communis digitorum muscle and destroyed the nerve supply of the extensor longus and brevis pollicis, resulting in loss of power of extension of the thumb and third and fourth fingers. The wound healed four weeks after injury. Operation, April 9, 1919, four months after wound had healed,

Fig. 16.—Side view of elastic traction splint.

when the muscle belly of the extensor communis digitorum was repaired and the extensor carpi radialis brevis was freed at its insertion and transplanted into the distal tendinous portion of the extensor longus pollicis. Eight weeks after operation, the soldier had almost complete return of extension in the thumb, third and fourth fingers.

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THE GASTRIC HYPERMOTILITY ASSOCIATED WITH DISEASES OF THE GALLBLADDER, DUODENUM, AND APPENDIX

A CLINICAL AND EXPERIMENTAL STUDY *

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AND

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NEW YORK

The stomach in a general way is recognized by the diagnostician as the spokesman for disease anywhere within the abdominal cavity, but particularly for organic disturbances of the gallbladder, duodenum and appendix. It is not only very difficult to ascertain which of these three organs is afflicted, but it is often impossible to free the stomach entirely from suspicion of disease. It becomes, therefore, of the utmost importance to the abdominal surgeon to have some system of classifying gastric motor pictures by which a pathologic condition of the stomach is established or eliminated, so that he may determine what organ is pathologic if the stomach is normal, and to what extent the diseased organ is involved.

There are obviously two means of studying the reflex activity of the stomach: the review of recent hospital records, and the duplication, as far as possible, of the human disease equations in the experimental laboratory. The reports of gallbladder, duodenum, and

appendix cases in the Third Division, Bellevue Hospital, from 1911 to the present time, have been reviewed, and from these have been selected only those cases with full roentgenographic reports based on complete gastro-intestinal examination confirmed or modified by direct inspection of the open abdomen. In those few instances in which the roentgenographic diagnosis did not correspond to the actual findings at operation, the error, which was one of inference and not of observation, was corrected. For example, a persistent irregularity in the outline of the stomach has been called organic and, at operation, the stomach appears absolutely normal; this same stomach is known to functionate normally in terms of emptying and of secreting; it is obvious that the "irregularity" described as organic may be either organic or inorganic; and, on the foregoing basis, the roentgenographic description is changed from "probable adhesion" or "scirrhous involvement" to gastropasm. The pathologic findings have been purposely omitted; their significance, as far as the stomach function is concerned, may be the measure of the stimulation or depression of the stomach.

From these surveys, it appears that the percentages of hypermotility, hypomotility and normal gastric function in gallbladder disease (meaning cholecystitis with or without cholelithiasis) are: hypermotility, 68.4; hypomotility, 0; normal, 31.6; in diseased duodenums (duodenal ulcers): hypermotility, 75; hypomotility,

Fig. 1.—Diffuse pylorospasm secondary to postappendiceal obstruction. There was no bismuth to be seen beyond the obstruction in the pylorus. The bowel was wholly free from bismuth.

12.5; normal, 12.5; and in "chronic appendicitis": hypermotility, 55; hypomotility, 0; normal, 45.

There are in this, as in any similar review of case statistics, many sources of error. A few of these are: the general condition of the patient; the emotional state of the patient at the time of the roentgen-ray examina-

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tion; the irritability of the stomach at the time of the examination, and the presence or absence of other diseased foci in the body. These factors should enter into the accompanying tables as variables; and the extent to which they affect the motor pictures of gallbladder,

Fig. 2.—Duodenospasm secondary to postappendical obstruction, with retention in stomach and duodenum, as shown by the retained bismuth.

duodenal and appendix-stomach cases should appear in the variations in each set of cases. Hypermotility is evidently the rule in each group; hypomotility and normal stomach, being variables, indicate, for example, malnutrition, depression, a phase of gastric inactivity,

TABLE 1.—SURGICAL GALLBLADDERS

Case No.	Operation	Roentgen-ray Finding for Stomach
1. C. 120	Cholecystectomy *	(W) Hyperperistalsis
2. C. 123	Cholecystectomy	(S) Normal
3. GD. 8	Division of Adhesions	(D) Hyperperistalsis
4. C. 15	Cholecystectomy	(S) Hyperperistalsis (1st exam.) Gastrosplasm (2d exam.)
5. C. 19	Cholecystectomy	(S) Hyperperistalsis
6. GD. 20	Cholecystectomy	(S) Normal
7. GD. 22	Cholecystectomy	(D) Hyperperistalsis
8. C. 78	Cholecystectomy	(D) Pylorospasm (diffuse)
9. C. 80	Cholecystectomy	(D) Gastrosplasm
10. C. 107	Cholecystectomy	(S) Normal
11. C. 110	Cholecystectomy	(S) Gastrosplasm
12. C. 15	Cholecystectomy	(S) Hyperperistalsis
13. C. 1	Cholecystectomy	(S) Pylorospasm
14. C. 7	Cholecystectomy	(S) Normal
15. C. 9	Cholecystectomy	(D) Pylorospasm
16. C. 25	Cholecystectomy	(D) Normal
17. C. 28	Cholecystectomy	(D) Normal
18. C. 30	Cholecystectomy	(D) Pylorospasm
19. C. 36	Cholecystectomy	Hyperperistalsis

* In Tables 1, 2, 3 and 4, the capitals enclosed in parentheses denote the operators: Stewart, Douglas, Cramp, Barber and Walker, designated by S, D, C, B, and W, respectively.

or the presence of two or more associated lesions. Some of these appear on the hospital charts; many, obviously, do not and cannot. A possible effect of two simultaneous lesions may be seen in Table 4.

The appendix group represents the greatest degree of variation. Hirsch, whose opinion is based on an enormous experience in such cases, holds that the rule is hypermotility for the stomach after chronic appendicitis. The "normal" percentage of 45 is probably due to the fact that a large proportion of the appendixes

were either normal or functionally inactive. This attitude is well depicted in Moschcowitz' report¹ on chronic appendicitis (1,500 cases) in which the reality of chronic inflammation of the appendix existing at all is questioned. On this basis, the 55 per cent. of appendixes giving hypermotile stomachs in Table 3 represent acute exacerbations of appendicitis. "Chronic appendicitis" in a fair percentage of instances is accompanied by adhesions or scar tissue from previous attacks of acute appendicitis which, in themselves, have been shown to influence the tone and motility of the duodenum and stomach. A very recent example

TABLE 2.—SURGICAL DUODENUMS

Case No.	Operation	Roentgen-ray Finding for Stomach
1. U.D. 67	Gastro-enterostomy (S)	Hyperperistalsis
2. U.D. 70	Gastro-enterostomy (B)	Hyperperistalsis
3. U.D. 71	Gastro-enterostomy (S)	Normal
4. U.D. 74	Gastro-enterostomy (S)	Hyperperistalsis
5. U.D. 47	Gastro-enterostomy (S)	Hyperperistalsis
6. U.D. 51	Gastro-enterostomy (S)	Hyperperistalsis
7. U.D. 54	Gastro-enterostomy (S)	Hyperperistalsis
8. U.D. 55	Gastro-enterostomy (D)	Hyperperistalsis

(Fig. 1) of postappendical adhesions involving the terminal ileum, cecum, uterus and right ovary, associated with spasm of the second portion of the duodenum and with diffuse pylorospasm giving a twenty-seven-hour end-ileal retention and a six-hour gastric residue, illustrates this relationship. It is, no doubt, fair to conclude that the probabilities of gastric hypermotility as described above in the presence of diseased gallbladders, duodenal ulcers, and chronic appendicitis of the mean case, as seen at Bellevue Hospital, are, respectively, 68.4, 75 and 55.

Fig. 3.—Stomach hyperperistaltic and to the right in the presence of gallbladder disease.

Occasional experience with the contracting stomach in the open surgical abdomen has been greatly supplemented by similar experimental studies on the mammalian stomach. A recent paper² records a late sum-

1. Moschcowitz, E.: Ann. Surg. 63: 697-714 (June) 1916.
2. Barber, W. H.: Ann. Surg. 69: 271-277 (March) 1919.

mary of these observations. Table 5 comprises a list of canine experiments. Each dog, which was to all appearances a normal animal, was prepared for operation by having breakfast withheld and by being given a hypodermic injection of morphin; he was etherized by means of the Janeway intratracheal apparatus, which keeps the subject evenly under the anesthetic during

TABLE 3.—SURGICAL APPENDIXES

Case No.	Operation	Roentgen-Ray Finding for Stomach
1. C.A. 246	Appendectomy	(B) Hyperperistalsis
2. C.A. 255	Appendectomy	(S) Normal
3. C.A. 256	Appendectomy	(S) Hyperperistalsis
4. C.A. 264	Appendectomy	(S) Normal
5. A.A. 471	Appendectomy	(D) Gastrosplasm
6. C.A. 234	Appendectomy	(C) Hyperperistalsis
7. C.A. 201	Appendectomy	(W) Normal
8. C.A. 207	Appendectomy	(D) Normal
9. C.A. 107	Appendectomy	(S) Normal
10. C.A. 112	Appendectomy	(D) Normal
11. C.A. 121	Appendectomy	(W) Normal
12. C.A. 122	Appendectomy	(D) Hyperperistalsis
13. C.A. 90	Appendectomy	(D) Hyperperistalsis
14. C.A. 145	Appendectomy	(S) Hyperperistalsis
15. C.A. 151	Appendectomy	(S) Pylorospasm (?)
16. C.A. 153	Appendectomy	(S) Normal
17. C.A. 155	Appendectomy	(S) Normal
18. C.A. 60	Appendectomy	(C) Hyperperistalsis; pyloro-spasm
19. C.A. 64	Appendectomy	(C) Gastrosplasm (?)
20. C.A. 76	Appendectomy	(S) Hyperperistalsis

the course of the experiment; and his abdomen was opened in the upper half so as to expose the stomach and duodenum with the least possible trauma of handling and of instruments. Under these conditions, the stomach was watched for the appearance of the normal two-cycle contractile phase. When these contractions appeared, which might be at once or after the lapse of half an hour, or if the organ was not properly irritable or not irritable at all (these animals had to be excluded), the stomach was considered to be approximately normally contracting, and any changes in these contractions produced by parietal and visceral traumas were carefully noted. In one instance, a non-irritable stomach was made to contract by gently blowing air into it through an esophageal catheter. This relation of the stomach contractions to rise in intra-gastric pressure is especially represented in the paper mentioned.² In these experiments, the latency of gastric response to extrinsic stimulation corresponded roughly to the latent period of contraction for involuntary muscle. This interval was often three minutes, but varied from less than one minute to ten minutes. In a fair proportion of the animals, it was impossible to describe normal contractions for the stomach at all

TABLE 4.—SURGICAL GALLBLADDER AND APPENDIX

Case No.	Operation	Roentgen-Ray Finding for Stomach
1. (V.6) C.18	Appendectomy; cholecystectomy	(S) Normal
2. C.19	Appendectomy; cholecystectomy	(S) Normal

or to arouse in them any reaction to extragastric stimuli. These animals are not included in Table 5.

It should be added that all these experiments were carried out before a review of the hospital records was undertaken—which should add weight to the striking correspondence in the two data. On the basis of these experiments, the motor functions of the stomach after gallbladder stimulation, in percentages (eleven cases) are: hypermotility, 61.5; hypomotility, 0; normal, 15.4; retrostalsis, 23.1. After traumatization of the duodenum (six cases), the gastric motility is: hypermo-

tility, 66.7; hypomotility, 0; normal, 22.2; retrostalsis, 11.1; and after clamping of the appendix (cecum) (four cases): hypermotility, 100; hypomotility, 0; normal, 0; retrostalsis, 0.

In comparing the two series, it will be noted that the variables: general condition of the patient, the emotional state, the gastric irritability, and the possibility of other diseased foci occurring at the same time, enter into both the human and the canine groups, although it is no doubt true that in the latter these elements are better controlled. This is particularly applicable to the appendix cases in which the potential appendix even after pathologic examination, in many instances, in the hospital series remains problematic, while there is no doubt of essential injury to the dog's cecum which is held in a tightly locked crushing clamp. Retrostalsis appears in the experimental but not in the clinical series. This is probably accounted for by the fact that

TABLE 5.—EXPERIMENTAL SERIES

Experiment No.	Organ Irritated	Effect on Stomach	Effect on Duodenum
10	Stomach	Gastrosplasm	
11	Duodenum		Duodenospasm
11	Parietal peritoneum	Peristalsis inhibited	
11	Cecum (appendix)	Pylorospasm	
11	Gallbladder	Pylorospasm	
11	Pylorus	Retrostalsis; hypermotility; gastrosplasm	
18	Gallbladder	Hypermotility	
18	Stomach	Hypermotility	
18	Duodenum		Duodenospasm
20	Cecum (appendix)	Gastrosplasm; pylorospasm	
20	Gallbladder	Retrostalsis	
21	Stomach	Gastrosplasm	
12	Gallbladder	Retrostalsis	
12	Duodenum	Hypermotility	
32	Intestine	Hypermotility	
32	Duodenum	Pylorospasm	
32	Gallbladder		
33	Stomach		
33	Duodenum	Retrostalsis; pylorospasm	
33	Gallbladder	Retrostalsis; hypermotility	
35	Parietal peritoneum	Dilatation	
35	Gallbladder	Hypermotility; pylorospasm	
40	Small intestine	?	
40	Duodenum	Hypermotility; pylorospasm; incisura	
40	Parietal peritoneum	Dilatation	
40	Gallbladder	?	
41	Appendix	Hypermotility	
41	Gallbladder	Hypermotility	
61	Parietal peritoneum	Peristalsis inhibited	
61	Gallbladder	Hypermotility	
68	Appendix; duodenum; gallbladder	Hypermotility	
69	Appendix; duodenum; gallbladder	Hypermotility	

patients who are vomiting are not submitted to roentgen-ray examination, although Hirsch reminds us that occasionally he has seen this phenomenon take place during fluoroscopic examination of the stomach. On the other hand, if vomiting did occur at the moment the roentgenogram was taken, it is probable that the direction of the wave from the pylorus toward the cardia could not be ascertained. Antistalsis is seen in the canine group because the animals are studied under conditions of acute traumas which provoke vomiting in the anesthetized creature. The human cases were chronic; the mammals correspond to acute types; but when it is remembered that the patients present themselves during their periods of acute suffering, this apparent dissimilarity loses weight.

It is apparently impossible, in the light of our present knowledge, to exclude absolutely, without direct examination, a pathologic condition of the stomach in the reflex type of individual under discussion. The roentgenologists are working on this problem, and it is hoped

that something will come of it. From experience with the surgical stomach, as presently outlined, one is led to conclude that the incisura or localized gastrosplasm, which may be a response to direct or to extragastric traumas, should practically always be associated with the gastric lesion and should relatively infrequently accompany the diseased gallbladder, duodenum and appendix. Given the pathologic grouping of individuals that the roentgenologist sees, it is probably true that the incisura is not infrequent after lesions of the gallbladder and duodenum, and not uncommon after appendicitis. What has been said of the incisura probably largely applies to spasm of the pyloric sphincter. On the other hand, diffuse pylorospasm very infrequently follows clinical and experimental disease of the gallbladder, duodenum and appendix.

To estimate in advance from a study of gastric motor physiology to what degree the suspected organ is diseased may not be out of the range of human possibility. A closer cooperation between the roentgen-ray and experimental laboratories, operating room, and pathologic laboratory may work to this end. There are two investigations that throw some light on a means of indicating the diseased organ and the extent of disease: one is that of antistalsis in the stomach, and the other is the selective response of the fundus and pylorus to extrinsic stimulation. Both of these problems are undergoing further study.

SUMMARY

1. For the past eight years, the records of chronic cholecystitis, with or without cholelithiasis, duodenal ulcer, and chronic appendicitis bearing roentgen-ray notes on the gastric motor function and verified by open operation, disclose gastric hypermotility for gallbladder disease in 68.4 per cent., for duodenal ulcer in 75 per cent., and for chronic appendicitis in 55 per cent. of cases.

2. Experiments purposely carried out in the open surgical abdomen antedating this clinical review give hypermotility for gallbladder disease in 61.5 per cent., for duodenal trauma in 66.7 per cent., and for appendix disease in 100 per cent. of experiments.

3. The motor characteristics of surgical lesions of the stomach are the incisura, and pylorospasm (pyloric-sphincter-spasm) in that they probably more frequently occur in the presence of essential disease. Diffuse pylorospasm appears very often "reflexly."

ABSTRACT OF DISCUSSION

DR. ANTHONY BASSLER, New York: Gastro-enterologists seem to have a very hazy idea as to what tonus really is. Some work on tonus has been done recently by Dr. Byrne of Fordham University, presenting tonus in a way which to me is practicable and understandable. Tonus may be divided into two parts, a postural status, which may be designated as the *jel* of the muscle. As I stand here without making any effort my muscles are in a state of *jel*. Then there is an additional element, the element that is added by the nervous system, mainly the cerebrospinal system. That represents the active part of tonus. I am going to speak particularly on the subject of hypermotility. I notice that in the statistics here, there are in the first statistics, gallbladder 68 and appendix 55 per cent.; whereas in the second statistics the gallbladder is reduced to 61 per cent. and the appendix elevated to 100 per cent. In my opinion, hypermotility is of no diagnostic significance in gallbladder pathologies. It is of significance in disease of the stomach, duodenum and appendix. The reason it should

not be considered in gallbladder cases is anatomic as well as clinical. The nerves of the stomach come from both pneumogastrics and sympathetics, containing medulated and nonmedulated fibers. Here the sympathetic system is a complex of both kinds of fibers. The nerves that supply the stomach come from the gastric plexus and these also supply the upper level of the duodenum—thus hypermotility in duodenal ulcer. The right vagus is the more important in this connection, in that it supplies fibers to the posterior wall of the stomach, the solar plexus, spleen, pancreas, intestine, midcolon and suprarenal. Thus the stomach has direct connection with the appendix as is the fact with the duodenum. The nerves of the gallbladder come from the solar plexus through the hepatic plexus, which is in the lesser omentum in company with the bile ducts, hepatic artery and portal vein. It inosculates with the left vagus but this only supplies branches to the anterior surface of the stomach over a very limited area of the stomach—thus the gallbladder is very indirectly connected with the stomach and then only in small part. I feel definitely that the roentgen-ray teaching of hypermotility of the stomach as a symptom of gallbladder pathology should be eliminated.

DR. R. WALTER MILLS, St. Louis: I do not understand what Drs. Stewart and Barber mean by hypermotility, whether they speak of total gastric motility, initial motility, or fractional motility, which, by the way, may be the method of the future. In a series of 2,500 cases in which I determined the exact time of total gastric motility after a standard roentgen-ray test meal to within seven minutes, no such findings as have been given by the present investigators were obtained. For instance, in that series there were fifty-three cases of gallbladder disease and 25 per cent. of them showed hypomotility instead of hypermotility, as indicated by a six-hour residue after the barium meal. In a series of 203 cases of duodenal ulcer, 49 per cent. showed hypomotility in the sense of total motility. In appendicitis, motility was practically that of a series of one thousand cases without any organic or marked functional disturbance. A great factor in estimating gastric motility is the type of individual. For instance, in the two extremes of bodily habitus, the stomach of the asthenic often will not clear of an average contrast meal in six hours. I have seen the same meal emptied from the stomach of the other extreme of type, the hypersthenic, in one and one-quarter hours. These are extremes. All motilities between these two form a gradient. If all persons are grouped in four types, hypersthenic, sthenic, hyposthenic and asthenic, their stomachs will be found to empty about as follows: The hypersthenics in four hours, the sthenics in four and one-half hours, the hyposthenics in five hours and the asthenics in five and one-half hours. The work of Dr. Alvarez on visceral neuromuscular activity as related to peristalsis and motility indicates that many gastric hypomotilities where the lesion is within the stomach, are the result of inhibition rather than to crippling of the gastric expulsive mechanism.

DR. I. O. PALEFSKI, New York: The conclusion reached by the authors is generally recognized among roentgenologists—that hypomotility is usually found in intestinal cases. However, I do not believe we can take that as a clinical application, because usually gallbladder cases that come under observation show that the predominating feature is that of gastro-intestinal stasis. At Bellevue Hospital, it has been my invariable experience from the clinical point of view that the reports showed hypomotility; while after a really mixed meal there is, perhaps, in about 80 per cent. of cases a residue after six or seven hours. I do not believe we can test the gastric motility through barium. In order to test the motility we must take into consideration the factors which enter into motility or the evacuation—the normal acidity, the normal stimulation. I feel that this is a very important point in gastro-enterology and it requires team work on the part of the gastro-enterologists as well as the roentgenologists to come to a conclusion.

DR. VAN VALZAH HAYES, New York: It seems to me that we do need a more thorough method, a more satis-

factory method of testing the motility of the stomach. Just one example:

Recently a patient came to my office. I took an ordinary test breakfast and to my surprise found present pieces of vegetable eaten at dinner the night before. The patient was then sent for roentgen-ray study and the barium was given. The roentgenologist reported that "the stomach evacuates itself rapidly and is almost completely empty at two hours."

DR. G. A. FRIEDMAN, New York: I would like to ask Dr. Stewart whether he has had occasion to examine his patients roentgenographically after their appendixes or gall-bladders were removed, and whether the roentgen findings in regard to motility of the gastro-intestinal tract were different from those found before operation. If the disturbance in motility was due to the diseased appendix or to the diseased gallbladder, normal motility should have established itself after the surgical procedures. If, however, the postoperative roentgen findings were identical with the preoperative findings, it may then be questionable whether the altered motility discovered previous to operation was really due to the pathology in the appendix or gallbladder. May it not be possible, then, that the disturbance in nerves regulating the musculature was the primary factor for the disturbance in motility?

DR. WILLIAM HOWARD BARBER, New York: In regard to the connections of the extrinsic gastric nerves with "reflex" gastric motility: keeping in mind the anatomy, as Dr. Bassler has described it, it is very difficult to interpret the effects on stomach tonus produced by traumatizing, clinically or experimentally, extragastric tissues; it is difficult to affirm positively that such effects are vagus or splanchnic. These nerves have been divided in the chest and in and about the stomach. From these experiments, it appears that the vagus nerve carries motor fibers to the fundus and inhibitory branches to the pyloric part. Appendical, duodenal and gallbladder irritation in the present series is most often associated with gastric hypermotility. One occasionally sees in the course of an operation, gastric motor waves followed (as the traumatism of handling continues) by fundic relaxation and, later, by pyloric relaxation or total dilatation. These changes may be due to the loss of vagus control or to the stimulation of the sympathetic.

Under the head of hypermotility are included the gastric spasms. Pylorospasm may be confined to the anatomic sphincter or to the pyloric end of the stomach. It is believed that the spasms are qualitatively identical with hypermotility. Increase in force characterizes the spasmodic contractions, but increase in rate characterizes the cycles in hyperperistalsis. Hypermotility must be differentiated from "emptying time" for it is evident that a forcibly contracting stomach may be associated with early emptying or retention accordingly whether there is pyloric relaxation or obstructive pyloric spasm. For this reason, the gastric "motor" meal is not a motor meal at all but significant of the time of gastric emptying. Of course, the anatomic types, spoken of by Dr. Mills, are to be considered among the variables influencing the tone and motility of the mean stomach. The choice of the opaque meal and the interpretation of the roentgenograms have been left with the roentgen-ray department. The gastric motor function following operation was largely a personal equation. It is to be expected that this improves as the general condition of the patient improves.

Report on After-Care of Poliomyelitis.—The annual report of the New York committee on the after-care of infantile paralysis patients has just been made public, and shows that during the past year 8,253 patients have been cared for. The report shows that regular after-care has resulted in great improvement in most cases and in many instances in permanent cure. It finds, however, that there is still a great deal to be done, and a survey now under way indicates the necessity of complete records of cripples, additional clinics, and increased means of transportation, and the development of field agencies to help those in need of orthopedic assistance.

BLOOD TYPE CLASSIFICATIONS, WITH A SLIGHT MODIFICATION OF TECHNIC

REPORT OF THE RESULTS OF MORE THAN
A THOUSAND CLASSIFICATIONS

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During the year ending Feb. 1, 1919, 1,122 blood type classifications were completed in the laboratory of the U. S. Army General Hospital No. 6 and the Department Laboratory, Southeastern Department, U. S. Army, Fort McPherson, Ga.

The whole blood, slide method was employed, the technic of which, having been slightly modified by this laboratory, is herewith reported.

The blood of the individual to be typed is collected from the finger tip in a leukocyte counting pipet. The pipet is not washed out with sodium citrate solution before taking the blood, as is usually advised; but the citrate solution (2.5 per cent.) is drawn to the 0.5 mark

RESULTS OF CLASSIFICATIONS

Types	Number	Per Cent.
1.	54	4.8
2.	601	53.6
3.	70	6.2
4.	397	35.4

of the pipet tube and the blood then drawn up until the bulb is half filled, when the blood remaining in the tube is drawn up about 1 mm. from the tip or point of the pipet and the citrate solution again drawn to the 0.5 mark. As a result of drawing the blood up to about 1 mm. from the tip of the pipet, a small space of air is placed between the blood and the solution, preventing admixture of the two fluids in the tube so that the solution may be drawn to the 0.5 mark without difficulty. Without this little bubble of air, it is impossible to observe the surface of the citrate solution in the tube since it mixes with the blood.

It has been observed that by drawing the citrate solution twice to the 0.5 mark instead of once to the 1.0 mark, a clot never forms in the bulb, since the solution and blood are more thoroughly mixed.

Several bulbs of blood are collected and blown into a small tube, such as a Wassermann tube. Blood from a known Type II individual (several of whom are on duty in this laboratory) is similarly collected.

The admixture of the unknown and known bloods is made by using the white blood counting pipet instead of a capillary tube. The Type II blood is drawn to the 0.1 mark and then the unknown is drawn up until the 1.0 mark is reached. This admixture is blown on a slide and thoroughly mixed by being drawn up and down in the pipet several times; any bubbles are broken by being blown on through the pipet. The entire amount of mixed blood is then drawn into the leukocyte pipet tube and blown on a drop of physiologic sodium chlorid solution on another slide (near one