adult worms which, however, except 2 out of 30, contained only dead embryos. By this method the microfilariae disappeared in from 4 to 6 days with a total of from 0.26 cc. to 0.69 cc. per kg. body weight. Whereas by the method of alternate day injections, it took from 11 to 14 days with the drug amounting to from 0.58 cc. to 0.71 cc. per kg. body weight (the last 2 doses in every case had to be given daily) to produce the same result. Compared with "Fouadin" from 21 cc. to 33 cc. of which, according to Underwood and Wright[4] were necessary to rid the dogs of the embryos, "Concentrated Fouadin" was 4 to 5 times therapeutically more potent. The largest single dose for dogs of from 12 to 15.5 kg. was 1.5 cc. as against 3 cc. for animals weighing 17.3 to 23.6 kg. with Fouadin. With the less amount of the drug required, the course (from 20 to 25 days for Fouadin) of treatment was also correspondingly as many times shorter.