Inhibitor of DNA in Lymphocytic Cells

The report presented by Houck *et al.* (*1*) deals with a specific inhibitor of the lymphoid tissue. Their results are almost identical to the ones that I have published (*2*). Our data were the following: the inhibitor was a protein with a molecular weight of 45,000; it inhibited DNA synthesis in vitro in human lymphocytic cell lines, but did not inhibit RNA or protein syntheses. When our tissue extract was injected into adult (DBA/2 × C57Bl6) F_1 mice it was able to (i) inhibit cell proliferation in the lymphoid tissue, (ii) decrease the number of immune competent antibody forming cells in the spleens of mice immunized by sheep red blood cells, and (iii) inhibit the graft versus host reaction when given to the donors. In vitro it blocked the blastic transformation induced by phytohemagglutinin [PHA(P)], by a specific antigen or by allogenic cells in mixed leukocyte culture (MLC), as measured by tritiated thymidine incorporation into material precipitable by acid. When we injected our protein extract (8 mg/day) into mice for 4 days, the lymphocytes of the treated animals showed a 40 percent decrease in their transformation rate induced by PHA or by allogenic cells in MLC.

The principal difference between our extract and the one obtained by Houck *et al.* (*1*) is that ours was obtained from bovine spleen and theirs from rat lymph node and spleen.

However, despite the similarity between our results and the ones which appeared in the report by Houck *et al.*, our work is not cited.

E. GARCIA-GIRALT
Institut de Cancérologie et d'Immunogénétique, Hôpital Paul-Brousse, 14 Avenue Paul-Vaillant-Couturier, 94 Villejuif, France

References

1. J. C. Houck, H. Irausquin, S. Leikin, *Science* **173**, 1139 (1971).
2. E. Lasalvia, E. Garcia-Giralt, A. Maciera-Coelho, *Eur. J. Clin. Biol. Res.* **15**, 789 (1970); E. Garcia-Giralt, E. Lasalvia, I. Florentin, G. Mathe, *ibid.*, p. 1012; V. H. Morales and E. Garcia-Giralt, *Z. Naturforsch.* **26**, 1139 (1971).

20 January 1972

Does the Striate Cortex Begin Reconstruction of the Visual World?

Pollen *et al.* (*1*) have proposed that the output of each complex cell in the visual cortex of a cat represents a Fourier component of the light intensity distribution on the retina. This hypothesis implies several properties of complex cells which are inconsistent with published evidence. If the firing pattern of a neuron in the visual system provides information about phase and amplitude for a spatial frequency, then: (i) Its output should be independent of position of an image in the receptive field except for a frequency-dependent phase angle. Pollen *et al.* indicate that this requirement is satisfied in that complex cell responses are invariant within their receptive fields except for the peak response latency. Yet examination of the published responses of complex cells reveals significant variation beyond that in peak response latency. This variation is evident in both individual spike trains (*2*) and average response histograms (*3*). (ii) The output of a neuron that represents a Fourier component should be a linear function of the effective stimulus magnitude. The output of a complex cell cannot be a linear function of the logarithm of image intensity for all images if, as argued by Hubel and Wiesel (*2*), simple cells provide the principal inputs to complex cells. For example, if a stimulus falls in an inhibitory portion of the receptive field of a simple cell, it decreases the firing rate of that cell. Sufficient inhibition can silence the simple cell, so that it gives no output when stimulated in a neighboring excitatory region until the excitation exceeds inhibition (*4*). Thus the response of a simple cell may be a nonsmooth function of intensity, and the response of complex cells postsynaptic to it must therefore be nonlinear. Any cell having a receptive field with excitatory and inhibitory portions must have a nonlinear intensity-response curve for some images. Hence, by the same argument, if any such cells are afferent to complex cells, the intensity-response curve for a complex cell must be nonsmooth and must depend on the location of the image in its receptive field.

The Fourier model is deficient in two other respects.

1) In the simplest neuronal Fourier analyzer the amplitude and phase of response to a constant image would be independent of time at each frequency. If the image varied in time, a linear, time-independent transform could be used to predict the output of the analyzer. If, however, an array of neurons gives a time-varying response to a constant input, the transform required to convert input to output must be time-dependent. In such a case any hypothesis that the array is a Fourier analyzer must specify this transform. Without the transform it is impossible to test the hypothesis by predicting the response of the array to novel stimuli.

The instantaneous response of a complex cell depends on the recent history of intensity distributions on the retina in at least two ways. Its response to a distribution fixed on the retina varies with time after the stimulus goes on or off, as the complex cell and cells afferent to it adapt (*2*). If the distribution moves across the retina, the firing rate depends on the direction and speed of motion of the image (*3*). Hence if complex cells present a Fourier transform, the amplitudes and phases must be history-dependent. The proposal by Pollen *et al.* does not specify the nature of the time-dependent transform which these data require. Furthermore, if lateral geniculate or simple cells afferent to complex cells adapt in response to a constant stimulus, information about the stimulus is lost, and the "conservation of information" which Pollen *et al.* posit for processing through these stages does not obtain.

2) Pollen *et al.* cite a study by Campbell *et al.* (*5*) on cat visual cortical cell responses as showing that at least one such cell has ". . . the sharp cutoff on each side of the preferred spatial frequency that would be expected according to a model based on Fourier theory." However, most visual cortical cells in this study were no more selective of a preferred frequency than lateral geniculate cells on the low frequency side of the frequency that gives peak response, and none was more selective of higher frequencies. Moreover, retinal ganglion cells are much more frequency-selective than those at either higher level (*6*). In fact, Campbell *et al.* (*5*, p. 232) paid little attention to the cortical responses at lower than optimal frequencies because ". . . the variations in the form of the low