PROGRESS IN PEDIATRICS

RÉSUMÉ ON THE CIRCULATORY SYSTEM LITERATURE OF 1920*

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THE HEART

The *electrocardiogram* during the past year has become more extensively used, and more carefully studied. There are many points on which observers disagree, but certain fixed conclusions stand out clearly and its value in aiding diagnosis is undisputed. It is interesting to learn that in all of Paris Ribierre¹ knows of only two hospitals equipped for electrocardiography. To remedy this he suggests that medical societies in the smaller cities should acquire equipment to be loaned to the members.

Mann² describes his monocardigram, which is an attempt to combine the graphs obtained in Leads I, II and III into a single curve. It is based on the fact that Lead II equals Lead III plus Lead I or the algebraic sum of the ordinates in Leads III and I at the same instant. By finding the location of the center of negativity at subsequent time intervals and connecting these points a curve is formed representing the cardiac cycle. This monocardigram is a fusion of the three leads into a single curve by an algebraic reversal of the process by which the leads are obtained.

Hamburger³ studies the changes in the P wave, which represents the *auricular complex*. The physiologic P complex is an upright wave which results from auricular systole. It expresses the origin of the heart beat at the normal site of the impulse formation, and the passage of the wave through the auricular tissue in definite directions. Alterations in the height, direction and configuration are caused by abnormal auricular conditions. Twenty per cent. of the 300 electrocardiograph curves at the Michael Reese Hospital (Chicago) show an inverted P wave, usually in Lead III. The P wave may be inverted by vagus stimulation, by the impulse originating in the lower portion of the auricle, by force expiration, and by digitalis. The P wave may be

* Received for publication, Jan. 25, 1921.

1. Ribierre, P.: *Méd. mod.* **1**:325 (March) 1920.

2. Mann, H.: *Arch. Int. Med.* **25**:283 (March) 1920.

3. Hamburger, W. W.: *Arch. Int. Med.* **26**:232 (Aug.) 1920.

persistently inverted, or an inverted P wave may sometimes become upright with atropin. In *auricular paroxysmal tachycardia* the P wave is apt to be inverted. White⁴ analyzes a series of electrocardiograms in which the P wave is normal and the origin of the beat is not ectopic or, at least, if it be ectopic, it originates close to the normal pacemaker in the sinoauricular node. This is Galli's nomotopic (nomos = custom, topos = place) type of paroxysmal tachycardia, and it has a better prognosis than the usual paroxysmal tachycardia. When the pacemaker moves toward the ventricle there is a tendency toward shortening the P-R interval unless there is a simultaneous vagal stimulation, and the P wave is flattened and finally inverted. White includes in the series two electrocardiograms of sino-auricular heart block not due to digitalis. There are few electrocardiograms of similar conditions in the published records.

Lewis⁵ and others, in a series of papers on *flutter and fibrillation*, have brought out a new conception of the arrangement of the muscles in the auricle, and of the path of the excitation wave through these muscles. Auricular flutter shows in the electrocardiogram rapid, contiguous waves uniform in extent and outline. The excitation wave passes through the auricle in a regular sequence from cycle to cycle, without any moment when all the muscle fibers are at rest, as they are in true diastole. The rates of conduction are slower than the rate with normal rhythm, and the direction of the wave of excitation after flutter is established has no relation to the point at which stimulation is applied. When the course is distinctly displayed it extends around the mouths of both the superior and inferior vena cava veins, probably in "a continuous circus movement in a natural ring of muscles existing in the intact heart." It may run either clockwise or counterclockwise. The auricular appendages and the sleeves of muscle on the great veins are supplied by excitation waves centrifugally from the body of the auricle—waves thrown off from the central path as the central wave revolves, so that the direction of the wave in these outlying paths is constant, and depends on the direction of movement in the central path. The basis of flutter is a "circus movement following a central path in the auricles." After long continued experimental flutter in dogs, there are slight variations in the path which Lewis classes as impure flutter. Experimentally, the processes of auricular flutter, impure flutter and auricular fibrillation are linked as parts of a whole complex.

4. White, P. D.: Arch. Int. Med. **25**:420 (April) 1920.

5. Lewis, Th.: Heart **7**:127, 131, 247, 293 (April, Aug.) 1920.

Eyster and Meek⁶ have a cassette changing mechanism allowing two roentgenograms of the human heart to be taken in the same cardiac cycle. With a simultaneously recording electrocardiograph, they get curves from which the exact incidence of the exposures in the cardiac cycle may be determined. No single border of the heart may be used as an accurate index of contraction, the movement of the entire outline must be considered. The associated electrocardiograms and the roentgenograms show that most of the filling of the ventricle occurs shortly after the ventricle relaxes, and it is almost completed before the auricle contracts. The auricular rôle in adding blood to the ventricles is slight.

Bazett⁷ finds that the duration of the *ventricular complex* in the electrocardiogram of the normal heart is a function of the pulse rate and may be determined by the formula $\text{Systole} = \sqrt{\text{cycle}}$ where $K = 0.37$ for males, and 0.40 for females. Exercise causes an increase in K , and an augmented vagal inhibition lowers K . Wiggers and Katz,⁸ determining the cycle length and the duration of systole in a slow vagal heart beat, construct a probable volume curve for each animal and devise a plot of the theoretic relation between the length of systole and the cycle of any heart rate where the heart beats according to a uniform law. The accelerator nerves act on the ventricular muscles causing a reduction of the contraction period.

Brugsch and Blumenfeld⁹ record heart sounds on phonocardiograms, controlled by electrocardiograms made at the same time in order to study the proportionate duration of ventricular systole expressed as a per cent. of the complete cardiac cycle. The variation in the different individuals and in the sexes is slight. The percentage length of ventricular systole increases with age. From 25 to 70 years of age the value is from 33.5 to 37.5 per cent. In aortic and mitral insufficiency the proportional duration of systole increases with the severity of the disease.

Fahr¹⁰ follows the *wave of excitation through the ventricles* by following the change in direction of the vector or potential difference through a heart cycle, and then applying what we know of the structure of the His-Tawara-Purkinje system; of the rates of conduction through ordinary muscle; and of the time of onset of the first heart sound and the ventricle pressure wave. The method of the equilateral triangle is accurate within ± 10 degrees, and is used for determining the frontal plane projection of the direction of potential difference in the human

6. Eyster, J. E. A., and Meek, W. J.: Am. J. Roentgenol. **7**:471 (Oct.) 1920.

7. Bazett, H. C.: Heart **7**:353 (Aug.) 1920.

8. Wiggers, C. J., and Katz, L. N.: Am. J. Physiol. **53**:49 (Aug.) 1920.

9. Brugsch and Blumenfeld: Berl. klin. Wchnschr. **56**: (Oct. 6) 1920.

10. Fahr, G.: Arch. Int. Med. **25**:146 (Feb.) 1920.

ventricle, and the manifest value. The ventricular wave of excitation begins in the subendocardial layer of the Purkinje network, developing a little earlier in the right ventricle, then spreads to the apical layers causing the Q wave. The excitation process extends to the basal arborizations of the Purkinje network, giving the anacrotic limb of R. In the meantime, the process has spread from the apical network to the apical heart muscle, and when the peak of the R wave is reached, the negativity of the apical muscle fibers is great enough to neutralize the preponderance of basal Purkinje arborizations and to cause the catacrotic limb of R and the S peak. At the base of the heart, the excitation process is extending from the basal Purkinje network to the muscles, and their negativity increases until the effect of the apical fibers is reduced and the S wave is reduced. The negative process at the apex dies first, leaving a negative preponderance at the base, causing the T wave. In hearts with left sided enlargement, the electrocardiograph changes are due to an increase in the length of the conducting path in the right ventricle, the right side receiving its negativity first while in right sided enlargement the preponderance of negativity is on the left side. In otherwise normal hearts the form of the Q R S group is dependent on the relative weights of the two ventricles. The interpretation of the ventricular complex is not always clear. Pardee¹¹ says that hypertrophy of the left ventricle is expected to show a tall R wave in Lead I, with an absent S; and a small or absent R with a deep S wave in Lead III. Hypertrophy of the right ventricle is expected to show a relatively small R with a deep S Lead I and an absent S and a tall R wave in Lead III. The simplest most accurate formula for the L/R ratio is that of Lewis ($R_1 + S_3$)—($S_1 + R_3$). An increased L/R ratio gives R_3 relatively small and R_1 and S_1 large. This is a left predominance. A decreased L/R gives R_1 small and S_1 and R_3 relatively large.

Willius¹² studies changes in the form of the *initial ventricular complex* which is represented by the Q R S waves of the electrocardiogram. Willius divides a series of 747 cases into two groups—Group 1, including 14 per cent., shows a notched Q R S complex, while Group 2 shows slurred or thickened Q R S. In the first group more than half of the cases had predominance of the left ventricle, and the etiologic factors in order of their frequency are: (1) degenerative processes; (2) infections; (3) local nutritional disturbances, and (4) congenital heart disease. In the second group, the etiologic factors are infection and degeneration. Notched and thickened Q R S complex is frequently found in undoubted cases of myocarditis and probably means local disorders in the ventricular myocardium. Smith¹³ gives

11. Pardee, H. E. B.: Arch. Int. Med. **25**:683 (May) 1920.

12. Willius, F. A.: Arch. Int. Med. **25**:550 (May) 1920.

13. Smith, F. M.: Arch. Int. Med. **26**:205 (Aug.) 1920.

a good review of the literature on atypical Q R S waves, and in experimental study in dogs of variations in the Q R S waves to determine the effect of lesions in the main branches of the A-V bundle, and of the arborizations of the bundle. His most interesting finding is that arborization block does not explain abnormal Q R S waves. Fatigue alone does not explain abnormal Q R S waves.

Fahr¹⁰ explains that the *diagnosis of right and left bundle branch* lesion is probably made wrong, that in left bundle branch lesions R should be high in Lead I and S deep in Lead III and in right bundle branch lesion S should be deep in Lead I and R high in Lead III. Wilson and Herrmann¹⁴ disagree with this view of Fahr concerning a mistake in the interpretation of the meaning of right and left bundle lesions. They say that in man the excitation wave passes down the Purkinje network of the septum, then upward through the network of the free walls inactivating the muscle in the same order. A lengthened P-R interval means delayed conduction through the A-V node or the main stem of the bundle of His. A lengthened Q R S depends on the thickness of the septum and is the most reliable sign of bundle branch block, the increase in amplitude having less value. The notching of Q R S complex is not uncommon in a normal electrocardiogram. The diagnosis of arborization block is on very shaky ground. The cause of the exaggerated T is not well understood. T deflection is produced by deactivation of the ventricular bundle.

Pardee¹⁵ gives the electrocardiogram of a woman believed to have a lesion in the left ventricle, due to *occlusion of a coronary artery*, who died of an attack of angina pectoris two years later. A day or two after the obstruction the electrocardiogram shows the Q R S group usually notched in two leads, with prominence of the left ventricle. The T wave does not start from the zero level in Leads I and III. It quickly turns away, from the starting point in a sharp curve, without the short straight stretch preceding the peak of the T wave which is so evident in normal records. There are five other records in the literature that are similar. Klewitz¹⁶ finds a negative T peak only in cases of organic heart disease, especially with myocardial lesions, but its absence does not rule out heart disease. Herrmann¹⁷ adds electrocardiograph findings in six more cases of coronary thrombosis with ventricular tachycardia, three of which were proven at necropsy to be cases of coronary thrombosis. One of these is the first clinical case recorded which substantiates the experimental work of Lewis.

14. Wilson, F. N., and Herrmann, G. R.: Arch. Int. Med. **26**:153 (Aug.) 1920.

15. Pardee, H. E. P.: Arch. Int. Med. **26**:244 (Aug.) 1920.

16. Klewitz, F.: Deutsch. Arch. f. klin. Med. **129**:41 (April 29) 1919.

17. Herrmann, G. R.: J. Missouri M. A. **17**:406 (Oct.) 1920.

All six patients clinically had severe anginal attacks and pulse rates from 170 to 250 per minute and the electrocardiograms are those of paroxysmal ventricular tachycardia.

Bishop¹⁸ offers two cases showing early signs of *ventricular fibrillation* as periods of ventricular tachycardia which he considers a serious factor in sudden death from heart failure, due either to fatigue of the ventricular muscles from the rapid rate of contraction or to fibrillation of the ventricle.

McCulloch,¹⁹ studying *electrocardiograms from athreptic infants*, finds alterations of the cardiac mechanism in two cases; in the form of a delayed auriculoventricular conduction and changes in the Q R S complex. These alterations disappear as the child improves.

Jones²⁰ made *electrocardiographs after the cessation of spontaneous respiration* in a case of cerebral hemorrhage where the heart beat for fifteen hours after normal respiration ceased, and intratracheal insufflation was used; after twelve hours under artificial respiration the heart has normal rhythm, with some lengthening of the ventricular complex that may at times exceed 0.5 second in duration.

Klewitz²¹ finds that the *electrocardiogram in persons asleep* differs materially from the electrocardiogram of the same person awake. During sleep the heart cycle is lengthened, the ventricular systole is proportionately prolonged. In different forms of heart disease no regularity can be detected in the sleep change, one case of bradycardia showing a shortened heart cycle.

Josue²² uses *auscultation of the venous pulse* to obtain information otherwise obtainable only by cardiograph methods. With the patient flat, and the head low, the stethoscope is applied between the sternal and clavicular attachments of the sternocleidomastoid muscle. The stethoscope should almost parallel the neck axis, slanting downward, backward and inward, pointing to the mediastinum. It is applied just back of and as close to the clavicle as possible, with a minimal amount of pressure. The sounds resemble the peaks in the electrocardiogram, and may be interpreted by the radial pulse relationship.

VAGUS EXCITABILITY OF THE HEART

Vagus control and the cardiac reflexes have been the subject of numerous experiments. Laslett²³ examined 108 persons in whom there was a striking reaction to vagus pressure, the mechanism being determined by slowing of the venous or radial curves. There is little

18. Bishop, L. F.: Ann. Med. **1**:58 (April) 1920.

19. McCulloch, H.: Am. J. Dis. Child. **20**:486 (Dec.) 1920.

20. Jones, H. W.: Lancet **2**:501 (Sept. 4) 1920.

21. Klewitz, F.: Deutsch. Arch. f. klin. Med. **130**:212 (Sept. 26) 1919.

22. Josue, O.: Bull. méd. Par. **34**:391 (April 28) 1920.

23. Lazlett, E. E.: Heart **7**:347 (Aug.) 1920.

practical difference in the predominance of right or left nerve. The right nerve has slight predominant control over the auricular rate, but the left also retards the ventricular rate. The ratio is R: L = 68:55. The left vagus is predominant in control of the auriculoventricular conduction, the ratio being R: L = 15:23.

Kleemann²⁴ used Czermak's test pressure on the vagus in 127 patients. Tests on the right vagus showed no effect in 80 out of 150 tests, and on the left vagus no effect in 90 out of 149 tests. Marked modification is only evident in cases of heart disease, but the intensity of the response is not always proportional to the severity of the disease, and a positive response does not always occur with heart disease. When there is partial heart block the response is aggravated. This brings the vagus pressure experiment into the medicolegal realm. Von Teubern²⁵ points out that in persons with a strongly positive vagus response compression of the throat for a very short space of time, as in attempts to strangle, or choking, may be sufficient to produce immediate arrest of the heart action.

Valsalva's experiment, i.e., forced expiration after deep inspiration with the nose, mouth and glottis closed, according to Maudru²⁶ gives a chance for better exploration of the heart, because the lungs are still, the heart rate is slower, so that murmurs are more easily studied, and the more intimate contact of the layers of the pericardium may bring out unexpected friction sounds. Dawson and Hodges²⁷ find that with the Valsalva experiment systolic blood pressure rises rapidly, at first, and this is followed by a marked fall. When the experiment is prolonged the intensity of efforts decreases and with this the changes in the heart rate are less marked. When the Valsalva experiment is interrupted by a series of single gasps, the systolic blood pressure rises from 10 to 20 mm. above the normal. Lifting and "exercises of strain" have this same effect.

The *oculocardiac reflex* is used for determining the vagus-sympathetic balance. Jenny²⁸ applied the compression of eyeball test to 250 children whose ages varied from 3 months to 15 years. In only two cases was there a disagreeable effect and the pulse was slowed in all but 4.4 per cent. which included five cases of tuberculous meningitis and two of diphtheria. The oculocardiac reflex is a physiologic reflex which ranks in value with the knee jerk. It tests the vegetative system, and is especially valuable for testing the heart as a control in digitalis treatment. Lesné and Binet²⁹ induce more vigorous responses in the

24. Kleemann: *Deutsch. Arch. f. klin. Med.* **130**:221 (Sept. 26) 1919.

25. Von Teubern: *Deutsch. med. Wchnschr.* **46**:322 (March 18) 1920.

26. Maudru: *Paris méd.* **10**:504 (July 19) 1920.

27. Dawson, P. M., and Hodges, P. C.: *Am. J. Physiol.* **50**:481 (Jan.) 1920.

28. Jenny, E.: *Arch. f. Kinderh.* **68**:64 (Aug. 31) 1920.

29. Lesné, E., and Binet, L.: *Arch. de méd. d. enf.* **23**:69 (Feb.) 1920.

oculocardiac reflex for testing vagus excitability in children than adults. In infants 2 weeks old, pressure on both eyeballs causes the pulse rate to drop from 120 to 130 down to 90. It returns to normal at once. Guyot and Jeanneney³⁰ emphasize the need for using caution in applying the test, but find it very valuable in estimating the condition of a patient before operation. If the reaction is normal, the patient may be operated on; if it is inverted it means an upset between the vagus and the sympathetic control, with the sympathetic predominating. This is the condition found in some forms of shock. When the reflex is abolished, there is insufficiency of the medullary centers, and surgery must be cautious.

Prevel³¹ speaks of the *abdominocardiac reflex*. This is the acceleration of the heart beat on changing from the reclining to the erect position. There is no alteration in the perfectly healthy person, nor in patients whose abdomen is supported by the abdominal band or by their hands. It is explained by traction from the sagging organs on the solar plexus.

ARRHYTHMIAS

Eyster and Swarthout³² find that anything that interferes with the normal rate and coordination of the beats interferes with the mechanical efficiency of the heart. Extra systole, always a premature beat, and a deficient beat as compared with the normal, does not markedly reduce the mechanical efficiency; auricular fibrillation and auricular flutter cause a decrease of cardiac output of as much as 34.9 per cent. of the normal; auriculoventricular heart block decreases mechanical efficiency because of the slow ventricular rate. Barlaro³³ insists that treatment of arrhythmias must be based on the special form and the occasional cause such as gastro-intestinal involvement or impacted gallstones. Schrumpf³⁴ concludes that serious cases of tricuspid insufficiency are nearly always accompanied by complete arrhythmia.

Tachycardia, according to Wilson,³⁵ in a man who is up and around, is compensatory, pointing to a mild infection with the toxin acting directly on the cardiac vagus. Paroxysmal tachycardia is not incompatible with an active life. Chevallier³⁶ lists the most common methods of arresting the paroxysms by reflex action. These include swallowing a chunk of bread or drinking in big gulps, taking an emetic to induce

30. Guyot, J., and Jeanneney, G.: J. d. méd. de Bordeaux **91**:591 (Nov. 25) 1920.

31. Prével: Presse méd. **28**:235 (April 21) 1920.

32. Eyster, J. A. E., and Swarthout, E. C.: Arch. Int. Med. **25**:317 (March) 1920.

33. Barlaro, P. M.: Prensa Médica Argentina **6**:231 (Jan. 10) 1920.

34. Schrumpf, P.: Arch. d. mal. du cœur. **12**:529 (Dec.) 1919.

35. Wilson, R. M.: Lancet **1**:146 (Jan. 17) 1920.

36. Chevallier, C.: Bull. méd. Par. **34**:395 (April 28) 1920.

vomiting or tickling the pharynx with a feather, lying on the back and breathing with the chest kept full of air, pressure on the right vagus nerve in the neck, and taking every ten minutes a cachet of pituitary extract. Galli³⁷ reports an interesting case of paroxysmal tachycardia in which the attack can be produced at will by the giving of atropin.

Paroxysmal auricular fibrillation is found by Mason³⁸ in 7 per cent. of the cases of auricular fibrillation in the Johns Hopkins Hospital records. The electrocardiograms are given. Willius,³⁹ studying 500 cases of auricular fibrillation, finds that the mortality in these cases doubles and sometimes trebles that of heart disease not accompanied by this arrhythmia. Levy,⁴⁰ in a research on *ventricular fibrillation* in cats and dogs, finds that the ventricle of the cat tends to spontaneous recovery, and this tendency may be aided by massage of the heart and the use of artificial respiration. The time interval between the moment of syncope and the beginning of the massage is not the important factor in recovery. The limitation to the efficiency of massage is the extent of time during which the central nervous system may be deprived of blood (oxygen?) without injury. This is about five minutes as an outside limit in the human brain. The human heart reacts like the cat heart. Ventricular fibrillation in dogs does not tend to spontaneous recovery and is usually fatal, although D'Halluin⁴¹ saved 65 per cent. of the dogs with ventricular fibrillation from exposure to electricity by the intravenous injection of solutions of potassium chlorid.

Esmein⁴² collected the recent literature on the pathology of the bundle of His and its ramifications. Schrumpf⁴³ reports a case of interfering double sinus rhythm the records from which seem to sustain the view that there is a dual action of the right and left nodes of Keith.

Bishop⁴⁴ reports an interesting case of *symmetrically placed ventricular extra systoles* and a slow pulse which is very different from true bradycardia in which the pacemaker is slow, or from heart block where impulses do not reach the ventricle. In this case every other normal pulse beat is replaced by a premature contraction which is too feeble to be noticed in the pulse. There is no functional disorder of the mechanism, but each alternating beat is an ectopic beat originating in the ventricle, and is followed by a beat controlled by the normal

37. Galli, G.: Heart **7**:111 (April) 1920.

38. Mason, V. R.: Bull. Johns Hopkins Hosp. **31**:145 (May) 1920.

39. Willius, F. A.: Minnesota Med. **3**:356 (Aug.) 1920.

40. Levy, A. G.: Heart **7**:175 (April) 1920.

41. D'Halluin, M.: Jour. de Radiol. e. d'Electrolog. Paris **4**:254 (June) 1920; Abstr. J. A. M. A. **75**:1297 (Nov. 6) 1920.

42. Esmein, C.: Ann. de Méd. **6**:415 (Dec.) 1919.

43. Schrumpf, P.: Arch. d. mal. du cœur. **13**:168 (April) 1920.

44. Bishop, L. F.: Am. Med. **15**: (new series), April, 1920.

pacemaker. Willius⁴⁵ made a study of 277 patients with *bradycardia* and he finds that the causes may be chemical substances, myocardial disease, physiologic changes without cardiac degenerations, early and late asphyxia, and stimulation of the cardiac vagus which gives a temporary bradycardia.

Parkinson, Grosse and Gunson,⁴⁶ taking fifty consecutive cases of acute rheumatism, find the myocardium unaltered in only twelve cases. Forty-seven of the patients had a sinus arrhythmia after the attack and 14 per cent. had premature auricular contraction; 30 per cent. had acute heart block, with dropped beats in 8 per cent. Some degree of acute heart block indicating myocarditis is common in acute rheumatism. Goodall,⁴⁷ studying twenty cases of *heart block*, points out that rheumatic and syphilitic histories are relatively infrequent. Heart block is almost invariably associated with mitral regurgitation, and pain is a frequent symptom. There is a tendency to sudden death with gastric distention, and Stokes-Adams attacks occur when the heart block is complete. He speaks also of the possibility of transmission of the condition from mother to child.

Eckstein,⁴⁸ working on the frog's heart, confirms the view that the width of the impulse conducting tract between the auricle and ventricle does not modify the transmission of the impulse. Partial heart block is not due to the narrowing of the tract. The power of the impulse is dependent on the number of times the elements of the tract can repeat a given process in a given length of time. When two parts with varying lengths of the refractory phase meet there must be arrhythmia—which may be purely functional, due to injurious influences affecting the heart through the blood or nerves or originating within the heart itself. Cases of heart block are reported by Gallavardin and Dumas;⁴⁹ Friedlander and Isaacs,⁵⁰ whose case shows a dissecting aneurysm of the septum in a man, aged 36; Odriozola,⁵¹ whose case with gumma of the septum shows complete heart block, and a pulse rate dropping to one beat per minute, probably the lowest bradycardia on record; and Pezzi, Donzelot and Yacoel,⁵² whose case of complete heart block shows a pulse of auricular origin due to myocardial weakness, in the femoral vein.

45. Willius, F. A.: Arch. Int. Med. **26**:630 (Nov.) 1920.

46. Parkinson, J.; Grosse, A. H., and Grunson, E. B.: Quart. J. Med. **13**:363 (July) 1920.

47. Goodall, J. S.: Lancet **1**:909 (April 24) 1920.

48. Eckstein, A.: Deutsch. Arch. f. klin. Med. **130**:95 (Aug. 15) 1919.

49. Gallavardin, L., and Dumas, A.: Arch. d. mal. du cœur. **13**:63 (Feb.) 1920.

50. Friedlander, A., and Isaacs, R.: J. A. M. A. **75**:1778 (Dec. 25) 1920.

51. Odriozola, E.: An de la Facultad de Med. de Lima **3**:5 (July-Aug.) 1920; abst. J. A. M. A. **75**:1601 (Dec. 4) 1920.

52. Pezzi, C.; Donzelot, E., and Yacoel, J.: Arch. d. mal. du cœur **13**:97 (March) 1920.

Heartblock in children is much more rare. Eyster and Middleton⁵³ could find only twenty cases of heart block in children in the literature. These were probably either congenital in origin or occurred during severe diphtheria. Their case is in a child, 2 years old, which has been under observation all her life. The lesion at present seems to be a well compensated mitral lesion, with a 2:1 auriculoventricular block, the ventricle rate being from fifty to sixty beats per minute. Carter and Howland⁵⁴ report a case of congenital *atrioventricular dissociation* with complete heart block in a child of 5. The auricular rate is 103 and the ventricular rate is 37. There are only seven other established cases of atrioventricular heart block in children. These cases are reviewed in the article.

THE SIZE AND CONTOUR OF THE HEART

Hoover⁵⁵ gives the fine distinctions of the lost art of percussion in locating the heart borders. Direct percussion is best for definitive percussion using the terminal phalanx of the extended middle finger, making the blow by firmly stroking, with the patient sitting because the heart is nearer the chest wall. The left cardiac border is located by percussing from the third intercostal space downward; then the upper border by percussing in a line midway between the sternum and the nipple line with the finger parallel to the ribs, downward each costal and intercostal space until there is the characteristic change in note and resistance. The right cardiac borders should be defined by percussing in each right intercostal space from the second to the fifth in succession. The location of the right margin requires all the niceties of technic. Not even the radiographic plate will give the information about flattening of the diaphragm with cardiac enlargement that may be obtained by studying the movement of the costal margins from the subcostal angle to the eighth costal cartilage. For this the patient should be recumbent. Normally, the two sides move symmetrically outward, but if the entire subcostal diaphragm is flattened, the costal margins on both sides from the angle to the eighth rib move less than the lower margins where the lateral phrenic leaves are attached. If the flattening is marked, the costal margins from the angle to the eighth rib move symmetrically inward, and the lower margins move outward, giving an inspiratory narrowing of the subcostal angle. This is a valuable clue to downward enlargement of the heart.

53. Eyster, J. A. E., and Middleton, W. S.: Am. J. Dis. Child. **19**:131 (Feb.) 1920.

54. Carter, E. P., and Howland, J.: Bull. Johns Hopkins Hosp. **31**:351 (Oct.) 1920.

55. Hoover, F. C.: J. A. M. A. **75**:1626 (Dec. 11) 1920.

Martinet⁵⁶ uses the height, the diameter of the chest from axilla to axilla, the transverse diameter and the longest and shortest diameters of the heart. These furnish an index of the relative values of the heart and aorta for different builds, which is very instructive. Cánovas⁵⁷ uses a radiocardiometer to measure the ratio between the diameter of the heart and the widest diameter of the chest. Normally, this is almost constant, 25 per cent. of the chest diameter lying to the left of the heart, 42 per cent. being occupied by the heart, and 33 per cent. lying to the right of the heart. Cohn,⁵⁸ using the teleroentgen method on soldiers returned from severe active service, finds that their hearts are not larger than the normal.

IRRITABLE HEART AND EFFORT SYNDROME

Warfield and Smith⁵⁹ note that cases of *irritable heart* give histories dating back for years—and exercise under observation gives the surest method of separating the fit from the unfit. Galli⁶⁰ shows that cardiovascular disease is an inherited tendency, and he gives family trees for “hereditary myocardism.” These subjects are unable to stand as much physical exercise as the normal. The heart and aorta are smaller than the average, and the blood pressure is lower. Kerley⁶¹ places the intelligent child, who is unable to apply himself to either mental or physical work because he becomes easily fatigued, in the class of the effort syndrome in children. Schiff⁶² reclassifies these children with constitutional inferiority of the circulatory system according to the stability of the vasomotor system. Stolte⁶³ calls attention to the children whose movements are slow, who do not join in games, who urinate little during the day, but at night when the circulation is relieved pass large amounts of urine. These children may have an indistinct first sound at the apex, or a murmur, which is due to atony of the heart muscles and which disappears as the child grows stronger. The effort syndrome is not heart disease. Meredith,⁶⁴ examining 2,000 young women, found 193 who had been told they had valvular lesions who gave no evidence of organic heart disease, but who had a functional disturbance that may be attributed to submyocardial development.

56. Martinet, A.: Presse méd. **28**:302 (May 15) 1920.

57. Cánovas, B. N.: Rev. Española de med. y cir., Barcelona **2**:600 (Nov.) 1919.

58. Cohn, A. E.: Arch. Int. Med. **25**:499 (May) 1920.

59. Warfield, L. M., and Smith, F. M.: J. Lab. & Clin. M. **5**:75 (Nov.) 1919.

60. Galli, G.: Policlinico, Rome **27**:65 (Jan. 19) 1920.

61. Kerley, C. G.: Arch. Pediat. **37**:449 (Aug.) 1920.

62. Schiff, E.: Jahrb. f. Kinderh. **91**:217 (March) 1920.

63. Stolte, K.: Jahrb. f. Kinderh. **92**:1, 1920.

64. Meredith, F. L.: Boston M. & S. J. **181**:734 (Dec. 25) 1919.

ORGANIC HEART LESIONS

White⁶⁵ insists on positive evidence for the diagnosis of *heart disease* in young people. This positive evidence consists of definite cardiac enlargement, murmurs that are definitely those of organic valvular lesions, serious arrhythmia such as heart block or auricular fibrillation, congestion of the veins of the neck, enlargement of the liver, edema of the feet and legs, ascites, pulmonary edema and cyanosis. Hewlett⁶⁶ adds to this list cardiac infection and alterations in the form of the electrocardiogram. Gibre,⁶⁷ from the records on 10,000 recruits with doubtful heart conditions, selects the cases of aortic regurgitation and mitral stenosis. He finds that the most important etiologic factor between the ages of 18 and 41 is rheumatic fever. It is rather surprising to find the statement that there is no evidence here that syphilis, gonorrhea, scarlet fever, diphtheria, or pneumonia are causes of valvular heart lesions. Hall,⁶⁸ in 2,500 heart cases, analyzed the 40 per cent. who had valvular heart lesions. Half of these were due to want of tone and to minor causes, all curable with the proper environment.

Of the acute infectious diseases producing heart lesions diphtheria is one of the most important. McCulloch⁶⁹ gives the records of eighty cases of diphtheria in children, of whom nineteen showed cardiac disturbance. With lesions of the myocardium and the mechanism, the mortality is 100 per cent. Cardiac failure results the moment the cardiac reserve is used up. The occurrence of *postdiphtheritic myocarditis* is beyond our control, but the outcome may depend on protection given the heart during the disease and convalescence. Aviragnet and Lutembacher⁷⁰ report a case of postdiphtheritic derangement of conductivity in a boy, 10 years old. Minet and Legrand⁷¹ report six cases of influenza with heart complications. The prognosis is grave for all organic forms and reserved in all types. Hamburger⁷² adds six more cases of *postinfluenzal myocardial involvement*. These may be grouped as (1) fatal cases with acute parenchymatous degeneration and vacuolization of the myocardium, (2) acute nonfatal cases showing involvement of the auricle and the conducting system during the height of the infection and recovery in from two to six weeks, and (3) non-fatal chronic cases with involvement of the auricle and arrhythmia long after subsidence of the acute infection. Acute respiratory infections,

65. White, P. D.: J. A. M. A. **74**:580 (Feb. 28) 1920.

66. Hewlett, A. W.: Northwest Med. **19**:224 (Sept.) 1920.

67. Gibre, C. C.: Brit. M. J. **1**:730 (May 29) 1920.

68. Hall, G. R.: Lancet **1**:1218 (June 5) 1920.

69. McCulloch, H.: Am. J. Dis. Child. **20**:89 (Aug.) 1920.

70. Aviragnet and Lutembacher: Arch. d. mal. de cœur. **13**:197 (May) 1920.

71. Minet and Legrand: Paris méd. **10**:133 (Feb. 14) 1920.

72. Hamburger, W. W.: Am. J. M. Sc. **160**:479 (Oct.) 1920.

such as influenza and streptococcus lesions, seem to single out the auricle and the conduction pathways. Oliverira⁷³ finds that lung processes, especially fibrous degeneration of the lung, cause disturbances in the venous cardiovascular system which are slowly progressive and lead up to auricular fibrillation. This correlation between auricular fibrillation and the pulmonary condition is the basis for his term—*pulmonary heart*.

Williamson⁷⁴ injects a warm gelatin and agar mixture into the pericardial sac of fresh cadavers, to study *pericarditis with effusion*. The fluid accumulates first along the lower margin of the heart and about the apex; with larger effusions it collects next over the large vessels of the base. This collection is independent of position. In almost every case this pushes down the diaphragm and the left lobe of the liver. Even in large effusions the anterior surface of the heart may remain uncovered so that a pericardial friction rub may still be noted. Percussion dullness in the right fifth interspace, or rounding of the cardiohepatic angle is not demonstrable in experimental pericardial effusions. Holden⁷⁵ reports three cases with abdominal symptoms and laparotomy—in which the lesion was a pericarditis. Rehn⁷⁶ treats *adhesive pericarditis* by splitting the sternum, slitting the pericardium, and breaking up the adhesions. Four cases in children showed immediate improvement, and recovery from the operation, but two died soon afterward of tuberculosis elsewhere, one after eighteen months of influenza, and one after one year of acute rheumatism.

Dwyer⁷⁷ cites a case of *ulcerative endocarditis* in a child, 23 months old, due to the gonococcus. In over 600 cases of endocarditis in children there is only one mention of endocarditis due to the gonococcus. The most common agent is *Streptococcus viridans*. This was found in the case of Kretschmer and Conboy⁷⁸ in which both the aortic and mitral valves were perforated. Münzer⁷⁹ thinks that the presence of streptococci in the blood does not justify prognostic conclusions; that chills and splenic enlargement are more important for a bad prognosis. Baehr and Lande⁸⁰ believe that the glomerulonephritis which is the cause of death in 11.5 per cent. of their cases of subacute streptococcus endocarditis is initiated only during the bacteremia in the acute stage of

73. De Oliverira, O.: An. de la Facult. de Med. Montivideo **5**:297 (July-Aug.) 1920; Abstr. J. A. M. A. **75**:1808 (Dec. 25) 1920.

74. Williamson, C. S.: Arch. Int. Med. **25**:206 (Feb.) 1920.

75. Holden, W. B.: Northwest. Med. **19**:230 (Sept.) 1920.

76. Rehn, L.: Arch. f. Kinderh. **68**:179 (Oct. 16) 1920.

77. Dwyer, H. L.: J. A. M. A. **75**:1643 (Dec. 11) 1920.

78. Conboy, J. E., and Kretschmer, H. L.: J. A. M. A. **74**:154 (Jan. 17) 1920.

79. Münzer, E.: Zentralbl. f. inn. Med. **41**:282 (April 17) 1920.

80. Baehr, G., and Lande, H.: J. A. M. A. **75**:789 (Sept. 18) 1920.

endocarditis. Cotton⁸¹ analyzes the clinical symptoms and complications in subacute endocarditis. Thomas and O'Hara⁸² report a case of endocarditis of the tricuspid valve due to the pneumococcus, Type I. Hannemann⁸³ finds that the warty efflorescences in endocarditis are made up of valvular tissue and are not superficial deposits, the deposit of cells arising from the valvular tissue and not from leukocyte accumulations.

Kaufmann,⁸⁴ studying *large hearts* in soldiers, finds that most of these are not hypertrophied. The power of dilation is a compensating heart mechanism, but the larger the heart the less the relief from dilation. The amount of strain depends on the previous condition of the heart and not the severity of the exercise. Of one group of fifty men showing no disordered heart action after two years at the front, only eight had had acute infections after the age of 14; while in another group of fifty men who were returned with severe heart symptoms after five months at the front, thirty-seven had had acute infections after the age of 14. Acute dilatation of the heart during or following surgical operation, in nine cases reported by Levine,⁸⁵ showed abnormal mechanism of the heart beat, with the changes in the auricular beat. Esmein⁸⁶ finds that the auriculoventricular valves are more apt to become insufficient with dilatation which really lightens the work of the heart. Wilson⁸⁷ says that every case of cardiac decompensation without valvular lesions must be considered a case of chronic myocarditis. Leon⁸⁸ and Morquis⁸⁹ report cases occurring in children in which a toxic action in the myocardium and compensatory dilatation caused a *gallop sound* which directed the attention to an acute nephritis. Lian⁹⁰ considers the *third heart sound* physiologic, and Pezzi⁹¹ opposes the view that a double crural sound is a symptom of aortic insufficiency. It is of mixed arterial and venous origin, is never present with compensated aortic insufficiency, and it occurs only with myocardial weakness.

81. Cotton, T. F.: Brit. M. J. **2**:851 (Dec. 4) 1920.

82. Thomas, H. M., Jr., and O'Hara, D.: Bull. Johns Hopkins Hosp. **31**: 417 (Nov.) 1920.

83. Hannemann, E.: Virchows Arch. f. path. Anat. **226**: Supp. 138-149, 1919; Abstr. Bacteriol. **3**: (Dec.) 1919.

84. Kaufmann, R.: Wien. Arch. f. inn. Med. **1**:211 (June) 1920.

85. Levine, S. A.: J. A. M. A. **75**:795 (Sept. 18) 1920.

86. Esmein, C.: Médecine, Paris **1**:336 (March) 1920.

87. Wilson, F. N.: Mississippi State M. A. J. **17**:403 (Oct.) 1920.

88. Ponce de Leon: Arch. Latino-Amer. de Pediat., Buenos Aires **14**:266 (May-June) 1920.

89. Morquis, L.: Arch. Latino-Amer. de Pediat., Buenos Aires **13**:424 (Oct.) 1919.

90. Lian, C.: Médecine, Paris **1**:333 (March) 1920.

91. Pezzi, C.: Arch. d. mal du cœur **12**: (Dec.) 1919.

Rosenbaum,⁹² studying *cardiac complications in scarlet fever*, finds myocarditis common in the latter part of the acute stage and in convalescence, but a pre-existing old heart lesion does not mean a bad prognosis in scarlet fever. Whitman and Eastlake⁹³ trace all stages from muscle cell to Aschoff cells in rheumatic myocarditis. The myocardial rheumatic nodule, or Aschoff body, is made up of large elements arranged radially about a center. The cells are similar to epithelioid cells, but larger like the giant cells in Hodgkin's disease. They are round, fusiform or oval, often multinuclear. The nodules lie close to small blood vessels and are surrounded by a zone containing polymorphonuclear leukocytes, plasma cells and lymphocytes.

Norton⁹⁴ reports a case of myxoma of the heart in the hope of finding a symptom complex for *cardiac tumors*. Rutherford⁹⁵ reports a case of *cardiac angina in a child*, with a review of the literature of angina pectoris and degenerations in the aorta in children. Lutembacher⁹⁶ cites three cases of aneurysm of the left ventricle in adults. Reid⁹⁷ reports an experimental study on dogs with experimental *arteriovenous fistulae*. There is a marked tendency for such experimental fistulae to close.

WOUNDS OF THE HEART

Mocquot and Constantini⁹⁸ report eleven cases in which the heart wound in the ventricle is plugged with a clot, and may heal spontaneously, although if this clot becomes destroyed, there may be secondary hemorrhage and delayed symptoms. Collins⁹⁹ sutured the heart in a case of gunshot wound of the left ventricle. The man lived thirteen days, and died of the effect of exposure due to an attempted escape from the hospital. At necropsy the heart and pericardium were completely healed. Proust¹⁰⁰ records the results of a re-examination ten years after suture of the heart, in which the heart is apparently normal. In the discussion of this paper Josue gives the findings in ten cases in which there were operations on the heart after war wounds.

CONGENITAL ANOMALIES OF HEART AND CIRCULATION

Vaquez and Donzelot¹⁰¹ distinguish between *dextrocardia* and

92. Rosenbaum, H. A.: Arch. Int. Med. **26**:424 (Oct.) 1920.

93. Whitman, R. C., and Eastlake, A. C.: Arch. Int. Med. **26**:601 (Nov.) 1920.

94. Norton, W. H.: Am. J. M. Sc. **158**:689 (Nov.) 1919.

95. Rutherford, W. J.: Brit. J. Child. Dis. **17**:22 (Jan.-March) 1920.

96. Lutembacher, R.: Arch. d. mal. du cœur **13**:49 (Feb.) 1920.

97. Reid, M. R.: Bull. Johns Hopkins Hosp. **31**:43 (Feb.) 1920.

98. Mocquot, P., and Constantini: Rev. de chir. **39**:257, 1920.

99. Collins, A. W.: J. A. M. A. **75**:1271 (Nov. 6) 1920.

100. Proust: Bull. et mém. Soc. méd. d. hôp. de Par. **44**:1035 (July 16) 1920.

101. Vaquez, H., and Donzelot, E.: Presse méd. **28**:41 (Jan. 17) 1920.

dextroversion; one, the mirror aspect, being merely a mechanical displacement and the other, inversion of the cavities, is an abnormal embryonal development. Parsons-Smith¹⁰² shows that dextrocardia with complete transposition of the organs—*situs inversus totalis*—does not incapacitate, but incomplete transposition is usually accompanied by actual malformations of the heart and of the body. Schüssler's¹⁰³ case had supernumerary vertebrae; Moncalvi's¹⁰⁴ case with *situs inversus* and dextrocardia has congenital stenosis of pulmonary, and probably a patent ductus arteriosus; Ochsenius¹⁰⁵ reports the fifth case in the literature of *familial situs inversus totales* in non twins.

Goehring¹⁰⁶ reports a case of *anueysm of the postaortic sinus of Valsalva* of congenital origin, which clinically gave signs of tricuspid insufficiency. Rupture resulted in death. There are only six such cases on record. Plowden¹⁰⁷ reports a case of congenital malformation of the heart in which there is no pulmonary artery, but there is a large abnormal branch arising from the arch of the aorta. Toy and Ellis¹⁰⁸ also report a case with absence of the pulmonary artery and other defects. McLean¹⁰⁹ has a case of congenital heart disease that cleared up in five years. He suggests that there might have been a defect in the ventricular septum, and that there has been a return to normal rather than compensation.

Weber,¹¹⁰ studying sixty-two cases of congenital heart defect, finds that there is no characteristic stunting of growth or malnutrition. Children with congenital cyanosis and with dyspnea are, however, more subject to deranged nutrition.

INCIDENCE OF HEART DISEASE AND THE CARE OF CARDIAC PATIENTS

Hoffman¹¹¹ collected the statistics on heart disease. The relative frequency of valvular heart disease and endocarditis in men of military age is 2.6 per cent.; and of all forms of heart disease leading to total rejections is 3 per cent.—about the same as pulmonary tuberculosis. Conner¹¹² gives heart defects as causing a rejection rate of 4.25 per cent. in the army, while in 1917 the death rate in the United States registration area from heart disease was 12.1 per cent. of the total.

102. Parsons-Smith, B.: *Lancet* **2**:1076 (Dec. 13) 1919.

103. Schüssler, O.: *Deutsch. med. Wchnschr.* **46**:658 (June 10) 1920.

104. Moncalvi, M.: *Pediatrics*, Naples **28**:907 (Oct. 1) 1920.

105. Ochsenius, K.: *Monatschr. f. Kinderh.* **19**:27 (Oct.) 1920.

106. Goehring, G.: *J. M. Res.* **42**:49 (July-Sept.) 1920.

107. Plowden, H. H.: *South Carolina M. A. J.* **15**:649 (Dec.) 1919.

108. Toy, W. B., and Ellis, A. G.: *J. A. M. A.* **74**:322 (Jan. 31) 1920.

109. McLean, S.: *J. A. M. A.* **74**:1229 (May 1) 1920.

110. Weber, O.: *Monatschr. f. Kinderh.* **18**:205 (June) 1920.

111. Hoffman, F. L.: *J. A. M. A.* **74**:1364 (May 15) 1920.

112. Conner, L. A.: *J. A. M. A.* **74**:1564 (June 5) 1920.

There is no doubt that the cardiac patients need special care and attention. Conner outlines the growth of cardiac clinics and institutions for the care of heart cases in New York City. In 1911 there was a single outpatient heart clinic in Bellevue hospital, while in 1920 there were twenty-seven cardiac dispensary classes, accommodating 3,000 persons, convalescent homes for heart cases, inspection and care of children with crippled hearts, and special classes for these children, and occupational work under supervision of the Employment Bureau for the Handicapped. St. Lawrence and Adams¹¹³ report in detail the care of cardiac children, with the object of making them useful citizens. Duggan¹¹⁴ reports from the Employment Bureau for the Handicapped the results of placing cardiac patients and the types of employment suitable for cardiac patients. One difficulty seems to be assuring the employer that the workman with a heart lesion will not drop dead suddenly.

LESIONS OF THE AORTA

Martin¹¹⁵ lists as causes for widening of the shadow of the great vessels chronic mitral lesions with dilated pulmonary artery, congenital heart lesions, long continued hypertension, a high diaphragm, arteriosclerosis and syphilitic aortitis. Brown¹¹⁶ calls attention to retrosternal pain as an important symptom of acute aortic dysfunction, the prognosis of which is not necessarily grave in young persons. Stolkind¹¹⁷ is unable to find in the literature a single case of proved *hereditary syphilitic aortitis* in older children, adolescents and adults, although such cases may exist. About seventy-five cases are on record of aortic changes in new-born infants with hereditary syphilis, and the pathologic findings are different from syphilitic aortitis in adults. The literature on the finding of *Spirochaeta pallida* in the tissues of children is also reviewed. Martinet¹¹⁸ finds only five cases in his series of patients with aortic aneurysm whose histories exclude the possibility of syphilis.

Moon¹¹⁹ reports a case of congenital stenosis of the aorta in a boy, 11 years old, who is active, energetic and bright, but somewhat undersized and pale.

THE CAPILLARIES

The conception of the capillaries has undergone a radical change in the past two years. Since about 1860, vasomotor changes have been considered synonymous with arteriomotor—a function of blood pres-

113. St. Lawrence, W. P., and Adams, E.: Hosp. Service Quart. **2**:151 (May) 1920. Quoted from Editorial, J. A. M. A. **75**:609 (Aug. 28) 1920.

114. Duggan, I. M.: Cardiac Hosp. Soc. Serv. Quart. **2**:229 (May) 1920.

115. Martin, C. E.: J. A. M. A. **74**:723 (March 13) 1920.

116. Brown, G. E.: Ann. Med. **1**:242 (July) 1920.

117. Stolkind, E. J.: Brit. J. Child. Dis. **17**:126 (Sept.) 1920.

118. Martinet, A.: Presse méd. **28**:733 (Oct. 16) 1920.

119. Moon, R. O.: Lancet **1**:1314 (June 19) 1920.

sure. The pumping mechanism¹²⁰ is not the sole factor in blood distribution—the peripheral vasomotor changes must be considered. The vasomotor control was formerly considered due to vasoconstrictor and vasodilator nerves, but more recently the possibility of chemical control—sensibility to cellular products has been discussed. Hooker¹²¹ examines the capillaries and venules in the cat's ear, and finds that there is a definite "*capillariomotor*" mechanism which is subject to chemical and to nervous control. Baylis¹²² says that the absence of a muscular coat does not rule out the possibility of active changes in the capillaries, and Krogh¹²³ says they function in active dilatation and there is capillary tone. In another article, Krogh¹²⁴ shows that the capillariomotor mechanism in the frog is only slightly dependent on the nerve supply, and that maintenance of the capillary tonus is dependent on the blood supply. With a lowered blood supply, the tonus diminishes, causing relaxation and the admission of a current of blood and tone is regained. The substance responsible for tonus in the blood is not known, but it is not oxygen supply. These experiments recall the old findings of Cushing on examining the capillaries in the meninges of the monkey through a trephine opening, and discovering that normally the capillaries are not continuously filled with blood, but that the filling comes in waves, or pulsations. Dale¹²⁵ accepts the view of actively contractile capillaries, and thinks this will play a part of increasing importance in the conception of the mechanism for regulating blood supply and in the explanation of shock. Wolfer¹²⁶ notes that the intrapulmonary circulation and the body circulation balance, supplement and compensate each other, and different drugs act differently on the two, epinephrin causing the vessels of the pulmonary circulation to dilate.

Danzer and Hooker¹²⁷ determine the *capillary blood pressure* with the microcapillary tonometer which fits on a microscope stage, and the pressure is applied through a capsule with a transparent membrane through which the skin is observed under the microscope with a magnification of 70x. The criterion for reading is the point where stagnation occurs. The normal pressure is 22.2 mm. Hg and there is slight diurnal variation. Kylin¹²⁸ uses the same type of apparatus and finds that in 100 healthy subjects the capillary blood pressure range is 110-190 mm. water. The arterial hypertension cases fall into two groups, one

120. Editorial, J. A. M. A. **75**:1784 (Dec. 25) 1920.

121. Hooker, D. R.: Am. J. Physiol. **54**:30 (Nov.) 1920.

122. Editorial, J. A. M. A. **74**:178 (Jan. 17) 1920.

123. Krogh, A.: J. Physiol. **52**:457, (May) 1919.

124. Krogh, A.: J. Physiol. **53**:399 (May) 1920.

125. Dale, H. H.: Bull. Johns Hopkins Hosp. **31**:256 (Aug.) 1920.

126. Wolfer, P.: Cor.-Bl. f. schweiz. Aerzte **49**:1817 (Nov. 27) 1919.

127. Danzer, C. S., and Hooker, D. R.: Am. J. Physiol. **52**:136 (May) 1920.

128. Kylin, E.: Zentralbl. f. inn. Med. **41**:505 (July 18) 1920.

with increased capillary blood pressure, and the other without any increase in the capillary pressure. The last group includes the benign nephroses.

BLOOD PRESSURE

An editorial in the *Journal of the American Medical Association*¹²⁹ calls attention to the change in the conception of the normal blood pressure: eight years ago from 150 to 160 mm. of mercury was taken as the upper limit of normal systolic blood pressure; two years later the age factor was more clearly recognized and systolic pressures over 135 mm. were considered as hypertension in persons under middle age. Alvarez¹³⁰ fixes the normal from studies made on freshmen at the University of California as from 85 to 155 mm. for women and from 90 to 175 mm. for men. In women there is a decrease in blood pressure between the ages of 17 and 25, and in men between the ages of 17 and 21. Kahn¹³¹ shows that the normal varies with the position of the arm, both systolic and diastolic pressures decreasing as the arm is raised. For comparable results all readings should be taken with the arm at the side.

Miller¹³² studies blood pressure changes of interest to surgeons.

TABLE 1.—SYSTOLIC BLOOD PRESSURE VARIATIONS DUE TO POSITION
(1,000 CASES)

Position	Variation Less Than 10 Mm., per Cent.	Blood Pressure Diminished, per Cent.	Blood Pressure Increased, per Cent.	Tendency to
Dorsal.....	55	22.5	22.5	Remain normal
Lithotomy.....	64.5	11.1	24.4	Remain normal
Trendelenburg.....	38.7	57.2	4.1	Diminish
Combined lithotomy and Trendelenburg.....	25	25	50	Increase

A drop in temperature in the operating room is followed by a fall in blood pressure which is more marked when there is visceral exposure. The temperature of the operating room should never be below 70 F. in major operations. A quiet anesthesia shows no blood pressure change; a deep anesthesia is apt to give a rapid decline in blood pressure, and spinal anesthesia may give a drop that reaches the danger zone.

Cordier¹³³ believes that localized hypertension in the hands and feet, which occurs spasmodically without any trophic disturbance, is the first

129. Editorial, J. A. M. A. **75**:1650 (Dec. 11) 1920.

130. Alvarez, W. C.: Arch. Int. Med. **26**:381 (Oct.) 1920.

131. Kahn, M. H.: Am. J. M. Sc. **158**:823 (Dec.) 1919.

132. Miller, A. H.: J. A. M. A. **74**:514 (Feb. 21) 1920.

133. Cordier, V.: Arch. d. mal. du cœur **13**:241 (June) 1920.

stage of a phenomenon to be noted in the next ten years when this present generation will present heart and kidney conditions due to the intoxications, fatigues and latent infections of the recent war campaigns.

There is a group of three papers on *blood pressure changes in pulmonary conditions*. Amblard¹³⁴ in acute pulmonary edema finds a high blood pressure, running higher during the development; then, as the ventricle gives way, there is a sudden drop, which is followed by edema. The heart action keeps up and no arrhythmia develops. Edgeworth¹³⁵ finds that in 3 per cent. of the cases of lobar pneumonia death results from a persistent fall in blood pressure. De Bloeme,¹³⁶ studying 500 cases of pulmonary tuberculosis, finds that the blood pressure is normal in 87.7 per cent. during the first stage, in 86 per cent. during the second stage and in 75 per cent. during the third stage. Only the third stage shows a marked tendency toward a falling pressure almost 18 per cent. having subnormal pressures. Cases with a low blood pressure—from 80 to 100 mm.—all terminate fatally in less than one year.

The correlation of *endocrine dyscrasias and blood pressure changes* are studied by Engelbach¹³⁷ who analyzed 500 uncomplicated endocrine cases. Ten per cent. of the cases showed increased blood pressure, the highest pressures occurring in the 30 per cent. of these cases representing pluriglandular dyscrasias; pituitary, thyroid, and ovarian changes come next in frequency as causing increased blood pressures. The prognosis in endocrine hypertension is more favorable than in vasculorenal hypertension. Downs¹³⁸ finds that splenic and thymic substances do not affect the blood pressure in dogs; ovarian and thyroid substances cause oscillation in the pressure; mammary gland substance first increases, then lowers the pressure; pancreatic substance and secretin lower the blood pressure while epinephrin raises it. Sandiford,¹³⁹ giving 0.5 c.c. of a 1:1000 solution of epinephrin chlorid gets an increase in systolic and a decrease in diastolic blood pressures. Schiff and Epstein¹⁴⁰ find that normal children respond to epinephrin with a considerable increase in blood pressure that is uninfluenced by change in position. Children with weak pulse and low tension may give little, if any, response to epinephrin, but if the vasomotor system is stable, the pressure rises on reclining. Children with unstable innervation usually give a prompt but slight rise in blood pressure which is not altered by

134. Amblard, L.: Paris méd. **10**:425 (May 22) 1920.

135. Edgeworth, F. H.: Bristol M.-Chir. J. **37**:86 (June) 1920.

136. de Bloeme, P. J.: Nederlandsch Tijdschr. v. Geneesk. **1**:943 (March 29) 1920; Abstr. J. A. M. A. **75**:1238 (Oct. 30) 1920.

137. Engelbach, W.: J. A. M. A. **74**:1619 (June 12) 1920.

138. Downs, A. W.: Am. J. Physiol. **52**: (July) 1920.

139. Sandiford, I.: Am. J. Physiol. **51**:407 (April) 1920.

140. Schiff, E., and Epstein, B.: Jahrb. f. Kinderh. **91**:128 (Feb.) 1920.

change in position. Lowry and Wright¹⁴¹ find that the injection of epinephrin in dementia praecox cases does not give data of value in the differential diagnosis. Weber¹⁴² calls attention to high blood pressure as a diagnostic sign in suprarenal tumors; one child 5 years old having a systolic pressure of 108 mm. Hg.

PULSE AND BLOOD PRESSURE

Sahli¹⁴³ considers that blood pressure determinations are misleading unless the pulse volume is determined at the same time. Sewall¹⁴⁴ suggests that estimations should be made, under different conditions, of the velocity of the blood current as represented by the product of the pulse pressure multiplied by the pulse rate.

Dawson¹⁴⁵ finds that physical training slows the pulse rate, increasing the diurnal variation in pulse rate; increasing the systolic pressure and decreasing the diastolic pressure thus increasing the pulse pressure. Building from Dreyer's foundation that the heart rate of the wild hare which leads an active life is 68 compared to a heart rate of 200 in the rabbit which lives an inactive life, and that wild hare's blood volume is three times the blood volume of the rabbit; and from Boney's work showing that with fatigue there is a difference in the pulse rate on standing and lying down, Schneider¹⁴⁶ tabulates the changes into a point system with plus and minus ratings. A score of 9 or less is characteristic of physically unfit men.

Wilson¹⁴⁷ tested twenty average normal children for their *circulatory reactions to graded exercises*. Immediately after exercise the pulse rate is markedly increased but in 86 per cent. it returns to normal or below normal in two minutes. The systolic pressure with moderate exercise rises to the summit in from twenty to forty seconds and falls to the pre-exercise level in two minutes. With severe exercise, the height of the rise is increased reaching a maximum in from fifty to seventy seconds, and falling more slowly, taking from three to five minutes to reach the pre-exercise level showing that the exercise tolerance of the child has been reached or passed. Mabon¹⁴⁸ studying changes in the blood pressure and pulse in fifty patients with effort syndrome finds that the amount of work they are able to accomplish before fatigue occurs is much less than the normal, but the pulse changes and blood pressure changes are not abnormal.

141. Lowry, L. G., and Wright, W. W.: Boston M. & S. J. **183**:209 (Aug. 12) 1920.

142. Weber, F. P.: Practitioner, London **105**:181 (Sept.) 1920.

143. Sahli, H.: Schweiz. med. Wchnschr. **50**:2 (Jan.) 1920.

144. Sewall, H.: Am. J. M. Sc. **108**:786 (Dec.) 1919.

145. Dawson, P. M.: Am. J. Physiol. **50**:443 (Dec.) 1919.

146. Schneider, E. C.: J. A. M. A. **74**:1506 (May 29) 1920.

147. Wilson, M. G.: Am. J. Dis. Child. **20**:188 (Sept.) 1920.

148. Mabon, T. M.: Am. J. M. Sc. **158**:818 (Dec.) 1919.

TABLE 2.—POINTS FOR GRADING CARDIOVASCULAR CHANGES
(SCHNEIDER'S TABLE)

A. Reclining Pulse Rate		B. Pulse Rate Increase on Standing				
Rate	Points	0-10 Beats, Points	11-18 Beats, Points	19-26 Beats, Points	27-34 Beats, Points	35-42 Beats, Points
50-60	3	3	3	2	1	0
61-70	3	3	3	1	0	-1
71-80	2	3	2	0	-1	-2
81-90	1	2	1	-1	-2	-3
91-100	0	1	0	-2	-3	-3
101-110	-1	0	-1	-3	-3	-3
C. Standing Pulse Rate		D. Pulse Rate Increase Immediately after Exercise				
Rate	Points	0-10 Beats, Points	11-20 Beats, Points	21-30 Beats, Points	31-40 Beats, Points	41-50 Beats, Points
60-70	3	3	3	2	1	0
71-80	3	3	2	1	0	0
81-90	2	3	2	1	0	-1
91-100	1	2	1	0	-1	-2
101-110	1	1	0	-1	-2	-3
111-120	0	1	-1	-2	-3	-3
121-130	0	0	-2	-3	-3	-3
131-140	-1	0	-3	-3	-3	-3
E. Return of Pulse Rate to Standing Normal after Exercise		F. Systolic Pressure, Standing, Compared with Reclining				
Seconds	Points	Change in Mm.		Points		
0-60	3	Rise of 8 or more	3			
61-90	2	Rise of 2-7	2			
91-120	1	No rise	1			
After 120: 2-10 beats above normal	0	Fall of 2-5	0			
After 120: 11-30 beats above normal	-1	Fall of 6 or more	-1			

May¹⁴⁹ and Lereboullet and Heitz¹⁵⁰ discuss the Pachon oscilometer, which gives valuable information by the amplitude of the oscillation. Lereboullet and Heitz say that it reveals apparent death in the new-born, shows maximal and minimal blood pressure, the condition of the peripheral circulation and the relative vasoconstriction of different arteries. May says the oscilometer index (amplitude of vibration) is the result of different factors, and that dividing this index by the difference between the maximal and minimal pressure gives an oscilometer ratio which is a true record of the vascular elements of the pulse.

BLOOD VOLUME

Löwy,¹⁵¹ using Bangs micromethod, determines the *sodium chlorid content of capillary blood* and then injects 400 c.c. of isotonic glucose solution intravenously. Immediately afterward, and sometimes five or ten minutes later, the sodium chlorid value is again determined. Then the total blood volume = $\frac{a_2 b}{a_1 - a_2}$ where a_1 equals the salt content before infusion; a_2 the salt content after infusion; and b the amount of

149. May, E.: Presse méd. 28:423 (June 26) 1920.

150. Lereboullet, P., and Heitz, J.: Paris méd. 10:1 (July 3) 1920.

151. Löwy, J.: Zentralbl. f. inn. Med. 41:337 (May 8) 1920.

fluid infused. The total blood volume normally is from one-eighteenth to one-twelfth of the total weight. Löwy gives the error of the method as not being over 5 per cent. Boenheim and Fischer¹⁵² consider Löwy's principle as good but say that the method used for the sodium chlorid determination is not accurate enough to give even approximate results. In a series of four studies on blood volume, Hooper, Smith, Belt and Whipple;¹⁵³ Dawson, Evans and Whipple;¹⁵⁴ and Smith,¹⁵⁵ determined the soundness of the dye blood volume method which has an error of not more than 5 per cent.; and the behavior of a series of dyes, selecting vital red as the one for use. McQuarrie and Davis¹⁵⁶ outline a method of reading refractometrically the serum protein increase after injecting a known amount of gelatin or acacia solutions. This method has the advantage of not being affected by hemolysis, cholemia or lipemia. Harris¹⁵⁷ suggests substituting congo red for vital red because the sodium salt of congo red is red, and the free acid form is blue. Changing it to blue for color comparison rules out any effect from hemolysis. The optimal interval for the withdrawal of blood after injection of dye is about twice the circulation time or two and one half minutes for man. His formulas are:

$$\begin{aligned}\text{Volume of plasma} &= \frac{\text{Dilution factor} \times \text{No. of C.c. of dye injected}}{\text{Ratio of strength of dye in plasma}} \\ \text{Volume of blood} &= \text{volume of plasma} \times \frac{100 \text{ per cent.}}{\text{Per cent. of plasma by hematocrit}} \\ \text{Weight of blood} &= \text{volume} \times \text{specific gravity.}\end{aligned}$$

Salvesen¹⁵⁸ finds that the average blood volume in six healthy young subjects is 5.95 c.c. per 1,000 gm. of body weight or from one-fourteenth to one-nineteenth of the body weight.

Plesch¹⁵⁹ determines the *volume of blood discharged during phases of the heart cycle* by the amount of oxygen given off by arterial blood. The oxygen consumption is determined by the respiratory metabolism; the amount of oxygen held in the blood by a special type of hemoglobi-nometer, and then the oxygen content of blood from heart by the rubber bag apparatus.

152. Boenheim and Fischer: Zentralbl. f. inn. Med. **41**:553 (Aug. 7) 1920.

153. Hooper, C. W.; Smith, H. P.; Belt, A. E., and Whipple, G. H.: Am. J. Physiol. **51**:205 (March) 1920.

154. Dawson, A. B.; Evans, H. M., and Whipple, G. H.: Am. J. Physiol. **51**:232 (March) 1920.

155. Smith, H. P.: Ibid. p. 221.

156. McQuarrie, I., and Davis, N. C.: Ibid. p. 257.

157. Harris, D. T.: Brit. J. Exper. Path. **1**:142 (June) 1920.

158. Salvesen: J. Biol. Chem. **40**:109 (Nov.) 1919.

159. Plesch, J.: Deutsch. med. Wchnschr. **45**:1401 (Dec. 18) 1919.

BLOOD CONCENTRATION

Rubow¹⁶⁰ by restricting the fluid intake to about one-third of the twenty-four hour requirement, reduces the water content of the blood as much as 12.5 per cent. in a few days. Rominger¹⁶¹ finds that the water content in the blood of infants is remarkably stable. Water passes readily from the stomach to the blood, but with the exception of decomposition cases the hydreemia is transient.

Blood concentration means a failing circulation, an inefficient oxygen distribution, oxygen starvation, decreased temperature and finally death. In influenza, while edema of the lungs is indirectly concerned, Underhill and Ringer¹⁶² believe that blood concentration is the immediate cause of death. The hemoglobin content is used as an index of concentration, and treatment to combat the concentration should be begun before the blood concentration has reached 125 per cent. of the individuals normal hemoglobin value. Wilson and Goldschmidt¹⁶³ believe that the loss of water from the blood in the development of lung edema is the cause of blood concentration and not imbibition of water by tissues as a result of oxygen want. Hill's¹⁶⁴ views oppose those of Wilson and Goldschmidt, but stagnation is considered the factor in causing oxygen want.

Lutz and Schneider¹⁶⁵ find that the cardiac and respiratory centers are stimulated by a decrease in oxygen and inhibited by an increase in oxygen. The heart responds in from five to fifty-five seconds to an oxygen decrease. Barcroft¹⁶⁶ divides *anoxemia* into three types, (a) the anoxic type with general condition low and low oxygen pressure, (b) the anemia type gaged by the quantity of oxygen liberated from the blood, and (c) the stagnant type with increased hemoglobin.

THE ACID-BASE EQUILIBRIUM AND ALKALI RESERVE

Studies on the alkali reserve and the acid-base equilibrium have been fewer in number during the past year and there has been more of an attempt made to establish normal and comparable values. Collip¹⁶⁷ finds that alkali reserve is either unaltered or diminished during sleep. Haskins and Osgood¹⁶⁸ use the Van Slyke titration method as a class room method, but find that students have difficulty in matching a clear

160. Rubow, V.: Hospitalstidende **63**:305 (May 19) 1920; Abstr. J. A. M. A. **75**:514 (Aug. 14) 1920.

161. Rominger, E.: Ztschr. f. Kinderh. **26**:23 (July 28) 1920.

162. Underhill, F. P., and Ringer, M.: J. A. M. A. **75**:1531 (Dec. 4) 1920.

163. Wilson, D. W., and Goldschmidt, S.: Am. J. Physiol. **50**:157 (Oct.) 1919.

164. Hill, L.: Lancet **1**:359 (Feb. 14) 1920.

165. Lutz, B. R., and Schneider, E. C.: Am. J. Physiol. **50**:327 (Dec.) 1919.

166. Barcroft, J.: Lancet **2**:485 (Sept. 4) 1920.

167. Collip, J. B.: J. Biol. Chem. **41**:473 (April) 1920.

168. Haskins, H. D., and Osgood, E. F.: J. Lab. & Clin. M. **6**:37 (Oct.) 1920.

phosphate standard with the turbid plasma, so they add raw starch to the standard, making it also turbid, and the students get better results. Haggard,¹⁶⁹ in a paper forming a portion of the studies on hemato-respiratory functions, reports that an increase in the body temperature lowers the alveolar carbon dioxid tension and reduces the amount of carbon dioxid in the blood. No compensatory changes occur in the carbon dioxid combining power of the blood. The alkali in use is not lowered in proportion to the decrease in the carbon dioxid dissolved so that the $C_2H_2O : NaHCO_3$ ratio is lowered and presumably the C_H value is lowered. Haggard and Henderson,¹⁷⁰ in three papers in the same series of studies, find that with low oxygen, over-breathing occurs before the blood alkali is appreciably reduced. Intravenous injection of lactic acid does not induce an acidosis at all commensurate with the amount administered, and an increase in the lactates in the blood or urine is probably an indication of a low $C_2H_2O : NaHCO_3$ ratio. Over-breathing throws off an excess carbon dioxid bringing the carbon dioxid ratio below normal. This alkalosis is compensated by the disappearance of alkali from the blood. The process is reversed by normal oxygen tension and acidosis recalls the alkali to the blood. The barometric pressure to which one is acclimated is the fundamental factor controlling the volume of air breathed per unit mass of carbon dioxid eliminated, the alveolar carbon dioxid tension, and the amount of alkali called into use in the blood. Haggard¹⁷¹ finds that the corrections in the Henderson-Morris method for determining carbon dioxid in plasma and whole blood almost exactly neutralize each other and the gas burette readings may be taken direct each 0.01 c.c. = 1 volume per cent. of carbon dioxid.

Collip and Backus¹⁷²⁻¹⁷³ finds that the carbon dioxid combining power of the plasma is an approximate index of the alkali reserve of the body fluids in normal animals. The C_H of the spinal fluid is protected to a greater degree than that of blood; the carbon dioxid combining power of spinal fluid as compared with plasma is at a high level in shock. Forced breathing washes out the carbon dioxid from the blood, but the tissues give a buffer reaction, taking up alkali, which accounts for the rapid return to normal when the forced breathing stops. The tetany and muscle cramps developing during hyperpnea would appear to be due to tissue alkalosis. Grant and Goldman's¹⁷⁴ experiments seem to substantiate this view.

169. Haggard, H. W.: *J. Biol. Chem.* **44**:131 (Oct.) 1920.

170. Haggard, H. W., and Henderson, Y.: *J. Biol. Chem.* **43**:15 (Aug.) 1920.

171. Haggard, H. W.: *J. Biol. Chem.* **42**:237 (June) 1920.

172. Collip, J. P., and Backus, P. L.: *Am. J. Physiol.* **51**:551 (April) 1920.

173. Collip, J. P., and Backus, P. K.: *Ibid.* p. 568.

174. Grant, S. B., and Goldman, A.: *Am. J. Physiol.* **52**:209 (June) 1920.

The effect of hemorrhage on the alkali reserve is studied by Buell¹⁷⁵ who finds that the drop in alkali reserve is slight if the animal is quiet; and by Tatum¹⁷⁶ who believes that a change in the acid-base balance in the body cells is responsible for rise in blood sugar after hemorrhage. *Ether anesthesia affects alkali reserve.* Carter¹⁷⁷ finds that the carbon dioxid combining capacity of dog's blood diminishes after the first hour of anesthesia, the amount being in direct proportion to the duration of the anesthetic, and the diminished alkali reserve continues for from one-half to one hour after the anesthetic. Prentice, Lund and Harbo¹⁷⁸ give the figures for alkali reserve as 0.23 before ether falling from 0.016 to 0.018 with ether. Raymond¹⁷⁹ finds that the fall in alkali reserve is relatively insignificant in acute shock, but with late shock the plasma may show a high alkali reserve. The condition of the animal cannot be judged by the alkali reserve. Adams and Sturges¹⁸⁰ find in fifty-four cases of effort syndrome that the carbon dioxid falls within normal limits, the combining power of the blood is normal and there is no indication that there is a decrease in the buffer salts of the blood.

The acid-base equilibrium of the blood is disturbed in acute tubular nephropathies. MacNider¹⁸¹ thinks this shows the tubular part to be more important in the maintenance of acid base equilibrium than the vascular portion. With experimental infections Hirsch¹⁸² finds that the blood alkali reserve is lowered at the time of the initial leukocytosis, then rises to, or above, the original level. In epidemic influenza and bronchopneumonia, Hachen and Isaacs¹⁸³ consider a comparison of the alkali reserve and the temperature as important in prognosis. With an alkali reserve of 46 or lower, the prognosis is good. With an alkali reserve of from 46 to 52, the prognosis is indefinite. With an alkali reserve of 53 and over, the prognosis is good. Sullivan and Stanton,¹⁸⁴ studying the alkali reserve in pellagra find little uncompensated acidosis. Henderson and Haggard¹⁸⁵ accelerate the elimination of carbon monoxid in carbon monoxid asphyxia by using a mixture of carbon dioxid and oxygen.

175. Buell, M. V.: J. Biol. Chem. **40**:29 (Nov.) 1919.

176. Tatum, A. L.: J. Biol. Chem. **41**:59 (Jan.) 1920.

177. Carter, W. S.: Arch. Int. Med. **26**:319 (Sept. 15) 1920.

178. Prentice, W.; Lund, H. O., and Harbo, H. G.: J. Biol. Chem. **44**:211 (Nov.) 1920.

179. Raymond, B.: Am. J. Physiol. **53**:109 (Aug.) 1920.

180. Adams, F. D.; Sturgis, D. C., and Sturges, C. C.: Am. J. M. Sc. **158**:816 (Dec.) 1919.

181. MacNider, W. de B.: Arch. Int. Med. **26**:1 (July) 1920.

182. Hirsch, E. F.: J. A. M. A. **75**:1204 (Oct. 30) 1920.

183. Hachen, D. S., and Isaacs, R.: J. A. M. A. **75**:1624 (Dec. 11) 1920.

184. Sullivan, M. X., and Stanton, R. E.: Arch. Int. Med. **26**:41 (July) 1920.

185. Henderson, Y., and Haggard, H. W.: J. Pharmacol. & Exper. Therap. **16**:11 (Aug.) 1920.

FERMENTS IN BLOOD

Lewis and Mason¹⁸⁶ find no constant relation between the variation in level of the blood ferments in nephritis and the progress of the disease. Fujimoto¹⁸⁷ thinks that diastatic substance passes from the pancreas to the liver where it is mixed with blood and lymph and its output is regulated by the liver. This is based on the fact that hepatotoxin decreases the diastase content of peripheral blood, while pancreatoxin and neurotoxin have no effect. Catalases, according to Reimann and Becker,¹⁸⁸ decrease in the blood in 65 per cent. of the cases during anesthesia. In anemia, Krumbhaar and Musser¹⁸⁹ find the catalase index (the catalase content divided by the hemoglobin content or the red blood cell count) of value in spite of wide individual variation. In anemias the catalase index varies from 15 to 53, with an average of 37+.

NITROGEN IN THE BLOOD

The study of nitrogen distribution in the blood of children results in the establishment of a better understanding of the normal. Utheim¹⁹⁰ finds that the serum protein in normal infants is from 6 to 6.5 per cent. until the tenth or eleventh month, when the protein begins to rise and reaches the adult level of about 8 per cent. by the fifteenth month. In athreptic and premature infants the protein may be as low as 4 per cent. Chapin and Meyers¹⁹¹ report the findings on chemical examination of the blood of 149 children, including thirty-eight nephritics and six diabetics. They are similar to adults but the kidney of a child is more efficient, and nephritis does not result so quickly in urea retention as in adults. Stransky¹⁹² examined the residual nitrogen in eighty-five children, including fifty infants. The high nitrogen content of the blood of the newborn has no clinical significance and diminishes by the end of the first week, after which the findings scarcely differ from those of early childhood. The values range from 40 to 50 mg. per 100 gm. of blood. Hammett¹⁹³ says that while total nitrogen, nonprotein nitrogen and sugar in the blood vary in the same person from week to week, the sum of the average deviation of the constituents for any given individual may be the *index of metabolic stability* for that person.

186. Lewis, D. S., and Mason, E. H.: J. Biol. Chem. **44**:455 (Nov.) 1920.

187. Fujimoto, B.: Am. J. Physiol. **50**:208 (Nov.) 1919.

188. Reimann, S. P., and Becker, C. E.: Am. J. Physiol. **50**:56 (Oct.) 1919.

189. Krumbhaar, E. B., and Musser, J. H.: J. A. M. A. **75**:104 (July 10) 1920.

190. Utheim, K.: Am. J. Dis. Child. **20**:366 (Nov.) 1920.

191. Chapin, H. D., and Meyers, V. C.: Am. J. Dis. Child. **18**:555 (Dec.) 1919.

192. Stransky: Monatschr. f. Kinderh. **19**:10 (Oct.) 1920.

193. Hammett, F. S.: J. Biol. Chem. **41**:599 (April) 1920.

Smith, Belt and Whipple¹⁹⁴ call attention to the remarkable stability of *serum protein concentration*.¹⁹⁵ When serum protein is depleted by interval bleeding and reinjection of washed corpuscles, there is an emergency reaction in fifteen minutes, then a gradual rise during the first twenty-four hours, and a more sluggish increase the next few days. The physiologic value of serum protein is not understood, but it may be a stabilizing value. With too great a dilution of serum proteins there is cell injury and clinical shock.¹⁹⁶

Cullen and Van Slyke¹⁹⁷ partition the fibrin, globulin and albumin in the blood by means of nitrogen determinations. The fibrin nitrogen is determined directly, and globulin and albumin nitrogen are determined from the figures for total nitrogen, nonprotein nitrogen and fibrin nitrogen. In *glomerulonephritis and arteriosclerotic nephritis* Fitz¹⁹⁸ finds no relationship between the nonprotein nitrogen in the blood, the phenolsulphonephthalein test and the type of nephritis. Jacobson and Edwards¹⁹⁹ say the blood urea level is governed by previous diet, fluid retention, and unknown metabolic factors and is not a reliable index of nitrogen retention.

In anesthesia and after operations Reiman and Hartman²⁰⁰ find blood urea and nonprotein nitrogen increased in all cases. Martin and Denis,²⁰¹ studying the chemical changes in the blood following roentgen-ray treatment of *leukemia* report that there is no connection between the white count and the uric acid concentration. In cases with a high nonprotein nitrogen there is a gradual fall, creatinin values are normal, urea is low, and uric acid is persistently high. Martin and Denis suggest that in leukemia there is a nitrogen compound in the white cells not accounted for in the present methods of microblood analysis.

In *pernicious anemia* and *severe anemias* Peters and Rubnitz²⁰² report that the nitrogen index $\frac{\text{per cent. whole blood nitrogen}}{\text{per cent plasma nitrogen}}$ is lowered and it may be used to indicate the state and progress of the anemic condition. Gettler and Lindeman²⁰³ give figures for nonprotein nitrogen, urea nitrogen, amino-acid nitrogen, uric acid and creatinin in the blood obtained from thirty-two cases of *pernicious anemia*. Aminoacid

194. Smith, H. P.; Belt, E. A., and Whipple, G. H.: Am. J. Physiol. **57**: 54 (May) 1920.

195. Smith, H. P.; Belt, E. A., and Whipple, G. H.: Ibid. p. 72.

196. Smith, H. P.; Belt, E. A., and Whipple, G. H.: Ibid. p. 101.

197. Cullen, G. E., and Van Slyke, D. D.: J. Biol. Chem. **41**:587 (April) 1920.

198. Fitz, R.: Boston M. & S. J. **183**:247 (Aug. 26) 1920.

199. Jacobson, A. T. B., and Edwards, H.: Am. J. M. Sc. **159**:833 (June) 1920.

200. Reimann, S. P., and Hartman, F. L.: Am. J. Physiol. **50**:56 (Oct.) 1919.

201. Martin, C. L., and Denis, W.: Am. J. M. Sc. **160**:223 (Aug.) 1920.

202. Peters, A. W., and Rubnitz, A. S.: Arch. Int. Med. **26**:561 (Nov.) 1920.

203. Gettler, A. O., and Lindeman, E.: Arch. Int. Med. **26**:453 (Oct.) 1920.

nitrogen is always increased, and ninety per cent. of cases have increased uric acid, while the serum proteins may be reduced from 40 to 50 per cent.

In *influenzal pneumonia*, Wells²⁰⁴ finds most fatal cases show an increase of blood uric acid, the average being 4.45 mg. per 100 c.c. of blood as contrasted with an average in the nonfatal cases of 3.14 mg. per 100 c.c. Pemberton and Foster²⁰⁵ find a high blood creatinin in 50 per cent. of the cases of *arthritis* which in some cases declines with improvement. Dufour and Semelaigne,²⁰⁶ in a case of *epileptiform seizures* after injections of neo-arsphenamin find an increase in the blood urea from 0.25 to 0.40 at normal times to 0.84 a few hours before a seizure. Loeper, Thinj and Tonnet²⁰⁷ report profound alterations in the nitrogen equilibrium of the blood with residual nitrogen increased and urea nitrogen decreased in cancer patients. The frequent increase in blood urea without renal change is significant.

BLOOD SUGAR

Methods for the accurate estimation of blood sugar are still unsettled. The work of Cowie and Parsons²⁰⁸ shows that the picrate solution used in the Lewis-Benedict method is sensitive to epinephrin in 0.025 mg. per cent., to acetone in blood solutions but not in water solutions, to diacetic acid and to creatinin. Creatinin does not often interfere. They suggest that the hyperglycemia occurring in emotional states may be due to epinephrin thrown into the circulation without mobilizing the glycogen stores in the liver. Rassero²⁰⁹ finds both crystalloid and colloid elements in the serum from cattle, sheep, rabbits and guinea-pigs that produce vasoconstricting action on intestinal muscle, uterine muscle of cats and artery muscles in cattle. These substances resemble epinephrin. Lippmann²¹⁰ finds that the drop in the freezing point in diabetes does not parallel the intensity of the glycemia, and this indicates disturbance in the mechanism regulating the osmotic tension of the blood, and that other reducing substances beside glucose are present.

Feigl²¹¹ modifies Bangs' micromethod for blood examination obtaining results with extracts from as small a quantity as 200 mg. of blood

204. Wells, C. W.: Arch. Int. Med. **26**:443 (Oct.) 1920.

205. Pemberton, R., and Foster, G. L.: Arch. Int. Med. **25**:243 (March) 1920.

206. Dufour, H., and Semelaigne, G.: Bull. et mém. Soc. méd. d. hôp. de Par. **44**:58 (Jan. 16) 1920.

207. Loeper, Thinj, and Tonnet: Progrès méd. **35**:159 (April 10) 1920.

208. Cowie, D. M., and Parsons, J. P.: Arch. Int. Med. **26**:333 (Sept.) 1920.

209. Rassero, J. R. F.: Nederlandsch Tijdschr. v. Geneesk. **1**:785 (March 6) 1920.

210. Lippmann, A.: Zentralbl. f. inn. Med. **41**:41 (Jan. 17) 1920.

211. Feigl, J.: Zentralbl. f. inn. Med. **41**:17 (Jan. 10) 1920.

and using picrate reduction for sugar. Silvestri and Aiello²¹² object to Bangs' micromethod and offer a modification of Bertrand's method after adding a known amount of glucose to the solution. Wallis and Gallagher²¹³ give a new microchemical method for estimation of sugar in blood.

Mertz²¹⁴ analyzes the literature and decides that the carbohydrate metabolism of infants and young children obeys the same laws as adults. Strause²¹⁵ finds variations in the normal blood sugar due to weather conditions, all the curves in a group of individuals being higher in March than in September. Water intake and excretion do not affect blood sugar. Alimentary hyperglycemia reaches its height in normals in half an hour and descends at once, while in diabetes the height is reached in one hour, and descends slowly. Brösamlen and Sterke²¹⁶ find a marked reduction in blood sugar after physical exertion. Asphyxial blood transfused into rabbits, in Yamakami's²¹⁷ experiments causes a rise in the blood sugar content, which is not due to the sugar in the asphyxial blood injected. Delatour²¹⁸ thinks that the pancreas produces substances that favor metabolism of sugar which explains the hyperglycemia in depancreatized dogs. Ross and Davis²¹⁹ conclude that the hyperglycemia with ether is due to reduction of the influence of the internal secretion of the pancreas. Rhodenburg and Pohlman²²⁰ think that the hyperglycemia following injection of fats and polypeptids which are supposed not to produce antibody production, is protective and may be a test to check antibody production when neither precipitin, agglutinins or lysins can be demonstrated. Friedenwald and Grove²²¹ find that carcinomia of the gastrointestinal tract gives a characteristic blood sugar tolerance curve, whether cachexia exists or not.

BLOOD LIPOIDS

Burns²²² thinks that the origin of xanthoma multiplex is an increase in the blood cholesterin with deposits of cholesterin in the skin.

Schippers²²³ questions whether the low fat content of the blood (about half the normal content) in infants with exudative diathesis

212. Silvestri, S., and Aiello, G.: *Policlinico*, Rome **27**:643 (June 21) 1920.

213. Wallis, R. L. M., and Gallagher, C. D.: *Lancet* **2**:784 (Oct. 16) 1920.

214. Mertz, A.: *Arch. f. Kinderh.* **68**:254 (Oct. 16) 1920.

215. Strause, S.: *Arch. Int. Med.* **26**:751 (Dec.) 1920.

216. Brösamlen, O., and Sterkel, H.: *Deutsch. Arch. f. klin. Med.* **130**:358 (Oct. 24) 1919.

217. Yamakami, K.: *Am. J. Physiol.* **50**:177 (Nov.) 1919.

218. Delatour, B. J.: *Arch. Int. Med.* **25**:1542 (April) 1920.

219. Ross, E. L., and Davis, L. H.: *Am. J. Physiol.* **53**:391 (Oct.) 1920.

220. Rhodenburg, G. L., and Pohlman, H. E.: *Am. J. M. Sc.* **159**:853 (June) 1920.

221. Friedenwald, J., and Grove, G. H.: *Am. J. M. Sc.* **160**:313 (Sept.) 1920.

222. Burns, F. S.: *Arch. Dermat. and Syph.* **2**:415 (Oct.) 1920.

223. Schippers, J. C.: *Nederlandsch Tijdschr. v. Geneesk.* **2**:1081 (Sept. 18) 1920; *Abstr. J. A. M. A.* **75**:1530 (Nov. 27) 1920.

may not throw light on the nature of the anomaly. Strathmann-Herwig²²⁴ finds that breastfed and artificially fed infants who are normal have the same cholesterol content in the blood serum. Cholesterol is usually increased in infections and decreased in anemia and infantile scurvy. Richter-Quittner²²⁵ says that normally cholesterol is divided about equally between the blood plasma and the corpuscles. Free cholesterol occurs only in the corpuscles, and cholesterol esters in the plasma, but with disease processes, free cholesterol may occur in the plasma also together with the cholesterol esters. Chaffard, Laroche and Grigaut²²⁶ report a marked drop in cholesterol in the blood during the febrile states, with a high rise after defervescence in moderate cases, but no rise in mild or severe cases. Cholesterol probably has an antitoxic action and presides over the antibody formation. Hypercholesterinemia occurs in chronic nephritis and may be a differential diagnostic point ruling out cardiac edema. Henes²²⁷ finds hypercholesterinemia usually in cases of chronic nephritis that are progressing favorably. He also assigns a protective rôle to cholesterol. Blood lipoids play a part analogous to antitoxin. They seem to act as a protection and to counteract certain poisonous substances. Beumer²²⁸ notes that the hypercholesterinemia in nephroses is independent of edema and fever and could not be influenced by restriction of fat or lipid in the diet.

Kipp²²⁹ finds that transfusion of whole blood does not alter the cholesterol content in the blood in cases of pernicious anemia, and in pneumonia he finds a primary hypocholesterinemia dependent in degree on the activity of the leukocytes, a secondary hypercholesterinemia and the return to normal.²³⁰ The variations are dependent on the leukocytes, and the lipoids act as an antitoxic substance.

HYPERINDICANEMIA

Van Vloten²³¹ tabulates the indican and the urea content of the blood serum from forty patients showing the variations with diet and the importance of blood indican for prognosis. The normal range limits by different observers run from 1.4 to 1.8 mg. per liter. In uremia,

224. Strathmann-Herwig: *Monatschr. f. Kinderh.* **19**:20 (Oct.) 1920.

225. Richter-Quittner, M.: *Arch. f. inn. Med.* **1**:425 (June 1) 1920.

226. Chaffard, A.; Laroche, G., and Grigaut, A.: *Ann. de Méd.* **8**:69 (Aug.) 1920.

227. Henes, E.: *Arch. Int. Med.* **25**:411 (April) 1920.

228. Beumer, H.: *Arch. f. Kinderh.* **68**:64 (Aug. 31) 1920.

229. Kipp, H. A.: *J. Biol. Chem.* **43**:383 (Sept.) 1920.

230. Kipp, H. A.: *J. Biol. Chem.* **44**:215 (Nov.) 1920.

231. Van Vloten, W. J. Van B.: *Nederlandsch Tijdschr. v. Geneesk.* **2**:585 (Aug. 14) 1920; *Abstr. J. A. M. A.* **75**:1170 (Oct. 23) 1920.

the urea and the indican content do not run parallel, although there is usually indicanemia; when it is persistently high, even though the urea content is normal, the prognosis is grave.

INORGANIC CONSTITUENTS IN BLOOD

Scheer²³² finds that the *chlorid level in the blood* serum of infants is dependent on the secretion of gastric juice. During digestion the chlorin level declines; to rise after the stomach is emptied. Host,²³³ using Bangs' micromethod, finds that the chlorids exist chiefly in the serum and less in the corpuscles. Fredericia²³⁴ confirms Van Slyke's work on the partition of chlorids between the plasma and the corpuscles. Rodillon,²³⁵ and Meyers and Short²³⁶ give new modifications or methods for determining the chlorids in blood. Rodillon calls the chlorids in the blood the index of kidney condition.

Denis and Minot²³⁷ study the *phosphate retention in the blood in nephritis*. In 65 per cent. of the nephritis cases there was definite retention of inorganic phosphates in the plasma. In eleven fatal cases there was a premortal rise to as much as ten times the normal value.

The *calcium content of the blood* is still a matter of great interest. An editorial²³⁸ in the *Journal of the American Medical Association* summarizes the uses of calcium in bones, in the clotting of blood and milk, in the maintenance of physiologic equilibrium, in the preservation of normal vessel permeability, and in the normal irritability of parts of the nervous system. Stheeman and Arntzenius²³⁹ consider the "calcipriva stigma" the basis for spasmophilia, habitus asthenicus and universal asthenia. In fifty-eight healthy children the calcium content of the blood was constantly between 12 and 13 mg. per 100 c.c. of serum; in six children the range was from 8.25 to 17 mg. per 100 c.c. of serum.²⁴⁰ The figures are low in prerachitic conditions, intestinal infantilism, tuberculosis and asthenia, the severity of the condition being reflected in the decrease in calcium. Erb's sign is nearly always positive with a low calcium content, becoming more and more positive as the calcium deficit becomes greater. Chvostek's sign has the same significance. In rachitis the calcium content in the blood may be high, but the

232. Scheer, K.: *Jahrb. f. Kinderh.* **91**:347, 1920.

233. Host, H. F.: *J. Lab. & Clin. M.* **5**:713 (Aug.) 1920.

234. Fredericia, L. S.: *J. Biol. Chem.* **42**:245 (June) 1920.

235. Rodillon: *Presse méd.* **28**:85 (Jan. 31) 1920.

236. Meyers, V. C., and Short, J. J.: *J. Biol. Chem.* **44**:47 (Oct.) 1920.

237. Denis, W., and Minot, A. S.: *Arch. Int. Med.* **26**:99 (July) 1920.

238. Editorial, *J. A. M. A.* **75**:941 (Oct. 2) 1920.

239. Stheeman, H. A., and Arntzenius, A. K. W.: *Nederlandsch Tijdschr. v. Geneesk.* **1**:1030 (March 27) 1920.

240. Stheeman, H. A., and Arntzenius, A. K. W.: *Nederlandsch Tijdschr. v. Geneesk.* **1**:1168 (April 3) 1920.

calcium in the tissues is actually deficient. It is evident from the positive Erb's sign that there is more than one kind of calcium in the blood, one efficient for growth and one nonefficient. The calcium content of the serum is important, but the calcium balance does not tell whether there is calcium impoverishment or calcium abundance until combined with nerve signs. Handowsky²⁴¹ is unable to find any difference in the calcium range in adults with a positive Chvostek sign and adults without a positive Chvostek. Jacobowitz²⁴² finds children free from tetany have a higher calcium level in the blood than children with tetany.

Kramer and Howland²⁴³ show that the calcium in the blood serum as determined by their method is remarkably constant in adults, the normal content being from 9 to 10 mg. per 100 c.c. of serum. The decrease in tetany may be more than 50 per cent.

Denis and Minot,²⁴⁴ and Clark²⁴⁵ substantiate the findings that calcium by mouth, or intravenously or subcutaneously and the feeding of diets rich in calcium does not make any appreciable difference in the calcium content of bones, blood and other tissues. Stheeman and Arntzenius²³⁹ point out that cod liver oil and phosphorus promote the retention of calcium in the body. Krehbiel²⁴⁶ finds that the blood calcium is within normal limits in cancer and obliterating arteritis, showing that calcium metabolism is not a factor in cancer.

TESTS FOR OCCULT BLOOD

Penn²⁴⁷ makes a smear of feces on a microscope slide, spreads two or three drops of glacial acetic acid over the smear, and heats gently over a flame. On the addition of one or two drops of benzidin dissolved in alcohol and the same amount of hydrogen peroxid, a dark blue color develops almost immediately if blood be present. The method commends itself as rapid and simple. Boas²⁴⁸ says the reagents are often too strong in the benzidin test. He used 0.5 per cent. benzidin solution and in place of hydrogen peroxid he used barium dioxid which is more stable. With the test used in this way very slight hemorrhages may be missed.

RED BLOOD CORPUSCLES

The *hemoglobin content* shows a diurnal variation which commonly reaches 10 per cent. but may reach 30 per cent. (Dreyer, Bazett and

241. Handowsky, I.: *Jahrb. f. Kinderh.* **91**:432, 1920.

242. Jacobowitz, S.: *Jahrb. f. Kinderh.* **92**:256, 1920.

243. Kramer, B., and Howland, J.: *J. Biol. Chem.* **43**:35 (Aug.) 1920.

244. Denis, W., and Minot, A. S.: *J. Biol. Chem.* **41**:357 (March) 1920.

245. Clark, G. W.: *J. Biol. Chem.* **43**:89 (Aug.) 1920.

246. Krehbiel, O.: *J. Cancer Res.* **5**:199 (April) 1920.

247. Penn, S.: *Med. J. Australia* **1**:525 (June 5) 1920.

248. Boas, I.: *Berl. klin. Wchnschr.* **56**:939 (Oct. 6) 1919.

Pierce,²⁴⁹) the excursions being more marked with a low hemoglobin content. McEllroy²⁵⁰ uses the fact that potassium ferricyanid does not liberate oxygen from methemoglobin but does from hemoglobin to determine the amount of methemoglobin. Total hemoglobin is determined, then the oxygen capacity and the difference gives the methemoglobin. Hemoglobin in itself has been held to be toxic, but Bayliss²⁵¹ finds that hemolysis in itself does not cause injury, hemoglobin is harmless when circulating free in plasma, and can carry oxygen. The results of the transfusion of incompatible blood are probably due to the action of a foreign protein.

To study the blood of animals in vitro, Normet²⁵² injects sodium citrate into the circulation. He demonstrates to his own satisfaction the development of blood corpuscles, eosinophils and erythrocytes, direct from the mononuclear leukocytes by a process of budding which is a method of cell reproduction not suspected in metazoa. Rieux²⁵³ gives the "genealogic tree of the blood corpuscle" showing additional stages preceding the mature erythrocytes and polymorphonuclears. The presence of the normomegaloblastic reaction, of nuclear relics and basophil granular erythrocytes are signs of recuperation of blood forming elements, and signs that the bone marrow is capable of producing blood corpuscles. Bockhoven²⁵⁴ thinks that basophil inclusions in the erythrocytes must be nuclear remnants and are signs of grave import. Walterhöfer²⁵⁵ says their pathologic significance lies not in the inclusion bodies in the erythrocytes but in the fact that red cells with azurophil inclusion bodies appear in the peripheral circulation. They are new cells, traceable to some bone marrow reaction. Cunningham²⁵⁶ suggests that the reticulated net work in the red blood cells may give a clue to the age of the cell, those with reticulation being immature and being an index to the hematopoietic activity. To stain the reticulum, smear a small drop of a 0.5 per cent. solution of brilliant cresyl blue over a small area on the slide, let dry, then wipe off the thick margin. Take a fresh blood drop on a cover slip, drop face down over the area of stain, make a smear and dry. Stain with Wright's stain. The reticulum is deep or light blue. Bauer and Buschner²⁵⁷ testing the "resistance

249. Dreyer, G.; Bazett, H. C., and Pierce, H. F.: *Lancet* **2**:588 (Sept. 18) 1920.

250. McEllroy, W. S.: *J. Biol. Chem.* **42**:297 (June) 1920.

251. Bayliss, W. M.: *Brit. J. Exper. Path.* **1**:1 (Feb.) 1920.

252. Normet: *Bull. de l'Acad. de méd. Par.* **83**:163 (Feb. 24) 1920; *Abstr. J. A. M. A.* **74**:1489 (May 22) 1920.

253. Rieux, J.: *Arch. d. mal. du cœur* **13**:254 (June) 1920.

254. Bockhoven, M.: *Ztschr. f. klin. Med.* **89**:304, 1920.

255. Walterhöfer, G.: *Deutsch. med. Wchnschr.* **46**:116 (Jan. 29) 1920.

256. Cunningham, T. D.: *Arch. Int. Med.* **26**:405 (Oct.) 1920.

257. Bauer, J., and Buschner: *Deutsch. Arch. f. klin. Med.* **130**:172 (Sept. 26) 1919.

range" of erythrocytes to varying concentration of salt solution find the widest range in severe anemias, and the smallest range in mild tuberculosis. The range varies in the same person at different times, and the younger erythrocytes have the highest resistance.

Craik²⁵⁸ uses doses of lead by mouth to produce polychromatic and punctated red corpuscles. These marked discs in the circulation are young corpuscles, and they are means of tracing malarial parasites. Multiple infections of the marked discs suggest that the youngest corpuscles are the least resistant to the plasmodium.

Wyss²⁵⁹ presents evidence that in the blood circulation erythrocytes are round or egg shaped, but that they collapse with the escape of the oxygen when the blood is drawn. Taylor²⁶⁰ finds that most of the red blood corpuscles injected subcutaneously do not reach the circulation as cells, although the hemoglobin is raised by such an injection.

Kambe and Komiya²⁶¹ conclude that preserved erythrocytes may retain their physiologic properties and live a normal length of life after transfusion. In transfusion after hemorrhage, nucleated forms may be absent so that the newly supplied cells prevent stimulation of the blood forming organs. In a blood effusion in a cadaver exhumed seven months after death, Straussmann²⁶² finds the red blood corpuscles unchanged, and well preserved, the lymphocytes present but altered, and the polymorphonuclears gone completely.

The sedimentation or sinking velocity of blood corpuscles in paresis is increased to about one-sixth of the time required in dementia praecox. Plant²⁶³ says that acceleration of sedimentation is a pathologic sign whose significance has not been determined, but the acceleration in pregnancy may have a diagnostic value. Linzenmeier²⁶⁴ finds that the sedimentation time for corpuscles in the blood of nonpregnant women is five or six hours, while in pregnant women from the fourth month on, the time is less than two hours, decreasing to fifty minutes in the last three months.

Goodman²⁶⁵ finds an increase in red blood cells following inflation of the peritoneal cavity with oxygen; that this may be due to the mechanical effect of pressure on venous trunks is shown by the fact that the same effect can be produced in rabbits by nitrogen inflation.

258. Craik, R.: *Lancet* **1**:1110 (May 22) 1920.

259. Wyss, O.: *Schweiz. med. Wchnschr.* **50**:226 (March 18) 1920.

260. Taylor, R.: *Am. J. Dis. Child.* **20**:337 (Oct.) 1920.

261. Kambe, H., and Komiya, E.: *Am. J. Physiol.* **53**:1 (Aug.) 1920.

262. Straussmann, G.: *Berl. klin. Wchnschr.* **56**:994 (Oct. 20) 1919.

263. Plant, F.: *München. med. Wchnschr.*, March 5, 1920, p. 279.

264. Linzenmeier, G.: *Zentralbl. f. Gynäk.* **44**:816 (July 24) 1920.

265. Goodman, C.: *J. A. M. A.* **74**:1515 (May 29) 1920.

Gregg, Lutz and Schneider²⁶⁶ contrast the theories of blood concentration versus a dormant supply of erythrocytes as the cause of fluctuations in the distribution of hemoglobin and erythrocytes under states of low oxygen tension. The question seems to have been settled in a satisfactory manner by records taken on the summit of Pike's Peak and at Cripple Creek during the summer of 1903 when comparisons between the curves of the red corpuscle increase, the hemoglobin and the specific gravity from daily records on six normal healthy individuals, show that the increase and daily fluctuation cannot be accounted for by different degrees in blood concentration (Kemp²⁶⁷) and must be due to a storage of mobile red corpuscles.

POLYCYTHEMIA

Thaysen²⁶⁸ makes systematic red counts over a long period of time in polycythemia. There are remarkable fluctuations of as much as 5,000,000 in a period of twenty-four hours. This is explained by varying contraction and dilation of skin capillaries due to an unstable vasomotor system. An editorial²⁶⁹ in the *Journal of the American Medical Association* states that the real factor in polycythemia is unknown, that splenic tuberculosis as a cause has been abandoned. There are two accepted causes, for true polycythemia, one hyperplasia of the erythroblastic bone marrow, and the other a decrease in the rate of destruction of the red corpuscles. Lamson²⁷⁰ says that *acute polycythemia* is always due to blood concentration, no matter whether it be physiologic, as the polycythemia in emotional states, or produced by local irritation or the injection of histamin. Bing²⁷¹ reports four cases of polycythemia with duodenal ulcer. The polycythemia here may be due to abnormal loss of sodium chlorid.

Weber²⁷² classifies the *secondary forms of polycythemia rubra* as: (1) Polycythemia hypertonica; no splenomegaly; blood pressure, 180 mm.; (2) splenomegalic polycythemia rubra, with tuberculosis or other splenic disease; (3) secondary polycythemia rubra, with splenomegaly and portal stasis, and (4) chronic cardiopulmonary cyanosis or Ayerza's disease.

266. Gregg, H. W.; Lutz, B. R., and Schneider, E. C.: *Am. J. Physiol.* **50**: 216 (Nov.) 1919.

267. Kemp, G. T.: *Am. J. Physiol.* **10**:33, 1903-1904.

268. Thaysen, T. E. H.: *Ugesk. f. Læger* **82**:473 and 514 (April 8 and 15) 1920.

269. Editorial, *J. A. M. A.* **74**:1781 (June 26) 1920.

270. Lamson, P. D.: *J. Pharmacol. & Exper. Therap.* **16**:125 (Sept.) 1920.

271. Bing, H. I.: *Ugesk. f. Læger* **82**:337 (March 11) 1920.

272. Weber, F. P.: *Brit. M. J.* **2**:658 (Oct. 30) 1920.

True polycythemia rubra in Herrenheiser's²⁷³ case was an instance of increased production of red cells and reduced rate of destruction. Böttner²⁷⁴ recommends irradiation of the long and short bones controlled by the blood picture. The roentgen-ray therapy of the spleen should be limited to irritative doses.

ANEMIAS

The question of the value of *iron in the treatment of anemias* is still under controversy. Nageli²⁷⁵ thinks that in proper dosage iron elicits a strong bone marrow reaction throwing quantities of young red cells into the blood stream. Alder²⁷⁶ says the improvement with Blaud's pills reaches its acme in three weeks, and then remains stationary. Hooper, Robscheit and Whipple²⁷⁷ show that Blaud's pills have no influence in simple secondary anemias even when combined with varied diets.²⁷⁸ Of the diets of value in secondary anemia, cooked lean beef heart and cooked liver are important for blood regeneration in dogs. Water extracts of meat and liver are not so effective.²⁷⁹ Bread and milk diet does not give complete regeneration after hemorrhage, while the increase in red blood cells and hemoglobin is greater in a fasting animal than in one fed on sugar.²⁸⁰

Larrabee²⁸¹ considers *aplastic anemia* a type of an anemia group. Most benign anemias are due to an increased destruction or loss of blood ce'ls, to compensate which some of the yellow bone marrow changes to red marrow, produces new corpuscles and then returns to the normal adult condition. In pernicious anemia there is intense marrow hyperplasia which still is not sufficient to balance the destruction. In aplastic anemia the marrow does not produce even the normal amount of blood cells and there is no compensatory hyperplasia. In aplastic anemia the power to produce red corpuscles, myelocytic leukocytes and platelets is all involved. The platelet decrease and prothrombin decrease explains the tendency to hemorrhage. Purpura hemorrhagica is probably an incomplete form of aplastic anemia, only the platelet producing power being affected. Mensi²⁸² adds to the cases of

273. Herrnheiser, G.: Deutsch. Arch. f. klin. Med. **130**:315 (Oct. 24) 1920.

274. Böttner, A.: Deutsch. med. Wchnschr. **46**:66 (Jan. 15) 1920.

275. Nägeli: Schweiz. med. Wchnschr. **50**:661 (July 29) 1920; Abstr. J. A. M. A. **75**:966 (Oct. 2) 1920.

276. Alder, A.: Ibid., p. 663.

277. Hooper, C. W.; Robscheit, F. S., and Whipple, G. H.: Am. J. Physiol. **53**:263 (Sept.) 1920.

278. Whipple, G. H.; Hooper, C. W., and Robscheit, F. S.: Am. J. Physiol. **53**:151 (Sept.) 1920.

279. Hooper, C. W.; Robscheit, F. S., and Whipple, G. H.: Ibid., p. 206.

280. Whipple, G. H.; Robscheit, F. S., and Hooper, C. W.: Ibid., p. 286.

281. Larrabee, R. C.: J. A. M. A. **75**:1630 (Dec. 11) 1920.

282. Mensi, E.: Pediatria, Naples **28**:785 (Sept.) 1920.

pernicious anemia in children reported in the literature, making a total of twenty-nine cases. The etiology is obscure after the elimination of a few cases due to syphilis, tuberculosis and intestinal parasites. Meulengracht²⁸³ reports *familial pernicious anemia* developing in four sons and the son of one daughter. This familial occurrence confirms the assumption of one or more endogenous factors.

Kaznelson²⁸⁴ cites a case of *hemolytic anemia* dating from childhood, in which splenectomy ended the symptoms but did not eradicate the disease. Fraginoli²⁸⁵ studied nine cases of hemolytic jaundice. The characteristic feature is the presence of numerous nucleated red corpuscles, megaloblasts, without sufficient anemia to account for them. This, he considers, is due to the persistence of megaloblast-producing tissue which normally undergoes involution soon after birth. The persistence of this one element throws the whole system out of gear. Clark and Evans²⁸⁶ suggest that the reason why hemolysis does not occur in normal blood is because the serum has a protective power against the natural hemolysins in the blood. If this protective power be diminished the normal hemolytic substances may act without any increase in the hemolysin or the introduction of foreign hemolysins. Ordinarily, the protective power is a constant, but in the anemias, especially with splenic involvement, the protective power is diminished.

Hallez²⁸⁷ reports two cases of anemia with splenomegaly in infants. Tuohy's²⁸⁸ case was associated with a leukocytosis of 65,000, 99 per cent. of the leukocytes being polymorphonuclears. In embryos up to the fourth month both spleen and bone produce red blood cells. After the fourth month, erythrocytes and myeloblasts are formed almost entirely from bone marrow and the spleen functions in blood destruction, the two hyperfunctioning coordinately. The method of leukocyte destruction and replacement is not known.

In hemolytic anemias, Speidel, Hoff and Nickson²⁸⁹ suggest partial splenectomy. In dogs partial splenectomy is accompanied by distinct polycythemia. Biffis,²⁹⁰ Losio²⁹¹ and Hartmann²⁹² report cases in

283. Meulengracht, E.: Ugesk. f. Læger **82**:777 (June 17) 1920; Abstr. J. A. M. A. **75**:644 (Aug. 28) 1920.

284. Kaznelson, P.: Wien. Arch. f. inn. Med. **1**:563 (Aug.) 1920.

285. Fraginoli, A.: Policlinico, Rome **27**:337 (Sept.) 1920.

286. Clark, H. M., and Evans, F. A.: Bull. Johns Hopkins Hosp. **31**:354 (Oct.) 1920.

287. Hallez, G. L.: Nourrisson, Paris **8**:154 (May) 1920.

288. Tuohy, E. L.: Am. J. M. Sc. **60**:18 (July) 1920.

289. Speidel, W. C.; Hoff, E., and Nickson, D. H.: Northwest Med. **19**:94 (April) 1920.

290. Biffis, P.: Policlinico **26**:393 (Nov.) 1919.

291. Losio, L.: Ibid., p. 410.

292. Hartmann, H.: Bull. de l'Acad. de méd. Par. **83**:599 (June 29) 1920; Abstr. J. A. M. A. **75**:571 (Aug. 21) 1920.

which the spleen was removed. Cushing and MacCallum²⁹³ report two cases of splenic anemia with splenectomy in 1898. So little has been added to our knowledge of the pathology of the spleen that MacCallum's report in 1898 is included unchanged. The blood changes after removal of the spleen in a case without anemia, were studied by Hall.²⁹⁴ The leukocyte count was increased for three months with no eosinophilia. The Arneth index suggests that the increase is due, in part, to the removal of some factor restricting the production of white corpuscles. Henn²⁹⁵ finds in experimental animals that the corpuscles of splenectomized dogs are more strongly resistant to hypotonic sodium chlorid solutions than in control animals; and in young animals the coagulation time is hastened. Downs and Eddy²⁹⁶ find that the subcutaneous injection of free splenic extract is followed immediately by a temporary decrease in the number of the red blood cells.

Sappington²⁹⁷ reports another case of Gaucher's disease bringing the total of authentic cases with histologic examinations to twenty-five cases.

THE LEUKOCYTES

Loeper²⁹⁸ studied the leukocytosis in animals after the injection of epinephrin. The mononuclear leukocytes seem to share in the production of antibodies, and increasing numbers presage recovery and immunity. Sprunt and Evans²⁹⁹ report six cases of acute tonsillitis, infections of the upper respiratory tract and moderate general lymphadenitis in which there was a mononuclear leukocytosis. Audain³⁰⁰ says that invading infections are combated by polymorphonuclear leukocytes when the region invaded is poor in lymphoid elements; but when lymphoid elements are present, they assume the local defense and mononucleosis is the rule. With infections of the lungs and bladder there is a polynucleosis throughout. Infections of the intestine, glands and spleen show a mononucleosis. If the lymphoid elements are not equal to the task, it is begun by the polymorphonuclears until the mononuclears become adequate for the defense. Ruppanner³⁰¹ finds that persons coming to the mountains have a pronounced leukocytosis at first, an acclimation leukocytosis, which yields in about six weeks to the moun-

293. Cushing, H., and MacCallum, W. G.: *Arch. of Surg.* **1**:1 (July) 1920.

294. Hall, M. W.: *Am. J. M. Sc.* **160**:72 (July) 1920.

295. Henn, C. S.: *Am. J. Physiol.* **52**:562 (July) 1920.

296. Downs, A. W., and Eddy, N. B.: *Am. J. Physiol.* **51**:279 (March) 1920.

297. Sappington, S. W.: *J. A. M. A.* **75**:105 (July 10) 1920.

298. Loeper, M.: *Progrès méd.* **35**:37 (Jan. 25) 1920.

299. Sprunt, T. P., and Evans, F. A.: *Bull. Johns Hopkins Hosp.* **31**:410 (Nov.) 1920.

300. Audain, L.: *Presse méd.* **28**:796 (Nov. 6) 1920.

301. Ruppanner, E.: *Schweiz. med. Wchnschr.* **50**:105 (Feb. 5) 1920.

tain leukocyte picture, i.e. a total count at the low range of normal, with the percentage of lymphocytes above normal and the neutrophil percentage below normal.

Otani³⁰² finds an increased phagocytic power for the particular species of invading organisms. The acceleration may be an immunologic reaction, making an early diagnosis of tuberculosis, typhoid and dysentery possible. Tunnicliff³⁰³ finds that injections of leukocyte extracts produce an increase in the number and in the activity of the leukocytes.

Schilling³⁰⁴ thinks the number of nuclear lobes in the neutrophil polymorphonuclears is as important as the pulse in examinations of the heart. Displacement to the left in the Arneth classification is a constant clinical symptom in some infections. Friedburg³⁰⁵ gets no effect on the white blood corpuscles by stimulation of the vegetative nervous system in children. There is no vagotonic or sympathetotonic blood picture. The eosinophils have a tendency to parallel the lymphocyte variations, and the mononuclears parallel the polymorphonuclears.

Giffin³⁰⁶ reports a persistent eosinophilia of 73.6 per cent. in a case with a leukocytosis of 21,800 and splenomegaly. Removal of the spleen increased the eosinophils to 90.7 per cent. and the leukocytes to 211,000. A special function of the spleen with respect to eosinophil cells or with respect to the toxins the eosinophils absorb is suggested. Klinkert³⁰⁷ considers eosinophilia a sign of a constitutionally inferior autonomic nervous system entailing a predisposition to asthma, gout, urticaria and migraine.

Pepper³⁰⁸ diagnosed a case of typhoid fever on the finding of numerous cells resembling endothelial leukocytes in the urine. Tryon³⁰⁹ gives the leukocyte reactions in paratyphoid dysentery and after vaccination. The differential counts are not so variable as the total counts, and in all cases the platelet count was high. Ingles³¹⁰ finds a definite but variable *leukocytosis in trench fever*. Both polymorphonuclears and nongranular cells are increased, the nongranular cells being the more numerous which may be a factor in differential diagnosis of trench fever.

302. Otani, M.: Med. Rec. **97**:439 (March 13) 1920.

303. Tunnicliff, R.: J. Infect. Dis. **26**:447 (May) 1920.

304. Schilling, V.: Ztschr. f. klin. Med. **89**:1, 1920.

305. Friedburg, E.: Monatschr. f. Kinderh. **18**:432 (Aug.) 1920.

306. Giffin, H. Z.: Am. J. M. Sc. **158**:618 (Nov.) 1919.

307. Klinkert, D.: Ztschr. f. klin. Med. **89**:143, 1920.

308. Pepper, O. H. P.: Am. J. M. Sc. **160**:336 (Sept.) 1920.

309. Tryon, G.: Boston M. & S. J. **183**:643 (Dec.) 1920.

310. Ingles, W. K.: Med. J. Australia **2**:431 and 454, 1919.

Canelli³¹¹ calls attention to the fact that azurophilia is not a blood finding that is specific for measles, being also found in pneumonia and scarlet fever; but the *azurophilia in measles* is so marked and pronounced that it may aid in differential diagnosis.

Schilling³¹² reports two cases of ulcerative endocarditis giving very high mononuclear leukocyte counts. Rosenow³¹³ considers the leukopenia of influenza due to the peculiar properties of the streptococci or other organisms associated with the disease.

Escomel³¹⁴ examines blood for bacteria before any surgical operations. The blood is mixed with 15 c.c. of a 1 per cent. acetic acid solution, centrifuged and the supernatant fluid poured off. The sediment is washed with physiologic serum, and stained smears made from the sediment show leukocytes, bacteria and parasites.

LEUKEMIA

Decastello³¹⁵ calls attention to the occurrence of *Bence-Jones proteinuria* in leukemia. It seems to originate in a pathologic condition of the bone marrow. Howell³¹⁶ finds that six of eight patients with leukemia produced no agglutinins after injection of typhoid vaccine. This suggests that in leukemia the power to produce anticellular antibodies also resides in the hematopoietic tissue.

Tancré³¹⁷ reports a case of acute lymphatic leukemia developing after a suppurating process at the umbilicus. Ward³¹⁸ considers the preleukemic states in infancy, referring to the large series of cases of Von Jaksch's disease reported by Martelli.³¹⁹ The blood may show a myeloid blood picture with slight leukocyte increase, a few myelocytes and anomalous cells, Tuerck cells, plasma cells and large mononuclears, and perhaps a few nucleated red cells, and a color index of over one. Gunewardene³²⁰ followed the development of such a case through to a definite myelogenous leukemia picture.

Fitz³²¹ reports the simultaneous occurrence of diabetes and myelogenous leukemia in one patient, which he believes are independent of each other. Ravenna³²² cites three cases of *myelogenous leukemia*

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- 311. Canelli, A. F.: Rev. di clin. Pediatrica **18**:82 (Feb.) 1920.
 - 312. Schilling, V.: Ztschr. f. klin. Med. **88**: 1919.
 - 313. Rosenow, E. C.: J. Infect. Dis. **26**:492 (June) 1920.
 - 314. Escomel, E.: Anales de la Facultad de med. de Lima **3**:12 (July-Aug.) 1920; Abstr. J. A. M. A. **75**:1601 (Dec. 4) 1920.
 - 315. Decastello, A.: Wien. Arch. f. inn. Med. **1**:335 (June 1) 1920.
 - 316. Howell, K. M.: Arch. Int. Med. **26**:706 (Dec.) 1920.
 - 317. Tancré, E.: Arch. f. Kinderh. **67**:7 (Nov. 30) 1918.
 - 318. Ward, G.: Brit. J. Child. Dis. **17**:18 (Jan.-March) 1920.
 - 319. Martelli, C.: Gazz. Internaz. di Med., 1919. Quoted from Ward.
 - 320. Gunewardene, T. H.: Brit. J. Child. Dis. **17**:9 (Jan.-March) 1920.
 - 321. Fitz, R.: J. A. M. A. **75**:1331 (Nov. 13) 1920.
 - 322. Ravenna, F.: Riforma med. **36**:86 (Jan. 24) 1920.

systematically treated with benzol. The effect is purely symptomatic and the symptoms return in a more grave form. Lafleur's ³²³ patient improved under the combination of benzene and Roentgen-ray treatment.

THE BLOOD PLATELETS

Marchesini ³²⁴ thinks platelets result from the debris of unstable red corpuscles. The process of platelet formation may be watched in the large erythrocytes of frogs and birds. Mallory and Medlar ³²⁵ find interesting changes in blood plates under the dark field microscope. At first, the platelets are round or ovoid, then they elongate into threads and star-shaped bodies with threadlike projections showing serpentine movement. In stained preparations these platelets give the reaction of fibrin.

Gram ³²⁶ uses the Thomsen method of obtaining a homogeneous suspension of platelets in plasma, and then dilutes 1:20 with a 2 per cent. solution of liquor formaldehyd in 0.9 per cent. sodium chlorid solution and counts direct in a Thoma Zeiss chamber. ³²⁷ This gives the number of platelets per c. mm. of citrated plasma. This figure is multiplied by constants which are determined by the hemoglobin content to find the number of plates in whole blood. The normal count is between 300,000 and 450,000. Pernicious anemia with a platelet count of under 100,000 tends to terminate fatally without remissions. Jost ³²⁸ finds that platelet extract by the mouth shortens the coagulation time and tends to arrest hemorrhage.

THE COAGULATION OF THE BLOOD

Several new methods for determining the coagulation time of blood are given. Gram ³²⁹ finds that too low recalcinations of citrated plasma lengthen the coagulation time. He uses the sedimentation plasma from the Thomsen method for counting blood plates because in the centrifugalized specimen the blood platelets are thrown down with the reds, and the coagulation time is doubled in normal bloods but not in bloods where the platelets are deficient. In hemophilia, the coagulation time is lengthened with a normal platelet count. This may be used for the diagnosis of the hemorrhagic diathesis. Love ³³⁰ determines the coagu-

323. Lafleur, H. A.: *Canad. M. A. J.* **10**:996 (Nov.) 1920.

324. Marchesini, R.: *Policlinico* **27**:227 (Feb. 23) 1920.

325. Mallory, F. B., and Medlar, E. M.: *J. M. Res.* **41**:327, 1920.

326. Gram, H. C.: *Arch. Int. Med.* **25**:325 (March) 1920.

327. Gram, H. C.: *Ugesk. f. Læger* **82**:718 (June 3) 1920; *Abstr. J. A. M. A.* **75**:282 (July 24) 1920.

328. Jost, W.: *Cor.-Bl. f. schweiz. Aerzte* **49**:1909 (Dec. 11) 1919.

329. Gram, H. C.: *Bull. Johns Hopkins Hosp.* **31**:364 (Oct.) 1920.

330. Love, G. R.: *Med. Rec.* **98**:436 (Sept.) 1920.

lation time by means of capillary tubes. The blood is drawn into paraffined test tubes and within two minutes is sucked up in capillary tubes and the time taken. Two minutes before the normal coagulation time, 2 cm. of the first tube is broken off drawing the fragments gently apart to avoid injuring the fibrin thread. Other segments of tube are broken off until the time interval is such that the fibrin thread will stretch from 7 to 10 mm. across the break. This is the end point. Rodda³³¹ uses a drop method, the drops from the heel of the baby being received in a clean watch glass containing a No. 6 shot. A second watch glass is inverted over the first. The crystal is tilted every thirty seconds, until the shot no longer rolls. The average clotting time for a new-born baby is seven minutes with a range of from five and one-half to eight and one-half minutes. King and Murray³³² draw the blood into open tubes with attachment below for a stop cock and a Luer needle. Two c.c. are drawn into the tube direct from the vein and kept at a temperature of from 65 to 90 F. The coagulation time is the nearest half minute from the instant the blood first appears to the moment when the tube may be inverted without displacing the clot.

The *coagulation time* in embryonic blood of the pig, according to Emmel, Levinson and Fisch,³³³ is six or eight times that of the adult, although the platelet count is the same. Platelet material from the adult and calcium chlorid both reduce the coagulation time, but not as much as the addition of tissue extract which makes the coagulation time the same as the adult. Stephan³³⁴ studies the active and inactivated blood serum and blood plasma of the specimen to be tested with the action of normal serums and plasms; and the effect of normal blood serum and blood plasma of a known value on the coagulation time of the unknown specimen. This gives the pathologic factors. With his method, the coagulation time of normal blood is from twenty-eight to thirty-three minutes.

Corachan and Mones³³⁵ insist on the value of the *warning of the coagulation index* as a pre-operative test. When the coagulation time is slow 3 or 4 grains of calcium chlorid per day, before the operation, may bring the coagulation time up to normal. Petrén³³⁶ tests coagulation of blood in jaundice by the bile-acid-alkali test. Normally from 0.55 to 0.66 per cent. of bile-acid-alkali is necessary to prevent coagulation. If

331. Rodda, F. C.: Am. J. Dis. Child. **19**:269 (April) 1920.

332. King, G., and Murray, H. A.: J. A. M. A. **74**:1452 (May 22) 1920.

333. Emmel, V. E.; Levinson, S. A., and Fisch, M. E.: J. Exper. M. **31**: 117 (Feb.) 1920.

334. Stephan, R.: Deutsch. med. Wchnschr. **46**:684 (June 17) 1920.

335. Corachan, M., and Mones, F. G.: Siglo méd., Madrid **66**:935 and 960 (Nov. 1) 1919; Abstr. J. A. M. A. **74**:68 (Jan. 3) 1920.

336. Petrén, G.: Beitr. z. klin. chir. **120**:501, 1920.

from 0.45 to 0.40 per cent. prevents coagulation, there is danger of hemorrhage during or after operation; if 0.30 per cent. prevents hemorrhage, operations are contraindicated.

Kinsella and Brown³³⁷ report a retarded coagulation time and a decrease in the platelet count in influenza.

Szenes³³⁸ finds that after an initial retardation, *irradiation of the spleen* accelerates the coagulation time, doubtless due to the breaking down of lymphocytes in the splenic follicles liberating thromboplastic substances. Jurasz³³⁹ thinks irradiation of the spleen with roentgen rays may prove effective in stopping hemorrhage, and be of value from twelve to fifteen hours before operation in cases in which the coagulation time is lengthened. Stephan³⁴⁰ has used this method successfully in a case of purpura fulminans.

Mills³⁴¹ finds that extract of the lung and kidney, and to a lesser degree extracts of skin, possess a strong coagulative activity. The potency of the lung may be a special protection in pulmonary diseases. Tait³⁴² thinks that the arrest of hemorrhage is due to the agglutination of certain cells "thigmocytes" which are highly phagocytic and on breaking down exude thrombin. When anticoagulants are added, the thigmocytes (platelets and spindle cells) are unaltered. Foreign surfaces and dirt give surfaces to which the cells may adhere, and become altered. Houssay and Sordelli³⁴³ find that twenty-two venoms, including cobra venom, prevent coagulation by destroying cytozym which normally combines with serozym and calcium to form thrombin, but that lachesis and crotalus venoms have a special coagulating power that coagulates even citrated blood. Menten³⁴⁴ finds that the anticoagulant power of hirudin and cobra venom is destroyed by an increase in acidity, while with peptone prevention the acidity is always increased, so that the mechanism differs with peptone.

The relationship between *coagulation time in the blood of the newborn and cerebral hemorrhage* becomes increasingly important with the discovery that cerebral hemorrhage is found in more than 50 per cent. of all necropsies on infants dying during the first few days of life. Rodda³⁴⁵ finds that coagulation time and bleeding time are prolonged from the first to the fifth day of life, with the maximal retardation on

337. Kinsella, R. A., and Brown, G. O.: J. A. M. A. **74**:1070 (April 17) 1920.

338. Szenes, A.: München. med. Wchnschr. **67**:786 (July 2) 1920.

339. Jurasz, A. T.: Zentralbl. f. Chir. **47**:824 (July 3) 1920.

340. Stephan, R.: München. med. Wchnschr. **67**:309 (March 12) 1920.

341. Mills, C. A.: J. Biol. Chem. **40**:425 (Dec.) 1919.

342. Tait, J.: J. Physiol. **53**:19 (Sept. 5) 1919.

343. Houssay, B. A., and Sordelli, A.: Prensa méd. Argentina **6**:113 (Oct. 20) 1919; Abstr. J. A. M. A. **74**:140 (Jan. 10) 1920.

344. Menten, M. L.: J. Biol. Chem. **43**:381 (Sept.) 1920.

345. Rodda, F. C.: J. A. M. A. **75**:452 (Aug. 14) 1920.

the fifth day and a return to normal on the tenth day. The delayed times correspond to the age incident of hemorrhagic disease and cerebral hemorrhage. The coagulation time may be brought back to normal by the subcutaneous injection of blood—which Voncken³⁴⁶ calls homo-hemotherapy. Foote³⁴⁷ says that blood coagulation tests should be routine examinations on all newborn infants, and in every case of suspected intracranial hemorrhage substances to increase blood coagulability are indicated.

HEMOPHILIA

Nobecourt³⁴⁸ says that the most effective treatment for hemophilia at present is horse serum and the subcutaneous injection of peptone solutions. He gives the treatment in detail. It gives marked improvement but is not a cure. After transfusion in Bulger's³⁴⁹ case of hemophilia, the coagulation time was the same as in the control, but both the coagulation time and the prothrombin time lengthened, but at the end of a month it was still less than before the transfusion. Weil³⁵⁰ controls his hemophilia cases by subcutaneous injection of 20 c.c. of animal or human blood serum every two months. Of fifty cases treated in fifteen years he has not lost one patient. He regards hemophilia as a congenital functional malformation of the elements in which blood and blood vessels originate. Chaliér³⁵¹ considers the mother's blood serum the most effectual treatment for congenital hemophilia.³⁵²

INTRACARDIAL AND INTRAVENCUS INJECTIONS

The controversy concerning the best method for *blood transfusion* is still unsettled, direct and indirect methods having their advocates. Schaaf³⁵³ says that the citrate method is the one of choice, and in pernicious anemia transfusion produces an immediate general improvement, but it has no curative value. Graham³⁵⁴ says that the ideal method is either direct from artery to vein or indirect from vein to vein without citrate. In pernicious anemia transfusion may cause remissions. The benefit is not necessarily in proportion to the volume of blood received. Terrien,³⁵⁵ instead of transfusing an infant 13 months

346. Voncken, J.: J. A. M. A. **75**:307 (July 31) 1920.

347. Foote, J. A.: Am. J. Dis. Child. **20**:18 (July) 1920.

348. Nobecourt, P.: Paris méd. **9**:452 (Dec. 6) 1919.

349. Bulger, H. A.: J. Lab. & Clin. M. **6**:102 (Nov.) 1920.

350. Weil, P. E.: Médecine, Paris **1**:354 (March) 1920.

351. Chaliér, J.: Rev. de méd. **36**:522 (Sept.-Oct.) 1919.

352. Chaliér, J.: Presse méd. **28**:773 (Oct. 30) 1920.

353. Schaaf, F. H. K.: Minnesota Med. **3**:382 (Aug.) 1920.

354. Graham, J. M.: Edinburgh M. J. **24**:282 (May) 1920.

355. Terrien, E.: Bull. et mém. soc. méd. d. hôp. de Par. **43**:1134 (Dec. 26) 1919.

old with malignant measles, injected whole blood subcutaneously with excellent results.

Van Dijk ³⁵⁶ calls attention to the development of malaria in a patient who was given serum from an influenza convalescent. The donor's blood contained no parasites at the time of transfusion although they had been present some months previous. Busman ³⁵⁷ calls attention to the fact new rubber tubing may give a marked reaction when it is used for transfusion. It is rendered harmless by soaking for six hours in normal sodium hydrate solution. Widakowich and Madrid ³⁵⁸ note that agglutination reactions in serum and in plasma differ. Normally, serum agglutinates alien erythrocytes more intensely than plasma, but in syphilitics, plasma agglutinates more than serum, and this is of importance in blood grouping for transfusion into a syphilitic. Kolmer and Matsumoto ³⁵⁹ point out that while all horse serum contains agglutinins for human erythrocytes, intravenous injection of horse serum does not introduce sufficient agglutinins and hemolysins to cause effects referable to intravascular agglutination.

Henschen ³⁶⁰ has succeeded in permanently *resuscitating the heart* after complete arrest by the direct injection of a stimulant. He injects epinephrin and pituitary extract directly into the left ventricle. In four cases the effect was instantaneous, but in only one case was recovery complete and permanent. Henschen thinks this is the only successful case on record. He gives illustrations showing five danger zones to be avoided in intracardial injections. Vogeler ³⁶¹ injected epinephrin directly into a heart which had ceased to beat, and in half a minute the heart was beating and respiration began, to stop again in about six minutes; a second injection had the same transient effect and the child died. Heydtoff ³⁶² injected epinephrin into the heart in a case in which there was total arrest of the heart for five or six minutes, and the heart began to beat rapidly. Artificial respiration was necessary for a time. This is a second case with recovery.

Aikman ³⁶³ discusses the methods for administration of saline and other solutions to children. In intravenous injections, one-sixtieth of the body weight can be introduced. In infants this is best done through

356. Van Dijk, H.: *Nederlandsch Tijdschr. v. Geneesk.* **2**:1181 (Sept. 25) 1920.

357. Busman, C. J.: *J. Lab. & Clin. M.* **5**:693 (Aug.) 1920.

358. Widakowich, V., and de Madrid, S.: *Semana méd.* **27**:296 (Feb. 26) 1920.

359. Kolmer, J. A., and Matsumoto, M.: *J. Immunol.* **5**:75 (March) 1920.

360. Henschen, K.: *Schweiz. med. Wchnschr.* **50**:261 (April 1) 1920; *Abstr. J. A. M. A.* **74**:1610 (June 5) 1920.

361. Vogeler, K.: *Deutsch. med. Wchnschr.* **46**:740 (July 1) 1920.

362. Heydtoff, E.: *Monatschr. f. Geburtsh. u. Gynäk.* **51**:318 (May) 1920.

363. Aikman, J.: *J. A. M. A.* **74**:244 (Jan. 24) 1920.

the fontanel, but with a closed fontanel either the jugular vein or the femoral vein should be used. Wentworth's technic for entering the femoral vein is given in detail. Friedmann³⁶⁴ is using the drop method for intravenous infusion. When there is increased lacrimal secretion or slight edema of the eyelids, it is a sign that the patient is getting too much fluid.

Pfalz³⁶⁵ uses glucose injections in heart disease when there is an indication that the heart is not sufficiently nourished. John³⁶⁶ uses intravenous injection of glucose solutions in pneumonia. None of the sugar appears in the urine and it all seems to be used for nutrition. Richaud³⁶⁷ points out that sugar solutions are less toxic than saline solutions and as much as a 1,300 c.c. of isotonic glucose, saccharose or lactose solution may be injected into the veins. Sugar tones up the heart and has an antitoxic action. Rathery and Boucheron³⁶⁸ inject hypertonic sugar solutions (30 per cent. glucose) intravenously to stimulate diuresis in selected cases of nephritis. It is contraindicated in chronic nephritis with "azotemia." Wells and Blankinship³⁶⁹ use the intravenous injection of hypertonic glucose solutions in influenzal pneumonia. It withdraws fluid from the body tissues to keep the blood isotonic, and the sugar content of the blood becomes normal without any glycosuria. Barthélemy³⁷⁰ uses intravenous injections of blood plasma and gum solutions. In cases in which blood pressure must be raised and sustained, gum saline solutions are especially indicated. Bayliss³⁷¹ says that gum acacia solutions (6 or 7 per cent. in 0.9 per cent. sodium chlorid solution) are capable of replacing lost blood unless the amount lost is more than 75 per cent. of the blood volume. It does not produce anaphylaxis, or hemolysis nor does it agglutinate blood corpuscles in man.

INTRAVENOUS THERAPY IN SHOCK

Bayliss³⁷¹ believes shock is due to the absorption of toxic substances produced by injured cells. Dale³⁷² finds that exhaustion, pain, cold, thirst, hemorrhage, anesthetics and histamin all have been alleged to play a part in shock. Widal, Abrami and Brissaud³⁷³ believe shock

364. Friedmann, M.: *Deutsch. Ztschr. f. Chir.* **151**:352 (Nov.) 1919.

365. Pfalz, W.: *Deutsch. med. Wchnschr.* **45**:1181 (Oct. 23) 1919.

366. John, H. J.: *Am. J. M. Sc.* **160**:542 (Oct.) 1920.

367. Richaud, A.: *Paris méd.* **10**:53 (July 17) 1920.

368. Rathery, F., and Boucheron, H.: *Bull. et mém. Soc. méd. d. hôp. de Par.* **44**:61 (Jan. 16) 1920.

369. Wells, C. W., and Blankinship, R. C.: *J. A. M. A.* **74**:75 (Jan. 10) 1920.

370. Barthélemy, M.: *Rev. de Chir.* **39**:271, 1920.

371. Bayliss, W. M.: *J. Pharmacol. & Exper. Therap.* **15**:29 (March) 1920.

372. Dale, H. H.: *Brit. J. Exper. Path.* **1**:103 (April) 1920.

373. Widal, F.; Abrami, P., and Brissaud, E.: *Presse méd.* **28**:181 (April 3) 1920.

is anaphylactic in its nature and due to a destruction of colloids. The most recent views on shock are summed up in two editorials in the *Journal of the American Medical Association*.³⁷⁴ Anything that causes a diminished volume of the blood that is in effective circulation attributable to loss of normal capillary tone, or to morbid permeability of the capillary walls is followed by a shocklike collapse.³⁷⁵ Gasser, Erlanger and Meek,³⁷⁶ in a series of studies on secondary shock, find the blood volume decreased in all experimental cases, and in treatment they conclude that the restoration of blood volume through osmotic action from the tissues is more efficacious than injecting the full amount of the fluid. Mann³⁷⁷ believes that colloid solutions are better than isotonic salt solutions for restoring blood volume but not as good as blood serum.

The most interesting development in intravenous therapy is the use of strongly hypertonic solutions. White and Erlanger³⁷⁸ point out that strongly hypertonic glucose and gum acacia solutions injected intravenously cause an immediate increase in blood volume. The crystalloids attract the fluids more rapidly, and the colloids tend to hold the fluid in the circulatory system for a longer period of time. The old rules requiring an absolutely isotonic solution for intravenous injection are swept to the winds by the report of Sachs and Belcher³⁷⁹ who gave 100 c.c. of a saturated solution of sodium chlorid intravenously at the rate of 1 c.c. per minute. The injection was repeated three successive times. This was a case of brain tumor in which the intracranial pressure was too high for a successful operation, and the saline injection reduced this pressure. The fragility of the red blood corpuscles on daily examinations never varied beyond the normal limits.

374. Editorial, J. A. M. A. **75**:247 (July 24) 1920.

375. Editorial, J. A. M. A. **74**:106 (Jan. 10) 1920.

376. Gasser, H. S.; Erlanger, J., and Meek, W. J.: *Am. J. Physiol.* **50**:31 (Oct.) 1919.

377. Mann, F. C.: *Am. J. Physiol.* **50**:86 (Oct.) 1919.

378. White, H. L., and Erlanger, J.: *Am. J. Physiol.* **54**:1 (Nov.) 1920.

379. Sachs, E., and Belcher, G. W.: *J. A. M. A.* **75**:665 (Sept. 4) 1920.