



## Using Electronic Noses To Detect Tumors During Neurosurgery

Sensors would help surgeons determine whether tumors have been removed completely.

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It has been proposed to develop special-purpose electronic noses and algorithms for processing the digitized outputs of the electronic noses for determining whether tissue exposed during neurosurgery is cancerous. At

present, visual inspection by a surgeon is the only available intraoperative technique for detecting cancerous tissue. Implementation of the proposal would help to satisfy a desire, expressed by some neurosurgeons, for an intraopera-

tive technique for determining whether all of a brain tumor has been removed. The electronic-nose technique could complement multimodal imaging techniques, which have also been proposed as means of detecting cancerous tissue.

There are also other potential applications of the electronic-nose technique in general diagnosis of abnormal tissue.

In preliminary experiments performed to assess the viability of the proposal, the problem of distinguishing between different types of cultured cells was substituted for the problem of distinguishing between normal and abnormal specimens of the same type of tissue. The figure presents data from one experiment, illustrating differences between patterns that could be used to distinguish between two types of cultured cancer cells. Further development can be expected to include studies directed toward answering questions concerning not only the possibility of distinguishing among various types of normal and abnormal tissue but also distinguishing between tissues of interest and other odorous substances that may be present in medical settings.

*This work was done by Margie L. Homer and Margaret A. Ryan of Caltech, Liana M. Lara of Santa Barbara Research, and Babak Kateb and Mike Chen of City of Hope Medical Center for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).*

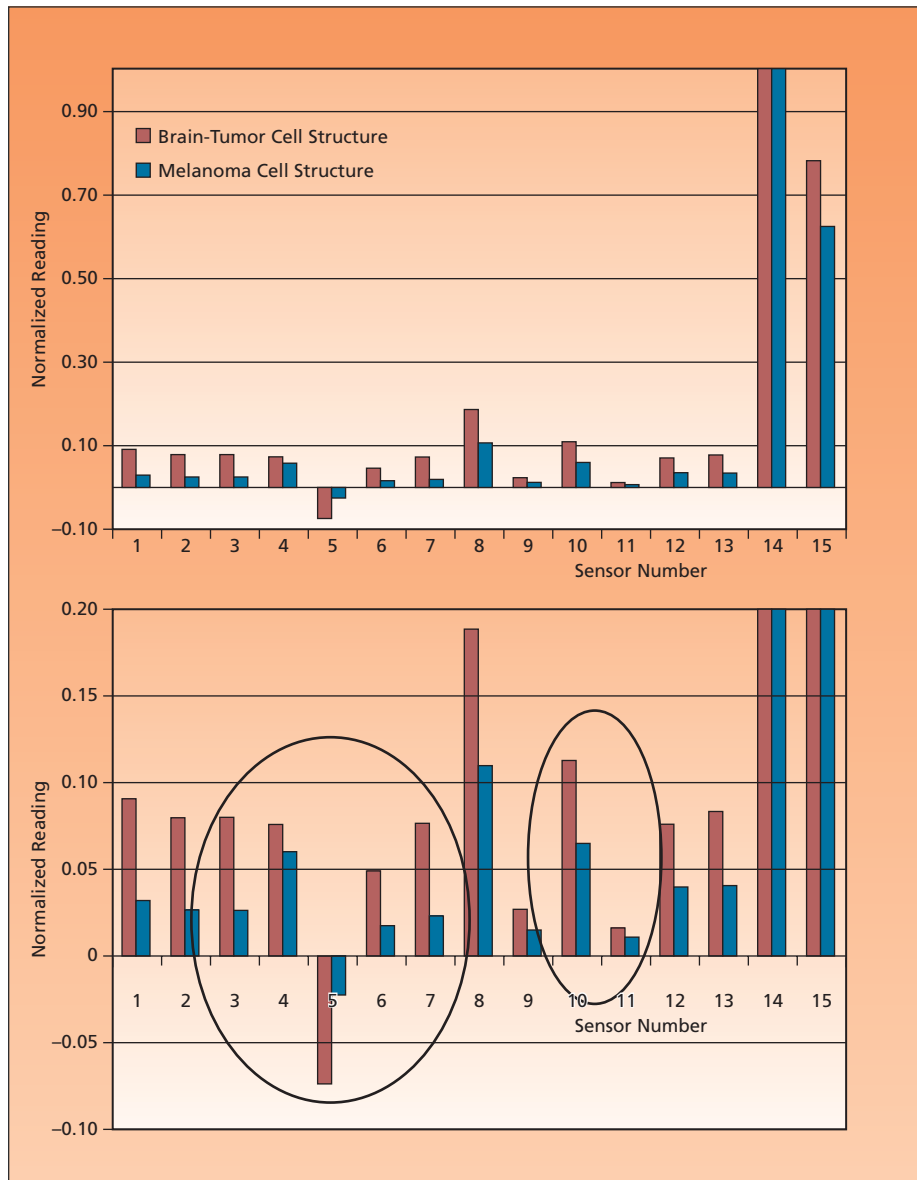
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**Processed Readings of the Sensors** in a 15-sensor electronic nose were recorded during an exposure to a melanoma cell culture and a brain-tumor cell culture. In processing the readings for each culture, growth-medium contributions were subtracted and all the readings were normalized to the largest reading. The lower plot is a vertically expanded version of the upper plot. In the regions enclosed by the ellipses, the differences between the patterns are considered to be typical of differences that would be sufficient to enable distinction between the two cell cultures.