Mild destruction of lingual enamel, with evidence of slight ridge formation at gingival margin 3
Moderate destruction of lingual enamel, with ridging more definite and some exposure of dentin 4
Severe destruction of lingual enamel, with marked ridge at gingival margin, and appreciable exposure of dentin 5
Almost complete destruction of lingual enamel with definite evidence of destruction on other surfaces, and marked exposure of dentin with some destruction 6

With very little study, one is able to readily distinguish between the different categories, so that this method of grading has given reproducible results in the hands of different observers.

After appraising the individual molars, one can determine the average tooth score for the animal or for the upper and lower jaws separately. When the effects of different acids are being compared, the latter system is frequently more revealing because certain acids seem to attack the upper and lower molars in different degrees—some affect the molars of both jaws fairly equally, while others produce far greater damage to the lowers than to the uppers.

Fig. 1 shows a series of tracings made from photomicrographs of ground sections of seven typical mandibular rat first molars depicting the various stages of enamel destruction described above. As the tooth score increases, the progressive loss of lingual enamel above the gum line is readily observed. In molars 5 and 6, mild to moderate destruction of dentin on the lingual and occlusal surfaces is apparent.

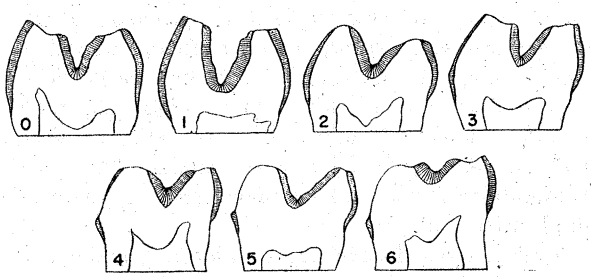

FIG. 1. Rat molars showing various stages of destruction by acid beverages.

To further substantiate the suitability of the visual grading system, the enamel content of several complete sets of molars from rats exhibiting varying degrees of gross enamel destruction was determined using the dentin-enamel separation procedure of Manly and Hodge.[4] The data in Table 1 show that as the average tooth score increases, the percentage of enamel in the teeth decreases.

TABLE 1

PERCENTAGE OF ENAMEL IN DRIED RAT MOLARS COMPARED WITH THE AVERAGE TOOTH SCORE DETERMINED BY THE VISUAL GRADING SYSTEM

No. of analyses	Average molar score	Percentage of enamel in molars	
		Range	Average
6	0	22.1–23.3	22.7
3	1.1–1.9	22.5–24.7	23.6
2	2.4–2.5	21.1–22.8	21.9
3	3.1–3.3	17.9–19.5	18.9
4	3.4–3.6	17.3–19.0	17.8

The application of this method to the study of tooth-decalcifying properties of specific beverages is being reported elsewhere.

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DISCUSSION

CONTINUITY AND DISCONTINUITY IN EVOLUTION

IN an earlier article[1] describing the concept of integrative levels, I indicated that its value lies in the full recognition of both continuity and discontinuity in evolution.

In stressing the need for special techniques, terminology and laws at the social level, I did not, as Gerard and Emerson[2] assert, "isolate completely everything human from the rest of nature," any more than a biologist denies chemical laws when he formulates biological concepts like natural selection. Man has much in common with other organisms. The closer an organism's sensory, integrative and reactive capacities are to man's the more we can learn from it about human behavior.[3]

Yet caution must be exercised in applying general biological laws to man's behavior. To understand man, attention must be centered on those qualities which make him unique. Man, alone of all organisms, possesses a culture which embodies his historical experience and which imposes basic patterns on his

[1] Alex B. Novikoff, SCIENCE, 101: 209–215, 1945.
[2] R. W. Gerard and Alfred E. Emerson, SCIENCE, 101: 582–585, 1945.
[3] Joseph Needham, *Science and Society*, 6, p. 375, 1942, has written, "social insects . . . differ so severely from the primates in their morphology that they have less to teach us than is often supposed."
[4] R. S. Manly and H. C. Hodge, *Jour. Dent. Res.*, 18: 133–141, 1939.

exceptionally plastic behavior. His social environment is determined culturally in large part and not purely biologically as in other animal "societies."[4] In meeting his needs, man acts upon nature with tools he designs and produces, and his activity constantly expands his ability to adapt himself to the environment and the environment to him. As his technology develops, his social relations and behavior undergo change. It is the continuous interplay between biological and cultural influences which determines an individual's personality and behavior.

Gerard and Emerson's verbal equation of the "direction" of organic evolution and the "plan" of a lion stalking his prey with what I called "planned activity of men" ignores the unique prevision involved in man's planning. Whatever the lion's intent, it is not the reasoned plan of the framers of a Constitution. The influence of the lion's behavior on evolution is not the issue; did the lion plan this influence?

Philosophers have long shown the fallacy of arguing that because there is apparent design in animate nature, an intelligent designer exists. Conversely, the lack of design or visible plan in human history may not legitimately be taken to mean the absence of underlying intelligent planning by men. The behavior of the individuals who collectively make history is purposeful, planned behavior. The outcome of this planned activity may not often resemble the initial plans because every social event involves the interactions of many individuals and groups with actions beyond the control, and often the prediction, of the individual.

Recent developments indicate that social outcome will tend to resemble plans more closely than it has in the past. Society's control over nature, as shown by its productive capacity, is increasing. Social science is steadily growing in maturity. Planning is becoming a cooperative process in which increasing numbers of men participate. As these prospects for valid and effective planning are realized, there will be a fuller utilization of the peculiarly human ability to substitute consciously directed forces for blind unconscious forces such as operate in biological evolution.

Gerard and Emerson contend that natural selection operates at both biological and sociological levels. As generally understood, natural selection involves selective action on genotypes, with the non-perpetuation of those producing unfavorable reactions to the environment. It undoubtedly played a decisive part in man's evolution and his attainment of the position of dominance in nature. In the process, the survival value of man's group relations was probably very significant. But changes occurring in human group relations as society developed have been due to cultural-social causes and not to biological change. They have been much too rapid to be dependent upon natural selection. While in the last several centuries there has been much social change, natural selection has caused little, if any, correlated change in man's genotypes. Social survival value, both on an individual and population level, has not corresponded with biological survival value.

Gerard and Emerson's failure to give due importance to the qualitative differences between the biological and sociological levels is also apparent when they: (1) remove the well-established connotations of the word "purpose" and make it a synonym for "function" or "adaptive significance"[5]; (2) make the word "cooperation" so broad as to lose all specific meaning and then use the extent of "cooperation" between parts and whole as the criterion of both biological and social progress; (3) use the facts of convergent evolution within the biological level to support Gerard's far-fetched analogies between biological and social processes; (4) object to my attempt to narrow the meaning of the word "social" or "sociological" so as to distinguish between human societies and those of other animals[6]; and (5) describe both organisms and societies as "living systems" and use the term "autocatalysis" for such dissimilar processes as gene duplication and learning.

To-day, when the fact of evolution is generally accepted, underemphasis of the discontinuity of the levels through which matter develops may impede our understanding perhaps as much as did the denial of continuity a century ago.

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[4] *Cf.* Lawrence K. Frank, *Scientific Monthly*, 56: 344–357, 1943; and Bernhard J. Stern, *Social Forces*, 8: 264–271, 1929.

[5] *Cf.* R. M. MacIver, "Social Causation," pp. 13–24. Boston, 1942.

[6] For the need for such distinction see W. M. Wheeler in "Human Biology and Racial Welfare," ed. E. V. Cowdry, p. 141, p. 150. New York, 1930: David Katz, "Animals and Men," p. 250. London, 1937; Lawrence K. Frank, *op. cit.*; R. M. MacIver, *op. cit.*

TOXICITY OF NEMATODE INFESTED CHEWINGS FESCUE SEED

DURING the winter of 1943–44 it was observed by the Department of Veterinary Medicine of the Oregon State College that losses occurred among sheep consuming a certain lot of 1943 Chewings fescue (*Festuca rubra, commutata*) screenings. Some of the implicated material was obtained by the author during the following summer, stored at room temperature, and used since then for the experiments referred