complexes of stone fruits, and possibly may aid in arriving at a more rational virus nomenclature based upon chemical properties.

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Manuscript received January 22, 1952.

Formation of 2,3-Butylene Glycol in Bacterial Fermentation of D-Glucosamine[1]

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There have been a few reports made with respect to the products of bacterial fermentation of D-glucosamine. According to these papers, acetic and butyric acids (*1*), propionic and D-lactic acids (*2*), D-lactic, L-lactic, and succinic acids (*3*), etc., have been shown to be produced by action of bacteria on D-glucosamine.

In our laboratory extensive investigations were recently carried out on the ability of microorganisms in the soil to make use of D-glucosamine; those that were observed to utilize it were isolated into pure cultures. From among them, a number of active strains of bacteria and of fungi were selected for studies on the fermentation of D-glucosamine. The bacteria of the coli-aerogenes group were found to utilize it vigorously.

A report is made here on the products of the fermentation of D-glucosamine by *Aerobacter cloacae* (Jordan) Bergey *et al.,* isolated from soil. A liquid culture medium containing D-glucosamine alone as the source of both carbon and nitrogen was employed; composition of the medium was as follows:

(*A*)	D-glucosamine hydrochloride			40.0 g	in 1 liter of water
(*B*)	NaCl	10.0 g,	KH_2PO_4	4.0 g	in 1 liter of water
	$MgSO_4 \cdot 7H_2O$	0.2 g,	$CaCO_3$	10.0 g	

where (*A*) and (*B*) were prepared apart, sterilized separately, and then combined aseptically.

A strain of *A. cloacae* was inoculated into the medium and incubated at 37° C for about 10 days. In the early stages of incubation, a vigorous generation of gas was observed.

After the incubation period, the liquid culture was filtered, concentrated *in vacuo* to about 300 ml, and extracted continuously with ether for 50 hr. The ether extract was dried, concentrated to a viscous liquid, and the residual liquid was distilled under diminished pressure to give 6.9 g (approx 20% of the D-glucosamine) of the main fraction at 89°–92° C/16–17 mm Hg after a small quantity of the foregoing fraction (0.5 g). The substance obtained was a colorless, clear, viscous liquid ($[\alpha]_D^{24°\,C} = +1.3°$ [1 = 1dm]), somewhat like glycerol, which crystallized in the cold. We confirmed it to be 2,3-butylene glycol by distilling it with 25% sulfuric acid, followed by separating the methylethyl ketone, which is to be derived from 2,3-butylene glycol, from the distillate, converting the ketone into the *p*-nitro-phenylhydrazone (yellow; mp, 126.5°–127.5° C), adopted under the Akabori method (*4*).

After the extraction of the glycol, the aqueous mother liquor was strongly acidified with sulfuric acid and extracted again with ether continuously for 40 hr. On concentration of the extract, there remained a considerable amount of colorless, clear, viscous liquid containing the crystals of succinic acid (1.1 g; approx 3% of the D-glucosamine) and giving out an acetic acid smell. The volatile acids contained were separated from it by steam distillation as usual; the total amount was estimated at 0.64 g as acetic acid. Lactic acid was also found in this acidic extract.

In addition, small amounts of ethyl alcohol and acids fixed in the precipitate, such as oxalic acid, were also observed to be produced in this fermentation.

Study as to when and how the amino group is split off in the process of the fermentation of D-glucosamine is in progress.

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Manuscript received December 3, 1951.

The Influence of Skin Temperature upon the Pain Threshold as Evoked by Thermal Radiation—A Confirmation

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In a recent paper Hardy, Goodell, and Wolff (*1*) reported experiments on the effect of skin temperature on pain threshold evoked by thermal radiation. By a graphical extrapolation from their data, they were able to infer that "the skin in the areas tested must be raised [to a temperature of 44.9° C] to be noxiously stimulated, regardless of the initial level of skin temperature."

[1] This research was carried out while the author was at the Psycho-Acoustic Laboratory, Harvard University, Cambridge, Mass.

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[3] The authors wish to express sincere thanks to Kendo Saito and Shiro Akabori for their kind guidance.

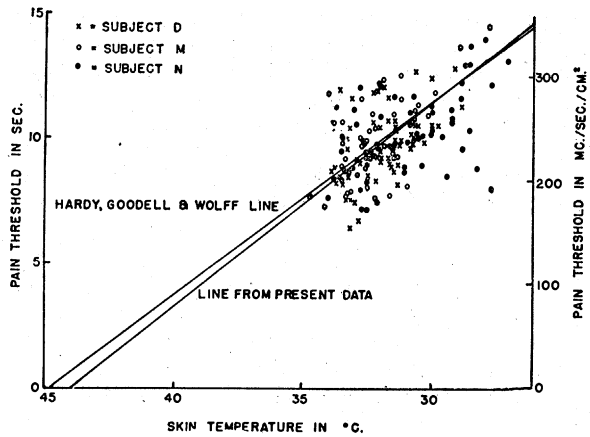

FIG. 1.

The present report derives from an investigation of the temporal variation of various sensory thresholds, in which skin temperature was measured as a control for pain threshold. The resultant data are comparable to those of Hardy, Goodell, and Wolff, except that the range of the present data is smaller than theirs, because no attempt was made to produce major changes in skin temperature artificially.

At 7 P. M. daily for 45 consecutive days pain thresholds were measured on each of three subjects. Measurement was performed on an apparatus designed after that of Hardy *et al.*, but with a different technique.

The radiant intensity was set at 275 mc/sec/cm² each time and was applied to the forearm on a blackened circular area 1.8 cm in diameter. The threshold was measured in terms of the number of seconds that the radiation had to be applied before the subject reported burning pain.

Just before application of the stimulus, skin temperature at the blackened spot was taken by means of a thermistor (1 V6 11) and a GR type 150 impedance bridge; resistance was translated into degrees centigrade by means of a calibration curve.

Correlation coefficients between threshold and temperature were −.70, −.61, and −.72 for the three subjects, and all were highly significant statistically (better than the .1% level). The data were plotted (Fig. 1), and a least square straight line was fitted to the data in a manner comparable to that in Fig. 1 of Hardy, Goodell, and Wolff. Extrapolation from this line provides a striking confirmation of their "zero point," since our data yield a value of 44.1° C in comparison with their report of 44.9° C. The agreement is all the more remarkable because Hardy, Goodell, and Wolff—

1) Used threshold for pricking pain, whereas we used that for burning pain;

2) Used the Hardy-Wolff-Goodell method, and we used a very simple temporal measure;

3) Used a temperature range of over 20° C, whereas we used one less than half as large; and the variability of our data was even larger than theirs.

The present experiments provide further confirmation of Hardy, Goodell, and Wolff's conclusion:

Buettner and Henriques and Moritz have shown that reversible tissue damage in the skin of the forearm and upper leg of humans is produced at the critical temperatures of 44° C to 45° C. In the above experiments threshold pain has been elicited when the skin temperature has been raised to roughly this same level, irrespective of the initial level of skin temperature. From these two independent observations the close relation between tissue damage and noxious stimulation can be inferred, thus significantly supporting the concept that the adequate stimulus for pain is tissue injury.

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Manuscript received November 23, 1951.

Time Distortion in Hypnosis and Nonmotor Learning

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By "time distortion" is meant a marked difference between the seeming duration of a time interval and its actual duration, as measured by the clock. In previous communications on this subject (*1, 2*), evidence was presented which indicated that the following statements are probably true:

1) In especially trained subjects, time sense can be deliberately altered to a predetermined degree by hypnotic suggestion. Such subjects can have an amount of subjective experience under these conditions that is more nearly commensurate with the subjective time involved than with the world time. This activity, although seeming to proceed at a natural rate as far as the subject is concerned, actually takes place with great rapidity relative to world time.

2) Retrospect falsification or elaboration does not enter into the subject's reports.

3) The continuity of these experiences during distorted time is good.

4) Thought, under time distortion, although apparently proceeding at a normal rate from the subject's point of view, can take place with extreme rapidity relative to world time. Such thought may be superior, in certain respects, to waking thought.

Thus, apparently, *time* can be given to the hypnotized subject, and he can use this time for various mental activities.

It is important for investigators to realize that the training of a subject for time distortion generally has required 3–20 hr, exclusive of his training as a hypnotic subject per se. Training was generally carried out on consecutive days, the average session lasting one hour. With sufficient effort and the proper technique, the phenomenon can probably be produced to varying degrees in the majority of hypnotic subjects.

In discussing time distortion in hypnosis, world time is solar, or clock, time, and personal time is sub-