

performance deficits produced by ECS. The results of giving additional tests to animals originally tested at 12 hours are shown in Fig. 2. There was no evidence that the additional tests eliminated performance deficits produced by ECS. The FS-ECS animals showed the short response latencies mentioned above, and the large differences in the latencies of the FS-ECS and the FS-NECS groups remained unchanged through several additional tests at different retention intervals. Quite clearly, the trained animals can maintain a high level of performance over many additional tests. The stability of the learned response as well as the amnesia produced by ECS are thus equally well demonstrated.

Over the intervals examined in our experiment, retrograde amnesia produced by ECS appears to be permanent. The differences in the latencies of the FS-ECS and FS-NECS groups remained constant both over several retention trials (Fig. 2) and when tested at different times after training (Fig. 1). These findings support and extend the findings reported by Chevalier (3).

Our data do not show the apparent recovery of retention reported by Zinkin and Miller, who, using repeated retention tests, demonstrated increased response latencies over trials for most of their experimental groups. The increased latencies were somewhat greater in their ECS-trained group than in their other experimental groups; however, comparisons between groups on any single test trial suggest that the ECS-trained group apparently does not attain the performance level of the

control group. Unfortunately, an evaluation of these findings is quite difficult since highly stable retention was not obtained for the control animals. The data may be interpreted as revealing some of the transient properties of ECS treatment or as demonstrating spontaneous fluctuations of a poorly learned response. Not enough information is available for a valid interpretation.

Our findings, unlike those of Zinkin and Miller, demonstrate permanent retrograde amnesia and support the hypothesis that ECS produces retrograde amnesia by interfering with time-dependent memory storage processes.

MARVIN W. LUTTGES

JAMES L. MCGAUGH

Department of Psychobiology,
University of California,
Irvine 92664

References and Notes

1. C. P. Duncan, *J. Comp. Physiol. Psychol.* **42**, 32 (1949); J. L. McGaugh, in *The Anatomy of Memory*, D. P. Kimble, Ed. (Science and Behavior Books, Palo Alto, 1965); R. Thompson and W. Dean, *J. Comp. Physiol. Psychol.* **48**, 488 (1955); C. A. Pearlman, S. K. Sharpless, M. E. Jarvik, *ibid.* **54**, 109 (1961).
2. J. L. McGaugh, *Science* **153**, 1351 (1966); S. E. Glickman, *Psychol. Bull.* **58**, 218 (1961).
3. J. A. Chevalier, *J. Comp. Physiol. Psychol.* **59**, 125 (1965).
4. S. Zinkin and A. J. Miller, *Science* **155**, 102 (1967); R. M. Cooper and R. S. Koppenaal, *Psychonom. Sci.* **1**, 303 (1964).
5. W. B. Essman and H. Alpern, *Psychol. Rep.* **14**, 731 (1964).
6. Twenty mice were initially used in each group; however, mice were eliminated if full tonic extension was not produced by ECS, if initial latencies were excessive, or for other procedural reasons. No more than three mice were deleted from any group.
7. Mann-Whitney U-tests were used for all comparisons between pairs of groups. Kruskal-Wallis one-way analysis of variance was used for comparisons of more than two groups.
8. Supported by PHS research grants MH 12526-01 and MH 10261-03.

25 January 1967; 14 March 1967

not meet until the International Geological Congress is held in Prague in 1968. Emiliani's statement is thus inaccurate and, had it been accurate, was premature.

GERALD M. RICHMOND

International Association for
Quaternary Research, Denver, Colorado
9 January 1967

In reply to Richmond's comment, I wish to quote a passage from each of three written communications which I recently received. These are from R. Selli of the University of Bologna, S. Venzo of the University of Parma, and André Cailleux of the University of Paris.

... I remember perfectly well that this proposal [to establish the section at Le Castella as type section for the Plio-Pleistocene boundary] was presented to the General Assembly on the last day of the Congress by the Chairman of the Commission on Nomenclature and Correlation of the Quaternary. The proposal was approved unanimously, as also recorded in the notes which I took at the Congress.—R. SELLI

... What you write about the Plio-Pleistocene boundary is correct. In the paper by R. Selli and S. Venzo "La partecipazione italiana al 7° Congresso Internazionale del Quaternario, Denver-Boulder, Colorado, 1965" (*Ricerca Scientifica*, 1966, No. 12), we write "S. Venzo represented Italy within the Sub-Commission on the Plio-Pleistocene boundary. Of particular interest to Italy is the proposal, later approved by the General Assembly, to establish the section at Le Castella (Calabria) as the type section of worldwide significance for the Plio-Pleistocene boundary."—S. VENZO

... It is true that I was president [of the General Assembly]. I am completely sure that there was no objection nor any disagreement on the reports of the Commissions, and, in particular, there was no disagreement whatsoever on the choice of Le Castella as the type section for the Plio-Pleistocene boundary.—ANDRÉ CAILLEUX

The above statements agree exactly with my own recollection and with what I wrote in *Science* and elsewhere. It would seem that the Secretary General did not follow the proceedings with sufficient awareness, did not take down accurate minutes, and assembled a record which is in fact incomplete.

CESARE EMILIANI

Institute of Marine Science,
University of Miami,
Miami, Florida 33149

Note

1. This communication is contribution No. 775 of the Institute of Marine Science, University of Miami.

13 March 1967

The Plio-Pleistocene Boundary

In an article entitled "Isotopic paleotemperatures" [*Science* **154**, 851 (1966)], Cesare Emiliani states, with reference to the definition of the Pleistocene, that "this epoch, characterized by the repeated occurrence of major glaciations, has been defined, by unanimous decision of the 7th INQUA Congress (Denver, Colorado, 1965), as the time that has elapsed since the first appearance of the benthonic foraminiferal species *Hyalina* (*Anomalina*) *baltica* (Schroeter) in the late Cenozoic section at Le Castella, Calabria, southern Italy." Though it is probable that this matter was discussed and possibly approved

by the Subcommittee on Marine Stratigraphy of the INQUA Stratigraphic Commission, no such decision appears in the report of the Stratigraphic Commission to the General Assembly of the 7th INQUA Congress (as yet unpublished), nor was any motion made for approval of such a decision on the floor of the General Assembly, of which I was Secretary General. Furthermore, because the Stratigraphic Commission of INQUA is itself the Subcommittee on Quaternary Stratigraphy of the International Union of Geological Sciences, its decisions must await approval by the Stratigraphic Commission of that Union, which does