ion exchange chromatography (*1*) after extensive surface cleaning. That fraction was combusted to carbon dioxide and then converted to catalytically condensed graphitic carbon at the UCR laboratory (*2*). A ^{14}C age was then obtained by accelerator mass spectrometry (*3*) at the Center for Accelerator Mass Spectrometry, Lawrence Livermore National Laboratory. The conventional ^{14}C age of this sample (UCR3476/CAMS-29578) is 8410 + 60 years before present (B.P.), with a $\delta^{13}C$ value of –14.9 per mil. As expressed, the ^{14}C age has been normalized to a $\delta^{13}C$ value of –25 per mil, with a measurement error expressed at ± 1 sigma (*4*).

This was the value reported to the Office of the Coroner in Benton County, Washington. In response to a request for a calibrated ^{14}C value, there was an indication that approximately 900 years would need to be added to the conventional value to adjust it in light of the known offset between ^{14}C and solar time. However, it was pointed out that there would be a significant reservoir effect because the diet of Kennewick Man would have included a significant amount of marine biomass, presumably salmon, which currently spends a significant part of its life cycle in the north Pacific ocean.

If it is assumed that 100% marine and terrestrial diets would give rise in the total amino acid fraction to $\delta^{13}C$ values of –12.8 and 19.6 per mil, respectively (*5*), and given the $\delta^{13}C$ value of –14.9 per mil, we calculate a marine dietary contribution of about 70%. The corresponding marine reservoir offset for the Kennewick sample is 530 ± 150 years, based on a 750-year marine correction for the Gulf of Alaska for the early 20th century (*6*). The overall error reflects our estimates of uncertainties in the reservoir correction factor, its constancy since the early Holocene, and its applicability to Columbia River run salmon, as well as in the dietary contribution (*5–7*). On the basis of these considerations, we calculate a reservoir-corrected age of 7880 + 160 years B.P. for Kennewick Man. The corresponding calendar (cal) age if one uses the Seattle-Gröningen method is 8500 to 8950 cal years B.P. (1-sigma range) or 8340 to 9200 cal years B.P. (2-sigma range).

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Science and the Web

The report "Searching the World Wide Web" by Steve Lawrence and C. Lee Giles (3 Apr., p. 98) nicely reminds us about the novelty of the Web as an information resource and convincingly warns scientists (and others) about the current limitations of the popular search engines (such as that they return only a fraction of the available documents that match the query, return documents that are no longer valid because those pages have moved or have been withdrawn, or simply return documents that do not contain the query terms). Apparently, the most likely explanation for the latter malfunction rests with the typical commitment of webmasters to frequently update the content of the pages they maintain on a server. Of course, this highly desirable updating is the main advantage everybody is seeking when surfing the Web in search of information. However, it also means that, unless there is alternative support that guarantees the permanence of the information (as is the case for *Science* and most online scientific journals published with their paper-printed companion), the information one gets on the Web can be altered or may disappear after an unpredictable period of time.

It is increasingly tempting these days to refer to a uniform resource locator (URL) when publishing a scientific paper, and Lawrence and Giles appear to follow this practice, although wisely including the date of publication (last update) of the referred URLs. However, when releasing new data, presenting background, or discussing relevance to previously reported work, scientists might refer to information that could become inaccessible at any time. This would appear to jeopardize the validity of scientific knowledge because interrupting access to a reference is likely to impede reproduction of the data by the scientific community. I therefore think that there is an urgent need, when publishing scientific data, to distinguish clearly in references between perennial information (available on the Web but also safely preserved in multiple institutional libraries scattered around the world and accessible anytime to anybody) and information with an unpredictable lifetime (that is, available on the Web exclusively from one server). In order to protect our credibility, reference to possibly short-lived information in scientific publications should, I believe, be restricted to commentaries and, perhaps, letters and systematically banned from regular articles and reviews.

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Research on Auditory Cortex Plasticity

This year, Michael P. Kilgard and Michael M. Merzenich published a report, "Cortical map reorganization enabled by nucleus basalis activity" (13 Mar., p. 1714). In 1996, we published a study, "Induction of physiological memory in the cerebral cortex by stimulation of the nucleus basalis" (*1*). In both studies, pairing a tone with nucleus basalis stimulation produced tone-specific changes of neuronal responses in the primary auditory cortex of adult animals. We reported associative receptive field changes that involved selective increased response to a frequency paired with stimulation of the nucleus basalis, similar to the receptive field plasticity that is induced during tone-shock associative behavioral learning (*2*). In our study of the nucleus basalis, as in behavioral experiments, plasticity was induced in a single session of 30 pairings and only in paired versus unpaired groups. The results of both studies support a long-standing cholinergic model of learning-induced cortical receptive field plasticity (*3*).

We welcome the additional observations of map changes that devolve from receptive field changes and the statement of a cholinergic basis for the effects of nucleus basalis stimulation. Readers should be aware, however, that the 1998 report is not the first study to show that paired activation of the nucleus basalis is sufficient to induce specific receptive field changes in the auditory cortex. The subject of the two papers has been of sufficient general interest to warrant invited commentaries: a *Science*'s Compass research commentary, "Mapping the sensory mosaic" by Sharon L. Juliano (13 Mar., p. 1653), and a commentary by Charles D. Gilbert (*4*), which provide overviews of the field.

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Response: Weinberger was among the first to hypothesize that the central cholinergic system is involved in the synaptic plasticity underlying fear conditioning and other forms of learning. Members of his laboratory have probed these mechanisms with the use of both electrical stimulation of nucleus basalis and direct iontophoresis of cholinergic agonists. This rich body of work represents a significant portion of the foundation for our recent experiments. It was not our intention to overlook any of the relevant earlier studies by Weinberger and others, and we cited several of them (*1*) in our report. Furthermore, our report did not state that we were the first to use cholinergic modulation to generate receptive field plasticity.

Four main points made in our report are, to our knowledge, new. First, as Weinberger mentions, our study quantified plasticity guided by cholinergic modulation at the level of the cortical map by recording from up to 100 locations in a single animal. Second, we demonstrated that the plasticity we recorded was progressive over the course of several weeks and endured for at least 24 hours. Third, the observed map reorganizations were of a larger scale than would be expected from short-term studies of receptive field plasticity. Fourth, and most important, we demonstrated that the details of the stimulus paired with nucleus basalis activation determine whether receptive fields expand or contract.

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One Infant's Memory of *Oedipus*

In their report "Infants' memory for spoken words" (26 Sept. 1997, p. 1984), my former colleague Peter W. Jusczyk and Elizabeth A. Hohne give an elegant demonstration of language memory in infants who do not yet speak but who had, of course, been exposed to speech for many months.

In 1941, psychologist Harold E. Burtt published the last of three papers of a related experiment on language memory in the absence of "knowledge" of the language (*1*). When the child (Benjamin B. Burtt) was 15 months old, his father read 20-line passages from Sophocles's *Oedipus Tyrannus*, changing them every 3 months until the boy reached the age of 3, for a total of seven selections. Benjamin was subsequently tested for his memory of the passages by a prompting-learning method at the ages of 8.5 years, 14 years, and 18 years. The seven selections plus three additional ones chosen for comparability were learned through many prompting sessions in a rotating order so that every passage appeared approximately equally often in every position. The results were clear: at 8.5 years it took about 27% to 30% fewer repetitions to learn the previously heard material than the new material; the passages heard later in the 3-month learning period were learned most quickly; at the age of 14, the savings advantage was reduced to about 8%; the last test, at age 18, revealed no savings at all, although Benjamin reported that the material sounded familiar. It would be interesting if, 18 years hence, Jusczyk and Hohne were to locate some of the participants in their study and test them for response latencies to the Story-Word and Foil-Word lists.

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