from the controls in the rate of disappearance of the "labelled" protein from the circulation. 2. Factors concerned with the interpretation of the data are discussed with reference to the effect of cortisone on protein metabolism.

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Composition of Meconium. Serological Study of Blood-Group-Specific Substances Found in Individual Meconiums.* (18696)

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Blood group substances with the same serological activity as the red blood corpuscles, while demonstrable in various secretions of the body, can not usually be found in feces. However, Witebsky and Satoh(1) mentioned that Yosida(2) had found blood group activity in meconium. Sekimoto(3,4) showed that some samples of human meconium exhibited high activity while others showed little. He separated the infants into secretors and non-secretors and believed that transition types might also be present. Okajima(5) found that the amount of blood group substance diminished rapidly after the first few days of life. Witebsky *et al.*(6) found that a blood-group-destroying-power first appeared in the lower ileum or caecum and that its effectiveness increased in the lower part of the large intestine. Thus in adults, the colon and rectum are free of the blood group activity. It was not determined whether this destroying principle, which was assumed to be an enzyme, is formed in the body or by bacteria growing in the intestinal tract. Blood group substances have also been demonstrated in saliva. However Schiff and Sasaki(7) found that some individuals do not possess the ability to secrete blood group substances. The ability to secrete these substances is hereditary and transmitted as a simple Mendelian dominant. The finding of large amounts of blood group substances in human meconium made it of great interest to determine whether their presence in meconium corresponded with the occurrence of blood group activity in saliva. Also, in view of the conflicting evidence(8,9) concerning the correspondence of the blood group activity of amniotic fluid and the blood type of the infant, comparative studies in this direction, with simultaneous determination of the activity of meconium, were undertaken.

The present report elaborates on the preliminary serological investigations of the blood-group-specific substances found in human meconium(10), while the chemical

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nature of meconium will be reported elsewhere (11).

Experimental. Methods. The blood samples were collected from the infant's heel, defibrinated, and typed with standard anti-A and anti-B serum, according to the usual procedures(12). The samples of saliva were collected on a sterile swab, which was immediately immersed in one cc of normal saline and heated for 5 minutes on a boiling water bath to destroy the enzymes which inactivate the blood-group-specific substances(13). The meconium samples were suspended in 3 times their weight of water. The presence of A and B blood group activity in the saliva and meconium was tested by the method of inhibition of agglutination as described by Morgan and King(14). Standard human anti-A and anti-B sera, which gave maximum agglutination at dilutions of 1:64 with normal saline, were diluted 1:8 for these determinations. 0.1 cc of the material to be tested was allowed to stand for an hour at room temperature with 0.1 cc of the diluted serum. 0.1 cc of a freshly prepared 0.5% suspension of washed A or B red cells in saline was then added. After 2 hours the amount of agglutination was determined macro- and microscopically. Absence of agglutination indicated the presence of active material. A sample of human anti-O serum was obtained from the Blood Grouping Laboratory, Boston, Mass. 0.1 cc of a 1:8 dilution of this serum with albumin (Armour, 0.3 g per cc) was allowed to stand with the sample to be tested for an hour at 4°C. A freshly prepared 0.5% suspension of type O red blood cells in 1:1 normal saline:albumin was added. After 2 hours, the amount of agglutination was determined.

Results. Blood Group Activity in Saliva, Meconium, and Blood.

Table I shows the comparison and correlation of the blood-group-specific substances found in the blood, saliva, and meconium of the infant.

TABLE I.
Comparison of Blood Group Substances Found in Blood, Saliva, and Meconium of the Same Infant.

No. of infants	Blood type	Saliva activity	Meconium activity*	Classification
16	A	A	$1:10^4$—$1:10^7$ A	A S†
4	A	——	——	A N
2	AB	A, B	$1:10^2$—$1:10^3$ A $1:10^3$B	AB S
7	B	B	$1:10^4$—$1:>10^7$ B	B S
3	B	——	——	B N
11	O	O	$1:10^2$—$1:10^3$ O	O S
8	O	——	——	O N
2	O	——	$1:10^2$ O	?

* The meconium was originally suspended in 3 times its weight of water. These figures represent approximate dilution of suspensions at which agglutination first appeared.

† S = secretors; N = non-secretors.

TABLE II. Summary of Blood-Group-Specific Substances in Meconium.

Classification	No.	%	
A secretors	16	22.9	28.6
A non-secretors	4	5.7	
AB secretors	2	2.8	2.8
B secretors	7	10.0	14.3
B non-secretors	3	4.3	
O secretors	11	——	54.3
O non-secretors	8	——	
O ?	2	——	
O not analyzed	17	——	
Total	70	——	100.0

A summary of the blood-group-specific substances found in meconium is shown in Table II. The total per cent figures indicate that the distribution of the various blood types can be correlated fairly satisfactorily with the average of those found in the United States. Wiener(15) states that the distribution of the various blood groups in the United States is as follows: 41% belong to type A, 4% to type AB, 10% to type B, and 45% to blood type O. In all cases except 2 the meconium possessed the same blood group activity as the saliva of the same baby. In all instances the activity found in the meconium corresponded with the blood type of the infant. The A and B determinations were all definite, except in the case of the two infants of type AB. The agglutinations of the blood of these infants formed slowly with anti-A serum, so possibly they belonged to

12. Wiener, A. S., *Blood Groups and Transfusion*, Springfield, Ill., 1943, 14.

13. *Ibid*, 278.

14. Morgan, W. T. J. and King, H. K., *Biochem. J.*, 1943, v37, 640

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TABLE III. Correlation of the Blood-Group-Specific Activity in Amniotic Fluid and Meconium.

Name	Classification of		Activity of	
	Mother	Baby	Amniotic Fluid	Meconium
S	AB secretor	B secretor	B	B
M	A non-secretor	O	No A*	No A
Sh	B secretor	O	No B	No B
H	B "	O	No B*	No B
W	B "	O	No B*	No B

* Artificially collected by a syringe from unbroken membranes.

a subgroup of A. This would also explain the low amount of blood group activity A in the meconium of these individuals.

The O activity was much lower in all cases. This may have been the result of the weak antigenicity of the blood type O specific substance. Generally any indication of O activity in the saliva was accompanied by some activity in the meconium. In two cases, the meconium possessed O activity, but there was no indication of activity in the saliva. It is possible that the tests as employed were not sufficiently sensitive to demonstrate the small amounts present in the saliva.

Tests for M, N, and Rh activity. Because meconium had proved such a rich source of the four main blood types, A, B, AB, and O, it was tested for M, N, and Rh activity. The meconiums of 6 infants, whose M and N blood type was known, were tested for M and N activity. No indication of activity was seen. These negative results correspond with the fact that M and N antigens appear to be restricted to the erythrocytes in normal individuals. In several instances, using the general procedure employed by Witebsky(16) for the detection of Rh activity in amniotic fluid, definite inhibition of agglutination occurred. However further work needs to be done to confirm these results.

Blood group activity of amniotic fluid and meconium. One of the classical theories of meconium formation is that it is the accumulation of fetal swallowing of amniotic fluid and products of endogenous formation. Amniotic fluid has also been shown to contain blood-group-specific substances. Putkonen(8) in 1930 stated that these substances corresponded to the blood type of the baby and not of the mother; however Kabat *et al.*(9) reported a case in which the type of substance in the amniotic fluid was A, corresponding to the blood type of the mother rather than to that of the infant, which belonged to the blood group O. In order to study these relationships further the amniotic fluid from a series of deliveries was collected. The blood and saliva of both mother and infant, and the meconium, were also obtained. In a series of 30 deliveries, 5 cases were found in which the mother had either A, B, or AB blood type and the baby a different blood type. The results on the saliva, meconium, and amniotic fluid are presented in Table III.

The results confirmed the work of Putkonen in that none of the blood-group-specific substances characteristic of the mother were found in the amniotic fluid. Whether the blood group substances in meconium resulted from an accumulation of swallowed amniotic fluid or whether the meconium was the source of the blood group substances in amniotic fluid was not determined.

The availability of a large and easily accessible source of human blood group substances in meconium obtained from human infants is of great theoretical and practical interest. It affords an unlimited supply of hitherto practically inaccessible blood group substances for serological and chemical study. It will also allow a comparison of the substances from human and animal sources.

Meconium also offers a great promise in blood transfusion as a source of neutralizing agents for agglutinins in pooled plasma or blood, since it is a very potent source of blood-group-specific substances which can be simply purified, and should be free of anaphy-

16. Witebsky, E. and Mohr, J. F., *J. Exp. Med.*, 1945, v82, 143.

lactic properties to humans.

Summary. 1. The blood-group-specific substances present in meconium from a series of 53 infants were found to correspond to the blood type of the baby and its ability to secrete blood group material in its saliva in all except 2 cases in which O activity was demonstrated in the meconium but could not be found in the saliva. 2. The meconiums of blood groups A and B were more active than those of groups AB or O. 3. No M or N activity could be demonstrated in meconium. 4. The blood-group-specific substances in amniotic fluid corresponded with the blood type of the baby and not that of the mother.

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Excitation of the Isolated Ventricular Septum of the Heart. (18697)

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One of the basic assumptions traditional in electrocardiographic interpretation is that the excitatory process in the ventricular septum starts symmetrically on either side and progresses toward its center. The potentials produced in the ventricular septum might then so neutralize one another that the manifest electromotive force recorded at a distance would be negligible. This hypothesis of ventricular septal excitation is most useful in the explanation of many electrocardiographic phenomena, but it has not been tested experimentally in any thorough manner.

In the dog's heart the arrangement of the coronary arteries includes a large septal branch which arises near the origin of the left coronary artery and passes directly into the musculature of the septum. With such an arterial supply insured, attempts were invited to perfuse the heart by the Langendorff technic with the free walls of the right and left ventricles removed. Under such circumstances the surfaces of the right and left side of the septum could be explored by an electrode under direct vision and the electrical activity recorded.

Methods. The heart was suspended from a cannula, tied in the aorta, through which the perfusate was introduced under pressure. Tyrode's solution with 1% added glucose was used routinely, though in the latter experiments approximately 100 cc of centrifuged erythrocytes were added to the total volume of perfusate (usually 2,000 cc). The lower one third to one half of the organ was submerged in the perfusate in a container beneath the heart. The distant electrode was placed in a corner of the container at a distance of approximately 15 cm from the heart. The reference tracing was uniformly obtained by recording the potentials between a wire electrode about the aorta and adjacent atria and a distant electrode. Relative positivity of the aortic electrode was represented by an upward deflection on the finished record. After stabilization of the heart rate the free walls of the right or left ventricle or both were excised nearly up to the atrioventricular groove. Routinely a band of ventricular muscle remained along the atrioventricular sulcus. This ridge of muscle was also removed in the later part of 2 experiments without alteration of the pattern of the reference tracing. The exploration of the septal surfaces was carried out by 3 technics: (1) by a bipolar method, in which the points from which the electrograms were obtained were approximately 1 mm distant from one another; (2) by a unipolar method in which a single electrode was used to explore the septal surface, and the potentials between it and the distant electrode were recorded; (3) by a bipolar method of recording wherein two electrodes were placed on opposing sides of the septum. All the utilizable records were obtained within one-half hour after the removal of the heart from the animal.

The recording equipment was a Sanborn