licated without a corresponding duplication of the chromosomes, and this extra generation makes up for the one lost at fertilization by one of the gametes (each gamete has two centrioles). Briefly, then, in changing from mitosis to meiosis, the centrioles gain a generation on the chromosomes, and in changing back to mitosis, they lose a generation, although ultimately there are the same number of generations of both.

We see in *Barbulanympha* and *Holomastigotoides* the changes which occurred in the transition from mitosis to meiosis, resulting finally in the formation of gametes. The first step is diploidy, and anything which prevents the centrioles from producing an achromatic figure or the achromatic figure from functioning properly in the movement of chromosomes can bring about a change from haploidy to diploidy. This is as far as *Holomastigotoides* and *Spirotrichosoma* have been able to go. *Barbulanympha* has gone one step beyond these organisms; by throwing the centriole-chromosome duplication schedule out of line, it has evolved a method for changing from haploidy to diploidy and vice versa. The next step is seen in *Saccinobaculus* and *Urinympha*, and sometimes in *Barbulanympha*, where the loss of a generation of centrioles does not usually occur until after the nucleus divides (otherwise the nucleus would not divide). Cytoplasmic division does not occur, the nuclei fuse, the chromosomes are duplicated, and two meiotic divisions change them to haploids. The next and final step occurs in *Trichonympha* and two other genera. The advance is a small but very important one: the cytoplasm divides and thus produces gametes which are free to fuse in any manner.

Evolution of meiosis has been direct: *Holomastigotoides*, haploidy to diploidy; *Barbulanympha*, diploidy to haploidy and vice versa; *Saccinobaculus*, fusion of nuclei; *Trichonympha*, cytoplasmic division producing gametes. In each stage after the first one, the events of the preceding stage are repeated, and one additional step forward is taken. *Trichonympha*, for example, goes through all the stages that the other organisms do and, in addition, produces gametes.

If meiosis, as many observations indicate, serves to relieve the instability of polyploidy—the relief when it is zygotic usually being for a longer period than when it is gametic—one might almost say that biparental inheritance and all the evolution that it has produced resulted because of the particular method which most organisms developed to free themselves from the limitations of permanent polyploidy.

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Are Lake Salmon Hereditarily Distinct?

A. G. HUNTSMAN

Fisheries Research Board of Canada
and *University of Toronto*

Peculiar salmon found in certain lakes of Europe and eastern North America have been considered by taxonomists to be distinct species (e.g. *Salmo sebago, 1*), merely subspecies (e.g. *Salmo salar sebago* and *S. s. ouananiche, 3*), or varieties (e.g. *S. s.* var. *lacustris, 2*) of the ordinary sea salmon.

Similar, supposedly nonmigratory kinds have been found in various other species of *Salmonidae*. Without proof, there should not be unquestioning acceptance of these as being hereditarily distinct kinds rather than the effects of environment on the individuals. The utter lack of published data from experiments to distinguish the effects of heredity and environment and the difficulty of carrying out such experiments should make the following of interest.

At Grand (Shubenacadie) Lake, Nova Scotia, the young from the lake salmon, locally known as "grayling," are reared for planting to get "grayling," and the young of sea-running salmon from the River Philip of northern Nova Scotia are reared for planting to get sea salmon. Grand Lake discharges into Shubenacadie River, which contains sea-running salmon. These evidently spawn in tributaries (entering the river below Grand Lake) which drain a relatively lakeless and arable country in comparison with the rocky country, well provided with lakes, that forms the watershed of Grand Lake. There is no physical barrier to prevent the young of these "grayling" from descending to the sea or the sea salmon from ascending into the lakes, which they may do. Are the differences in appearance, structure, and migration between "grayling" and sea salmon the results of a difference in heredity, which would justify keeping the stocks separate, or are they the results of differences in the conditions they face as they grow up?

In June of both 1944 and 1945, yearling offspring of lake and sea salmon, as reared at Grand Lake, were marked distinctively and planted together in equal numbers in streams in a linear series draining into Grand Lake. This has been a cooperative experiment by the Fisheries Research Board of Canada and the Fish Culture Branch of the Department of Fisheries. Supt. W. H. Cameron reared the salmon and marked them, the "lake" salmon by removal of the adipose and right pelvic, and the "sea" salmon by removal of the adipose and left pelvic fins. The streams planted formed, with intervening lakes all tenanted by lake salmon, an ascending linear series: Grand Lake, lower Rawdon River (½ mile long), Long (Kinsac) Lake, upper Rawdon River (½ mile long), Beaverbank Lake, and Beaver River (1-mile stretch).

Very few survivors were found in September seinings, either from the 9,538 marked yearlings planted in 1944 or from the 9,240 planted in 1945. Although the streams had scarcely any bottom suitable for spawning, native parr of comparable size (yearlings or older) were present and finally predominated over the marked fish, as if they kept possession of the good places in the streams by virtue of being there first. So far as could be judged by September seining, the few parr were in both years mainly in the lower part of Beaver River, but the numbers taken were very small: 1944—9 native, 1 "sea," 1 "lake"; 1945—16 native, 1 "sea," 1 "lake." With higher water they were more numerous in 1945 than in 1944 (more taken with less seining), which afforded a better opportunity to follow their movements.

That they may have descended into the lakes shortly after planting and survived there seems negatived by the facts that (1) five lots of 50 yearlings each when planted in 1945 above traps in branches of the Petitcodiac River, N.B., failed during that season to appear in the traps or to be seined more than 200 yards from the point of planting, and (2) 175 yearlings planted in 1946 above a trap on the lower Rawdon River failed to appear in the trap and yet disappeared utterly so far as seining showed.

With so few survivors even in the first few months of stream

life, the only good chance for determining any difference in migratory behavior seemed to be to trap the fish when descending as smolts the next spring. Only one trap was feasible, and this was placed on the lower Rawdon River near the lower limit of planting. If neither kind migrates seaward through Grand Lake, a trap at its outlet will get no smolts—a fact which might be interpreted as failure of any "sea" salmon to survive. If "lake" smolts, in descending, stop in the first lake they reach, but "sea" smolts continue seaward, a trap in the lower Rawdon will take "lake" smolts only from lower Rawdon but upper Rawdon and Beaver as well as lower Rawdon "sea" smolts. With such a difference in migratory behavior, it was expected that more "sea" than "lake" smolts would be trapped.

D. I. Rice, of Dalhousie University, Halifax, constructed the trap and operated it from May 26 to July 31, 1946. No salmon descended after June 12 by which time 105 native, 2 "lake," and 2 "sea" smolts had entered the trap. There was, therefore, failure to find any difference in migratory behavior. Further experiments are desirable to discover possible hereditary differences in migratory behavior of supposed "races" or "strains" in salmonid species.

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Role of Glucose in Promoting Growth of *Lactobacilli* in Saliva

DAVID WEISBERGER

Harvard School of Dental Medicine

It has been shown that an oral strain of *Lactobacillus* grows and produces acid to a maximal extent when incubated on a synthetic medium consisting of d-glucose, tryptophane, sodium acetate, potassium phosphates, thiamine hydrochloride, calcium pantothenate, nicotinic acid, and casein hydrolyzate (vitamin free) (*4*). In a subsequent report (*2*) it was shown that whole saliva could substitute only partially for the three water-soluble vitamins, but completely substituted for the mineral salt fraction of the synthetic media. However, the whole saliva did not serve as a substitute for either casein hydrolyzate or tryptophane. In a later paper (*3*) saliva hydrolyzed by acid or alkali was found capable of substituting for casein hydrolyzate in the synthetic media. It was also found that it was unnecessary to add l-tryptophane to the media when an alkali hydrolyzate of saliva was substituted. These observations suggested saliva as a potential source of the amino acids found essential for the growth of an oral strain of *Lactobacillus*.

The present report is concerned with (a) observations on some chemical changes occurring in saliva incubated with glucose at body temperature, and (b) the use of an incubated saliva-glucose mixture as a substitute for tryptophane and for casein hydrolyzate in a synthetic medium. For these purposes whole saliva, collected from individuals, was incubated at 37.5°C. with and without glucose. To estimate the proteolysis occurring in incubating saliva the "carboxyl CO_2"[1] changes were determined. The ammonia (plus urea) nitrogen changes were also measured as an index of deamination.

As a result of the addition of glucose to incubating saliva there was an increase of approximately 100 per cent in the "carboxyl CO_2" liberated during the incubation. Also, markedly less ammonia was formed in the saliva incubated with glucose. These results are interpreted as evidence that the presence of glucose in saliva favors proteolysis over deamination. Table 1 illustrates the findings in a typical experiment. Further observations have been made regarding the ability of saliva, given preliminary incubation in the presence of glucose, to substitute for tryptophane and to a lesser extent for the casein hydrolyzate in synthetic media. Typical findings are shown in Table 2.

TABLE 1

CHANGES IN "CARBOXYL CO_2" AND IN AMMONIA (PLUS UREA) NITROGEN OF INCUBATING SALIVA WITH AND WITHOUT ADDED GLUCOSE

Period of incubation (hrs.)	"Carboxyl CO_2" present (mg. %)	Ammonia (plus urea) nitrogen (mg. %)	pH
No glucose present			
0	1.52	20.9	8.25
120	0.42	45.9	7.47
1% glucose added			
0	1.52	20.9	8.25
120	4.07	22.6	3.68

TABLE 2

ACID PRODUCED IN BASIC MEDIUM IN WHICH SALIVA INCUBATED FOR 192 HOURS WAS SUBSTITUTED FOR CERTAIN ESSENTIAL GROWTH FACTORS

Replacement	Essential substance omitted from media	Acid produced (ml.)
Saliva incubated without glucose	Casein hydrolyzate	0.06
Saliva incubated with glucose	Casein hydrolyzate	1.05
Saliva incubated without glucose	Tryptophane	0.18
Saliva incubated with glucose	Tryptophane	5.00

These chemical findings suggest an additional role for glucose in the physiology of the oral cavity. In contact with saliva at body temperature, glucose assists in the liberation of amino acids which can be utilized as nutrients for the growth of oral *Lactobacilli*. The data obtained in this investigation will be published in detail at a later date.

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[1] Terminology of Van Slyke, Dillon, MacFadyen, and Hamilton (*1*).