Table 1. Assays of interferon titers (PR_{50} units) on different cells. Interferon titer was calculated by determining the greatest dilution which reduced by 50 percent the number of plaques found in virus control cultures which had not been treated with interferon (PR_{50} unit); NT, not tested.

Cells used for interferon production	Cells used for interferon assays				
	A_9 mouse line cells	B_1 hamster line cells	AB hybrid cells	Primary hamster cells	Primary human embryonic kidney cells
A_9 (mouse line)	32	0	64	0	0
B_1 (hamster line) (10× concentrated)	0	0	8	8	NT
AB (hybrid)	16	0	32	8	0
Primary hamster cells	0	32	256	512	0
Human (amniotic)	NT	NT	0	0	32

concentrated tenfold had the same 1 : 8 titer on primary hamster cells as did the unconcentrated hybrid cell interferon.

The hybrid cells were sensitive to interferons produced in mouse line cells, hamster line cells, hybrid cells, and primary hamster cells, but not to interferon produced in human cells. The hybrid cells were eight times more sensitive to interferon produced in primary hamster cells than the parental hamster line cells were.

The hybrid cells produced interferon (interferons) which protected both mouse and hamster cells and were sensitive to both mouse interferon and hamster interferon. Cellular production of interferon and sensitivity to its action are unrelated. Therefore, genetic determinants for both production of species-specific interferons and sensitivity to the action of species-specific interferons were contributed to the hybrid cells by both of the parental cell lines.

The hybrid cells produced ten times more hamster interferon than the hamster line cells. Thus, it appears that the presence of the mouse cell genome in hybrid cells in some way allowed for better expression of the information carried in the hamster cell genome concerning production of hamster interferon. The molecular basis for this is not now known.

Guggenheim *et al.* (*8*) recently reported that heterokaryons, created by Sendai-induced fusions of nucleated chick erythrocytes and human cells, produce low titers of chick interferon although nucleated chick erythrocytes alone do not produce any chick interferon. Heterokaryons contain separate nuclei from two different cells in the cytoplasm of a single cell and do not replicate, whereas the hybrid cells used in our experiments contain both parental genomes in a single nucleus and were propagated as a cell line.

It is interesting to speculate whether the hybrid cells produce three different interferons: mouse, hamster, and a hybrid interferon with mouse and hamster subunits. We do not know (*2*) whether the composition of an interferon includes only a single polypeptide chain or the multiple chains consistent with this hypothesis.

When tested for sensitivity to the action of hamster interferon, the hybrid cells were eight times more sensitive than the hamster line cells. Thus, we have another example of the presence of the mouse cell genome in the hybrid cell, allowing for better expression of information carried in the hamster cell genome.

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Visual Form Discrimination after Removal of the Visual Cortex in Cats

Winans (*1*) claims to have demonstrated form discrimination in cats following bilateral ablation of cortical areas 17, 18, and most of 19. If the claim could be substantiated it would be important, and surprising in view of the well-established microelectric findings on what may be termed a primary contour-coding system in these areas (*2*). However, it is not at all clear that Winans' claim is valid. Criticisms are offered on several grounds, the first and most important, hinted at in her report, being that in her situation a visual discrimination was possible which was not based on shape or pattern as such.

Consider the training stimuli used in her experiment; these were white isosceles triangles on black grounds, one with base horizontal (the positive shape) and the other rotated through 180° (the negative shape). Six sets of training shapes were used, each set consisting of the same pair of triangles, their sizes decreasing from one set to the next. In each case the same orientation was used for the positive shape. Since original training was on the largest pair, it is very possible that discriminative responding was based on a difference in brightness gradient between the pair, that is, that the cats learned to choose the pattern that was brighter at the bottom than at the top. Indeed, if the cats attended only to the bottoms (or tops) of the patterns, the original discriminative responding to the patterns could be based simply on a brightness difference between them. Since the training sequence consisted of the identical patterns reduced progressively in size, an initial bias toward responding in terms of differences in brightness gradients would be expected to transfer to other sets in the training sequence where the differences in gradient are not so obvious.

We argue, therefore, that Winans has not sufficiently demonstrated a true pattern or form discrimination in her experimental subjects. In order to do so it would be necessary, in the first place, to find a more adequate specification of pattern, and what one means by a pattern discrimination. This is not an easy matter (*3*), but at least one can define a pattern discrimination largely by exclusion; it must be a visual discrimination not based on differences in brightness, brightness gradient, or position. In

addition it is desirable to choose patterns that are drawn in outline, so that contour becomes the primary cue, and that are symmetrical about horizontal and vertical bisectors of the shape so that general orientation is not available as a cue. Even if such patterns are used, it is not sufficient simply to demonstrate that a subject can discriminate between a pair, since it is possible that the discrimination is based on part of the shape where a difference in brightness may be present.

To establish that the discrimination is based on differences in pattern per se it is necessary to run some transfer tests, to show whether or not part-figure discrimination occurs, and to find out whether other stimulus parameters affect the discrimination. In the experiment under discussion, at the very least it would be necessary to find out whether the discrimination breaks down when only the top halves or bottom halves of the shapes are shown, and whether the discrimination occurs with a pair of shapes differing only in brightness, such as a white and a gray circle of equal area, or with two white triangles of different sizes. Without such tests, Winans' findings are clearly equivocal. Also, since animals can pick up quite minimal cues in extended training—including nonvisual cues—it would be desirable to introduce "catch" trials from time to time in the training sequence (both doors unlocked, no food available) in order to prove that the discrimination was indeed a visual one. In contrast to the report of Snyder, Hall, and Diamond (*4*), no data are given on the extra-experimental behavior of Winans' cats to show whether visual pattern recognition was still partially intact.

Although the report is interesting in showing possible residual visual functions after ablation of the visual cortex, it would be highly misleading to claim that this definitely and unequivocally establishes the presence of pattern recognition during postoperative discrimination training.

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I agree with the statement in the last sentence of Dodwell and Freedman's comment; no claim of the kind mentioned was made anywhere in my report. In fact, Dodwell and Freedman have reiterated the precise considerations which constituted an important part of the concluding section of my report, in which I stated: "It should be noted, however, that although the total luminous flux was equated for the positive and negative stimuli, differences in the spatial distribution of flux between members of each pair were present throughout the series. This difference in the distribution of flux between erect and inverted triangles may be significant to these results since adult visual-decorticate cats can perform a discrimination based on differences in total luminous flux between two stimuli [(*10*)]. To what extent the mastery of this discrimination represents a conceptual response to form per se (that is, triangularity of the stimulus in these studies) must therefore await further studies of the discrimination capacities of these animals" (*1*, p. 946). Dodwell and Freedman have elaborated upon the generally accepted types of "further studies" which I indicated would be necessary and which I have subsequently carried out with both normal and lesioned animals.

I regret that Dodwell and Freedman did not interpret my report as being in accord with their own viewpoint, but do not understand how they could ascribe the "claims" they indicate to the discussion above and to my conclusion, which stated that the results "show that the histologically defined striate cortex is not essential in the cat for mastery of a visual discrimination based on the spatial organization of light" (*1*, p. 946).

As to the suggestion that nonvisual cues may have been the basis for the animals' responses, two examples of procedures which I had performed and which I felt justified my statement that "Auditory, olfactory, and individual stimulus-panel cues were also controlled" (*1*, p. 945) are: (i) the performance of all of the cats dropped to chance levels, after mastery of the basic problem, during tests with certain novel stimuli which were constructed from the same materials as the mastered stimuli and presented in an identical manner (differentially reinforced, changed from positive to negative by inversion of the stimulus card, and so forth); reintroduction of the mastered stimuli resulted in immediate return to high levels of performance; and (ii) all of the cats maintained performance at the level of mastery during testing sessions with other novel figures which were constructed from different materials and presented on critical trials (food behind both goal doors).

The only apparent source of my critics' misinterpretation is the title of my report which, in the absence of the report itself, would be misleading. The title was chosen purposefully to be a part of the development of the entire report, to initiate the argument that after removal of the visual cortex, adult cats can discriminate the type of visual stimuli used for visual pattern discrimination training by Lashley (*2*) with the rat, Smith (*3*) with the cat, Karn and Munn (*4*) with the dog, and Kluver (*5*) with the monkey, to mention only a few. In other words, training with stimuli such as these has served to establish discriminatory responses to visual forms. Whether these responses were indeed responses to form or pattern was ascertained to some degree in the earlier studies and must be ascertained for these lesioned cats with further studies using novel but related stimuli and new testing situations. This was the extent of my "claim."

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