number of infants up to the age of 3 days. In the infants of this age who no longer demonstrate a shunt, either functional closure of the ductus arteriosus has occurred or, owing to a decrease in pulmonary vascular resistance, flow through the ductus has changed from the fetal to the adult direction. In most infants more than 3 days old, the ductus is either closed to the passage of blood or a change in direction of flow has occurred.

Further studies are being carried out in this laboratory to determine more accurately the incidence of this phenomenon and to study the factors that affect alterations of flow through the ductus.

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Evidence for a Diurnal Pulse in Stream Phytoplankton

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Since the discovery of stream plankton (potamoplankton) about 1890, an extensive literature has accumulated, which includes a number of merely qualitative lists of species from various rivers, many quantitative reports of phyto- and zooplankton, numerous 12-mo studies listing either qualitatively or quantitatively the species present in stream plankton, and a relatively small amount of experimental work. Much of this literature is reviewed by Des Cilleuls (*1*).

In small streams lacking impoundments, it appears that nearly all the organisms carried as plankters originate from the benthos as attached forms or, in many cases, as single cells or filaments mixed with the upper layer of sediments that settle in quiet areas. Steuer (*2*) lists eight environmental factors that regulate the potamoplankton both qualitatively and quantitatively, but no mention is made of the diurnal factor. It would seem that later authors would almost certainly have taken up this subject; however, a diligent search has yielded no reference to work dealing with diurnal changes in stream plankton.

During 1952 and much of 1953, the algae of the Saline River in southeastern Michigan were under close observation. The Saline is a small stream located in Washtenaw County about 7 mi south of Ann Arbor that is polluted by both domestic and industrial wastes. In the summer of both these years, this stream exhibited in its polluted portion a region about 4 km in length that was dominated by the benthic diatom *Nitzschia palea* (Kütz.) W. Smith growing in a conspicuous brown sheet or layer on submerged rocks or silt deposits. Filamentous algae were abundant at certain seasons, but at the time and place of the work here reported they did not represent a significant element of the plankton or an important vehicle for the transport of entrapped or epiphytic organisms.

A very dense net plankton composed almost entirely of *N. palea* can be collected from this stream in the summer months but only in and immediately below the course of the river within which *N. palea* is abundant as a bottom organism. The *Nitzschia* plankton is, therefore, obviously of benthic derivation. This appeared to be a favorable situation in which to find a diurnal variation in stream plankton, if indeed such a variation existed anywhere. Two locations were accordingly chosen, one near the middle (Saline Mills) and one near the downstream end of this 4-km portion, for making comparative observations at different hours of the day. At each point, the net plankton was sampled at dawn and in late afternoon of Aug. 13, 1953. Counts of this material showed that planktonic *N. palea* was much more abundant at both stations in the afternoon than at dawn.

In an effort to demonstrate a diurnal periodicity more clearly, plankton samples were then taken at approximately hourly intervals throughout a 24-hr period on Aug. 25 and 26, 1953, at the Maple Road station, which is about 5 km below the industrial and domestic sewage outfalls. Throughout the sampling period, the weather remained clear and cloudless. Fair or cloudless weather, favorable for algal growth, had furthermore prevailed for at least 2 wk prior to the sampling period. Water level remained approximately the same throughout this period, with a variation of ±1.5 mm recorded. Water temperatures varied between 17.8 (6:15 A.M., Aug. 25) and 24.0°C (4:10 P.M., Aug. 25), air temperatures between 15.0 (6:15 and 7:15 A.M., Aug. 25) and 31.7°C (2:10 and 3:10 P.M., Aug. 25). I estimate that at this time (Aug. 25–26) it required about 5.8 hr for water in midstream, at a surface speed of 1.9 m/sec, to pass from the upper reaches of the *Nitzschia* community to the sampling point at Maple Road.

All samples were surface water taken from exactly the same point in the stream. Plankton was collected, and 20-field counts made, with minor variations, according to the method of Verduin (*3*). Because of the difficulty of distinguishing dead cells from certain moribund cells, all diatoms both dead and living at the time of collection were counted. Few of the frustules were completely empty, although cells obviously dead made up a larger percentage of the total during

Table 1. Hourly totals for plankton organisms in the Saline River, 1953.

Time	*Nitzschia palea* (10^3 units/liter)	All other phytoplankters (10^3 units/liter)
Aug. 25		
5:15 A.M.	66	10.7
6:15	103	12
7:15	112	8.9
8:15	114	7.5
9:15	102	2.7
10:10	299	8.5
11:05	2290	14.7
12:05 P.M.	1340	9.8
1:20	880	11.1
2:15	1460	18.3
3:10	807	21
4:10	389	8.5
5:15	382	7.1
6:05	238	11.6
7:40	153	14
8:30	239	13
9:25	260	15.2
10:15	168	8.9
11:15	207	12.5
Aug. 26		
12:15 A.M.	116	7.1
1:15	184	18.3
2:15	139	8.5
3:15	150	7.6
4:20	121	6.2

the nocturnal hours than during the day. It should be noted that single empty valves are given equal importance with complete cells in this type of count.

The results are shown in Table 1. It is clear that *N. palea* entered the plankton in quantity in late morning. Its numbers fell off sharply in midafternoon, and during late afternoon and evening a slow return to the nocturnal minimum took place. The principal nonphotosynthetic organism in the plankton consisted of bacterial filaments, apparently fragments of *Sphaerotilus natans* Kütz. Other chlorophyll-bearing plankters included *Nitzschia linearis* W. Smith, *Navicula cuspidata* Kütz., *Dinobryon sertularia* Ehrenb., and fragments of *Stigeoclonium tenue* Kütz. None of these exhibited any clear tendency to be more abundant in the plankton at one time of day than at another.

As factors in the diurnal periodicity exhibited by *Nitzschia palea,* both water temperature and water level can very likely be ruled out, since neither varied significantly in such a way that its variations could be correlated with changes in the phytoplankton.

Save for dissolved gases, the results of chemical analyses of the river water for various organic and inorganic components made over a period of 14 mo gave no reason to suppose that there is either a consistent change from hour to hour or any consistent diurnal variation, although such a variation was not specifically looked for. The region dominated by benthic *N. palea* is first evident about 0.8 km below the two principal polluting outfalls. There is no apparent periodic variation from hour to hour or from day to day in the amount of waste delivered from either of these outfalls. Near the point where the industrial outfall enters the stream, it has been the practice each evening to dump into the stream several gallons of dilute sulfuric acid largely neutralized by alkali. However, the stream is high in bicarbonate and well buffered. During the 12 mo in which *p*H determinations were made on 126 water samples from points 0.1 to 5.0 km below these outfalls, the *p*H showed little variability—the extremes were 7.60 and 8.55. It seems clear that the dumping of acid in itself has little effect on the aquatic environment at more than a few dozen meters below the outfall. From the standpoint of time, furthermore, the acid waste appears to be eliminated as a causative factor in the midday *Nitzschia* pulse, for the latter reached its peak after 10 A.M., at a time when the dissipated acid would already be found several kilometers below the sampling station.

Earlier workers, including Butcher (*4*) and Jónasson (*5*) have observed the detachment and rise of filamentous benthic algae from stream bottoms. A similar phenomenon, starting in late morning on fair summer days and continuing until midafternoon, has been observed several times during my work on the Saline River. This phenomenon is caused, at least in part, by the production of oxygen bubbles in photosynthesis as a result of the much greater available light during the midday hours. The buoyancy of the algal mass is then greatly increased; it rises to the surface and moves slowly downstream, constantly shedding filaments or cells, which become part of the potamoplankton. It is probable that this midday production of oxygen is the mechanism for the entry of *Nitzschia palea* into the plankton as here recorded, although most of the *Nitzschia* cells rising into the current apparently did so independently of their neighbors. Floating or suspended masses of cells were seldom seen.

To the stream ecologist, the diurnal pulse thus observed is significant because of the increasing pollution of many small rivers and the consequent probability that other streams whose plankton has been or will be studied exhibit similar regions dominated by photosynthetic unicells that are benthic but unattached. For the area immediately downstream from such a benthic community, a plankton sample taken once, at an indiscriminate hour of the day, as has been commonly done in the past, must hence be regarded as untrustworthy.

The phenomenon here recorded may be limited geographically to small, and perhaps to polluted, streams. The magnitude of the diurnal variation is probably dependent upon any factor that might limit the entrance of benthic organisms into the plankton or otherwise influence their representation there. Plankton samples taken on cloudy days, or at some point other than the downstream end of a region dominated by benthic unicells, or in periods of rapidly changing water level, or even from a stream receiving similar pollutants but larger in volume of flow might be expected to show much less marked periodicity.

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Distribution and Heredity of Blood Factor U

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In a previous report (*1*), a new blood factor **U** was described, sensitization to which caused a fatal hemolytic transfusion reaction (*2–4*). The purpose of the present report is to describe further observations on the distribution and heredity of this blood factor.

Tests for factor **U** were carried out on blood specimens from 1100 Caucasoids and 989 Negroids. As is shown in Table 1, all 1100 Caucasoids had the blood factor **U**, and only 12 of the Negroids lacked the factor. The A-B-O groups, M-N-S types, Rh-Hr types, and Kell types of these 12 individuals, as well as the patient who had the hemolytic reaction and from whom the antiserum was obtained, are shown in Table 2. From these results, factor **U** apparently bears no relationship to any of these blood group systems, except possibly the M-N system. Moreover, the distribution of the **U** factor precludes any relationship to Duffy, Kidd, Lutheran, or Lewis systems.

The peculiar racial distribution suggested the possibility that factor **U** might be an alternate of the Hunter factor (*4*) or Henshaw factor (*5*). As will be shown later, the low frequency (2.7 percent) of the Henshaw factor found by Chalmers, *et al.* (*6*) among Negroids would tend to exclude that possibility, but the results obtained by them for the Hunter factor (21.7 percent) closely approximate the expected value. However, tests for these factors kindly carried out by William S. Pollitzer, Research Fellow, Institute of Human Variation, Columbia University, on a blood specimen from an individual of type uu were negative for the factors Henshaw and Hunter. This was contrary to expectations were either of the latter an alternate of **U**.

With regard to the heredity of the blood factor **U**, the simplest and most plausible theory is that factor

TABLE 1. Distribution of the blood factor **U**.

Racial group	Number of individuals		
	Positive	Negative	Total
Caucasoids	1100	0	1100
Negroids	977	12	989

TABLE 2. Blood types of individuals with blood lacking factor **U** (type uu).

Blood of	A-B-O group†	M-N-S type	Rh-Hr type	Kell type
Patient	B	MN	$\mathfrak{R}h_1rh$	kk
1*	O	N	Rh_1rh	kk
2	B	N	Rh_0	kk
3	O	MN.ss	$\mathfrak{R}h_0$	kk
4	B	N	Rh_0	kk
5	O	MN.ss	Rh_0	kk
6	B	MN.ss	Rh_0	kk
7	B	MN.ss	Rh_1rh	kk
8	O	MN.ss	rh	
9	O	N.ss	rh	
10	O	N.ss	Rh_0	
11	O	MN.ss	Rh_2	
12	B	N	Rh_1rh	kk

* The numbers 1–12 represent the 12 individuals referred to in Table 1.

† Only individuals of group B and group O were tested, because the patient's serum contained anti-A agglutinins.

TABLE 3. Family studies on blood factor **U**.

Family number	Father	Mother	Children		
1		O N Rh_1rh kk† uu	O N rh′rh kk ♀ U		
2	O MN.ss $\mathfrak{R}h_0$ kk† uu	O N.ss Rh_1rh kk U	O N.ss Rh_0 kk ♀ uu	O N.ss Rh_0 kk ♀ uu	O N.ss $\mathfrak{R}h_0$ kk ♀ U
3			B MN.ss Rh_0 ♂ † uu	O M Rh_0 kk ♂ U	
4	O MN.ss rh† uu	O MN.S Rh_1rh kk U	O MN.ss Rh_1rh kk ♀ U	O MN.ss Rh_1rh kk ♂ U	

† Propositus.