any dwellings, where there is always considerable leakage, and where there is a great amount of bedding, upholstery, clothing and plastering which must necessarily absorb a large amount of the gas, very much larger quantities have been found necessary. Generally with small amounts of from 4 to 12 ounces to 1,000 cubic feet, I could not get very good results; occasionally they would be good. But on increasing the amount the results were much better. To get satisfactory results in house disinfection, I agree with Dr. Wyatt Johnson of Montreal that at the very least one pound of formalin to 1,000 cubic feet should be used, and it would be better to use even considerably more. In this city it is the custom to use nearly a quart to the 1,000 cubic feet, and the varying and inconstant results with small amounts have not been repeated.

INFLUENCE ON HOUSEHOLD GOODS.

In our experience in this city there has never been any injurious influence exerted by the gas upon any article of household furniture, clothing, bedding, upholstery, carpets, or on any ornaments, pictures, gilding, or on wall-papers. Further, no person has complained of the gas causing any injury to his goods, and this after the use of formaldehyde in many hundreds of houses in all grades of society.

Dr. Kinyoun, in his experiments with 225 samples of wool, cotton, textile fabrics, hair, fur and leather, found them unchanged by the gas. Colors are not affected with the exception of the aniline color fuchsin which is changed to purple; all other observers practically agree in these results.

INFLUENCE ON ANIMAL LIFE.

Our opportunities for observation in this line have been limited. Dogs and cats which have been left in rooms were found killed. Flies were invariably found dead. Bed-bugs, which were exposed to the direct action of the gas, were likewise killed.

Drs. Harrington and McCollom both found that the gas was fatal to rabbits. The early claims of the innocuousness of the gas to all animal life have not been substantiated.

IN CONCLUSION.

I believe we have in formaldehyde the best practical gaseous surface disinfectant known. For dwelling-house disinfection it is unsurpassed. It is easy of application, and does no injury to goods. It is not ideal, its use being limited to surface disinfection. Its penetrative powers under ordinary conditions are so slight as to be almost valueless. Good results are best obtained by using a large body of gas, and having the room as tightly sealed as possible. Length of exposure and the influence of temperature are secondary to the amount used.

Under these conditions disinfection may be regarded as complete after the use of formaldehyde.

SUPERFICIAL AREA OF THE HUMAN BODY. — At a recent meeting of the Société de Biologie of Paris, MM. Bergouie and Sigalas stated that as a result of recent investigations they had found the superficial area of the human body to be 16,206 square decimetres (17.4 square feet) about one-tenth higher than the figures of Bouchard.

Clinical Department.

A CASE OF TETANUS, TREATED WITH LARGE DOSES OF THE ANTITETANIC SERUM. RECOVERY.

BY S. J. MIXTER, M.D., BOSTON,

Visiting Surgeon to Massachusetts General Hospital; Instructor in Clinical Surgery, Harvard Medical School.

[The good result obtained in this case is largely due to three persons, to whom I wish to extend my heartiest thanks. They are Dr. F. B. Lund, whose article read before the Massachusetts Medical Society is the most thorough and up-to-date résumé of the subject, and who kindly saw the boy with us; Prof. Theobald Smith who furnished the serum, and Dr. Seabury Allen, at that time my senior house surgeon, to whose constant care and unfailing interest more than anything else (except the serum) is due the cure. — S. J. MIXTER, M.D.]

E. J. C., a boy of eleven years, was brought to the accident-room of the Massachusetts General Hospital, June 22, 1898, with the following history:

Ten days ago while walking in the woods he cut his right foot on a piece of broken bottle. Free bleeding ensued and he went to a physician immediately, who etherized him and dressed the wound. Eight days afterwards he complained of a sharp pain across the shoulders and later in the day of a similar pain in sides of neck, preventing chewing, but not swallowing. Forty-eight hours after this he entered the hospital.

Examination. — Normally developed, lean, anemic; heart and lungs negative; pulse firm and hard; reflexes normal; head retracted; back slightly arched; abdomen, jaw and back muscles set; able to open mouth one-half inch; no glandular enlargement; granulating septic semicircular wound on ball of right foot one and one-half inches long; conscious and rational; speaks clearly. While being examined, patient had two tetanic spasms with risus sardonicus and slight opisthotonos. After each spasm, pulse rose forty beats and respiration twenty.

Patient was put to bed and given 80 c. c. of the State Board antitetanic serum under the skin of the thigh without noticeable effect, except considerable pain from distention of the skin. Spasms with opisthotonos of a mild type every twenty minutes.

June 23d. Urine, color normal; acid; specific gravity 1.022; no albumin; no sugar. White blood-count 14,000. Severe convulsions attended with great pain every twenty minutes; muscles not relaxing entirely between attacks. Patient drinks large quantities of liquid nourishment through soft rubber tube; 540 c. c. of serum injected deep into thigh muscles without effect (divided doses). Primary chloroform anesthesia obtained on account of the pain of distention. A few drops of chloroform inhaled at beginning of each spasm to lessen severity. Special nurses.

June 24th. Only two severe spasms all morning, 100 c. c. of Gibier's serum infused into median basilic vein without disturbance. In the afternoon an infusion of 250 c. c. (State Board serum) was followed in half an hour by six very severe convulsions with diaphragmatic and pharyngeal spasms, extreme cyanosis and absence of pulse from wrists. By the quick use of chloroform and hypodermics of cocaine and strychnia, the patient came around all right. Temperature arose from 99.9° to 104.2°; pulse rose 40 beats to 140. As the infusion had been given similarly to the previous ones it was thought that the limit of tolerance for the antitoxin had been reached. Complained of headache after the infusion. Pulse weak all the evening. After four severe spasms nearly as bad as

above, between 8.15 and 8.35 o'clock P. M., condition improved greatly, there being nothing but the usual stiffness and muscular twitchings during the night.

June 25th. White blood-count 15,500. At 5 A. M. severe spasms again appeared; 240 c. c. of the regular serum given at 10.30 A. M. and repeated at 11.30 P. M. produced no bad results. Five severe spasms between 9.40 and 11.30 P. M. and eight between 12.20 and 1.20 A. M. (26th) and every three and five minutes between 2.20 and 3.45 A. M.

June 26th. Four hundred and eighty c. c. of the serum this morning followed by slight weakening of pulse and rise of 20 b. ats.

June 27th. Schleich's No. 3 anesthetic substituted for chloroform, as latter depressed pulse dangerously. Delirious all day; morphia sulphate one-quarter grain subcutaneously, repeated three times during the day, gave two hours' sleep in all; 480 c. c. serum at 8 P. M. caused in one hour a temperature of 106° and a pulse of 160, but no collapse. It was thought that the serum

had been heated a little too much. Only three severe spasms all night.

Hemorrhagic macular eruption all over shoulders and chest which itches severely. Blood-count, reds 3,300,000.

June 28th. At 4.30 P. M., 480 c.c. serum infused, and half an hour afterwards tremendous contractions appeared requiring two persons to hold patient in bed. As before, extreme collapse and cyanosis were overcome by the use of ether and hypodermics. Temperature rose from 99° to 103° and pulse 30 beats to 160. Full anesthesia for half an hour gave complete muscular relaxation. Half an hour later patient was conscious and in good condition. Ether substituted for Schleich's mixture.

June 29th. In good shape this morning. Had several hours of natural sleep, with body resting on heels and shoulders.

Large areas of subcutaneous hemorrhage over limbs and trunk. No infusion to-day, it being thought that limit of tolerance had again been reached; also pulse and temperature were the best for the past five days.

Urine hyperacid; specific gravity 1.026; albumin one-eighth; no sugar; sediment; free renal (?) epithelium. Considerable free blood, and blood on casts.

June 30th. Exhaustion from lack of sleep; 100 c. c. of serum caused rise in temperature from 100.5° to 104° and in pulse of 20 beats to 106. Entire muscular relaxation between spasms for first time. Reflexes absent.

July 1st. Marked hemorrhagic diathesis; bleeding from nose, gums, scratch marks, infusion-incisions, etc. One hundred c. c. of the serum caused rise in temperature of 2° and of 40 beats in pulse. Blood-count, reds 3,500,000.

July 2d. Only one severe spasm last night. This morning spasms of a mild character came every hour. No ether since last night, the patient cries for it and feigns contractions. One hundred c. c. of serum has no effect.

July 3d. Only five genuine spasms to-day. Aromatic spirits ammonia on cone partially satisfied craving for ether. One hundred c. c. given with local (cocaine) anesthesia. Patient watched whole process and said he felt no change at all.

July 4th. No sleep all night, though there were no convulsions. All muscles relaxed except those of the jaw. Patient in howling delirium, trying to get out of bed, sees things in his room which do not exist. Temperature 103°, pulse 110. Is evidently in delirium tremens from ether. Inhales violently through mosquito netting or towel, or whatever is held over nose resembling an ether cone. Quieted by morphia sulphate, one-fourth grain, repeated twice.

July 5th. Violent and sleepless all night, except for an occasional half-hour's quiet following a whiff of Schleich's anesthetic. One slight tetanic spasm last night.

July 6th. White, blood-count 6,100. Delirium tremens much less violent to-day.

July 7th. Quiet and sleeping all last night. Special nurses omitted. Out on veranda.

July 13th. Inflammation of lower submaxillary lymph glands from ulcers on tongue where latter has been bitten.

July 18th. Jaws entirely relaxed and mouth opens normally for first time.

July 30th. Tuberculin injections gave no reaction.

July 31st. Patient is slowly recuperating and it is expected that he will be able to go home in about a week.

Conclusions. — The following points suggest themselves: The case was in no sense one of chronic tetanus; all others occurring at the Massachusetts Hospital that have approached this in severity have died. As the treatment varied from that of other cases only in the large doses of antitoxin given, it seems probable that this was responsible for the recovery.

Since the experiments on animals show that the autitoxic serum has little or no power over the disease when it has become well established, it is important to begin the dosing at the earliest possible moment. When injected, the serum should be heated to about 1° F. above the rectal temperature; if more than this, the body temperature will rise; if less the heart will be slowed and collapse may occur.

The best way to administer the serum is by intravenous infusion. Hypodermic injection is slow and painful, and it is not absorbed if given by the mouth or rectum.

The physiologists urge as an objection to the trans-

fusion of a large amount of animal serum, the danger of thrombosis and embolism, although in this case these accidents did not occur. There did seem, however, to be some danger from overloading the heart, from the variation in temperature between that of the body and that of the serum, and also from the anemia and hemorrhagic tendency consequent to the injection of so large a quantity. (In all this patient was given 3,400 c. c., averaging about 285 c. c. daily.) It is evident that a more highly concentrated serum would obviate these difficulties. The dosage of serum in this case had to be regulated on the supposition that the strength was one unit to the cubic centimetre, which was the actual strength at the time it was last estimated by Dr. Smith.

Paraldehyde, twenty minims every hour and bromide of sodium twenty grains every two hours, were valueless. Morphine sulphate, one-fourth grain hypodermically every three hours, caused no diminution in the number or severity of the spasms, but did give rest and sleep between them.

Chloroform and Schleich's anesthetic were too depressing for a heart already overtaxed. Ether alone was safe.

This case is probably the first one in this country, at least it is the first one thus far reported, in which an attempt was made to give 500 units, the amount advised by Behring at one dose, and to inject it directly into the blood stream. The success of this case certainly points to the possibility that in the cases reported heretofore the dosage has not been sufficient, and demonstrates the practicability of the intravenous infusion of 500 c. c. of animal serum in cases where it is necessary.

Although the preparation of a stronger serum is much to be desired, it is evident that success can be attained with the present preparation if used in sufficiently large amount.

Medical Progress.

REPORT ON PROGRESS IN THORACIC DISEASES.

BY GEORGE G. SEARS, M.D., BOSTON.

THE PATHOLOGICAL ANATOMY AND ETIOLOGY OF ENDOCARDITIS.¹

HARBITZ publishes the results of three years' pathological and experimental study of endocarditis. He has found that the infectious form is a much commoner affection than is usually thought. Most cases are caused by the ordinary pyogenic bacteria (staphylococci, streptococci and pneumococci), but the course and pathological picture vary with the character of the organism. In one group of cases, where the infecting agent is the staphylococcus, one finds the classical symptoms of pyemia with a rapidly fatal course, while anatomically there are multiple pus foci and often a local focus of pus. In another group, due to the streptococcus and the pneumococcus, the course is more chronic and there is a certain tendency to recovery. Here the point of original infection is rarely found, the infarctions are not infectious and there are no purulent foci. A toxico-infectious influence, is, however, shown in other organs, for example, in the occurrence of nephri-

tis. Endocarditis due to the gonococcus undoubtedly occurs, but it is still questionable if the tubercle bacillus can cause it. Although in certain cases of chronic endocarditis bacteria cannot be found the rest of the picture is so similar to infectious endocarditis that there is little doubt but that they were the cause. The process usually starts as an endothelial necrosis, but it may arise from bacterial emboli in the vessels of the valves.

Although no specific organisms have been found in acute rheumatism a number of these cases must be regarded as due to infection with weakened pyogenic organisms, and the accompanying endocarditis may well be of a toxico-infectious nature. Many of the slight excrescences found in other chronic diseases are also readily explained as the product of a toxic influence leading to a superficial necrosis.

AN EXPERIMENTAL INVESTIGATION OF THE CAUSE OF FAILURE OF COMPENSATION IN VALVULAR DISEASE.²

Since all theories as to the reason why a hypertrophic heart, the result of valvular disease or other cause, becomes insufficient, are of a purely speculative nature, Balint has endeavored to get at some positive facts from experiments on dogs, rabbits and cats. The aortic valves were destroyed by Rosenbach's method and the animals kept under observation for a long time. In each case after death marked hypertrophy of the heart-muscles was found but no trace of any failure of compensation although often several months had elapsed. In a later series of experiments, in addition to the destruction of the aortic valves, measures were taken to injure the cardiac muscle or the nervous mechanism. Intravenous injections of staphylococci produced too speedy death from ulcerative endocarditis, and the continuous subcutaneous injection of phosphorus, while it produced a high degree of fatty degeneration, did not lead to the slightest lack of compensation, and showed that the latter is certainly not due to an affection of the heart-muscle. When, however, the vagus was divided a different result was obtained. If both vagi were cut death followed very rapidly, much sooner than in otherwise healthy animals, but when one was left intact it was possible to produce cardiac insufficiency in dogs and cats but not in rabbits. Balint therefore considers it probable that in man a disturbance of the nervous mechanism of the heart leads to failure of compensation in valvular disease.

HYPERTROPHY OF THE HEART IN ARTERIO-SCLEROSIS.³

Hasenfeld says that the diversity of opinion regarding the frequency of cardiac hypertrophy in arterio-sclerosis can be explained on the supposition that the former is not a necessary result of the latter, although theoretically from the increased work thrown on the heart it might be expected. He asks whether these varying effects may not be due to the special distribution of the sclerotic changes in the vessels in various portions of the body, as it appears to be proved that sclerosis of the splanchnics exercises a much greater influence on the circulation than that of other arteries, while probably marked sclerosis of the aorta has a similar effect. In order to arrive at a solution of this question he has made a careful study of the arteries in

¹ *Contrib. f. in. Med.*, 1898, No. 24.

² *Deut. med. Woch.*, 1898, Nos. 1 and 2.

³ *Deut. Arch. f. klin. Med.*, Bd. 59, s. 193.