responding by proboscis extension to 1-percent solutions of these materials were as follows: 35.6 to yeast hydrolysate, 24.6 to GMP-5′, 12.4 to GMP-3′, and 30.0 to AMP-5′. All other monophosphate nucleotides tested for tarsal stimulation were inactive.

An enzymatic hydrolysate of casein (*10*) also stimulated feeding and clustering of female flies on filter papers, but the presence of GMP could not be detected by the same chromatographic and analytical procedures as used for yeast hydrolysate. Instead, the active fractions were eluted from the ion-exchange columns with $1N$ ammonium hydroxide solution and tested by the ninhydrin reaction which indicated the presence of peptides or amino acids, or both (*11*). When the constituent amino acids of casein were bioassayed on filter paper in phosphate buffer, five of these —leucine, isoleucine, methionine, lysine, and phenylalanine—were very active at 2 mg. Without the phosphate buffer these amino acids exhibited only slight activity, even at 2 mg. Several other anions, including sulfate, carbonate, and chloride, were tested as possible replacements for the phosphate; none were effective. Bioassay on filter paper showed that L-leucine and L-methionine in phosphate buffer were the most active of the amino acids (Table 1). The D-isomers of all the active amino acids showed slight activity when tested at 1 mg. However, when the D- and the L-isomers were compared on the same disc, the flies always selected the L-isomer even in the presence of more of the D-isomer. The peptide L-leucyl-L-leucine was inactive even at 2 mg. The active amino acids were also specific for female flies.

The stimulatory activities of the amino acids on the tarsi agreed well with the feeding and clustering tests on filter papers. Leucine, isoleucine, norleucine, lysine, and methionine at 1-percent concentrations stimulated more than 50 percent of the tethered flies. Phenylalanine, glutamic acid, and aspartic acid were stimulatory, but to a lesser number of flies, and the last two amino acids did not cause clustering on filter paper.

When tested for tarsal stimulation at a comparable molarity of $0.05M$, the active amino acids stimulated more flies than the guanosine nucleotides. Amino acids at about $0.005M$ concentrations elicited responses from 50 percent of the flies. In contrast, even at concentrations higher than $0.05M$, the guanosine nucleotides did not elicit responses from more than 40 percent of the flies. In tarsal stimulation tests adenosine monophosphate was as active as GMP-5′ and more active than GMP-3′, yet on filter paper it was inactive.

Differences in the relative activities of the nucleotides tested on free flies (filter-paper assay) or on tethered flies (tarsal stimulation) are not strictly comparable, since behavior of a group as opposed to that of an individual must be considered. Also, a large group of physiologically responsive flies is present during the filter-paper assay. Yet for reasons now obscure, some nucleotides that elicit proboscis extension when presented to the tarsi did not evoke feeding and clustering on filter paper. The active amino acids showed a better correspondence between tarsal stimulation and clustering of female flies. These amino acids also stimulated tarsi of males, but the clustering phenomenon occurred only with females. Phosphate buffering of all materials was necessary to obtain maximum feeding and clustering as well as maximum tarsal stimulation. Phosphate buffer alone was inactive by either assay.

Several adenosine nucleotides, including the mono-, di-, and triphosphates, are potent feeding stimulants for female mosquitoes of two species, *Culex pipiens* var. *pallens* Coquillett (*12*) and *Aedes aegypti* (Linnaeus) (*13*). However, the guanosine nucleotides were ineffective with these two species. In *C. pipiens* var. *pallens* the 3′- and 2′-isomers of adenosine monophosphate did not elicit responses and only the 5′-isomer caused feeding and engorgement. A comparable structure-activity relationship exists between the GMP isomers as flavor enhancers for human food in that the 5′-isomer alone is active (*14*). With the female house fly, although the 5′-isomer was the most active, the 3′- and 2′-isomers were also active.

Yeast and certain protein hydrolysates are extremely attractive foods as baits to several species of Diptera (*15*), including certain economically important species of fruit flies (*16*). Recently, a combination hydrolysate-pesticide poison bait was used extensively in eradication of the introduced Mediterranean fruit fly [*Ceratitis capitata* (Wiedemann)] (*17*). It will be interesting to determine whether the same components that stimulate feeding in the house fly are responsible for the effectiveness of the protein hydrolysates used as baits for other insects.

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Preference for Shapes of Intermediate Variability in the Newborn Human

Abstract. *Newborn humans presented with pairs of shapes, each shape differing in number of turns (angles), prefer shapes with 10 turns to shapes with 5 turns or 20 turns, as inferred from photographic recordings of eye fixations.*

The possibility that newborn humans can perceive pattern has been suggested by recent evidence of Fantz (*1*) and Hershenson (*2*), although the results are by no means conclusive and the dimensions of pattern which presumably underlie the differential responding have not been established. One dimension on which discrimination could be established and perceptibility determined, is the number of independent turns (angles) in a figure, a dimension approximating information value (*3*). This dimension is of particular interest since it has been demonstrated to be the basis of strong preferences in adults and in children (*4*). Specifically, when presented with random shapes containing from 3 to 40 independent turns, elementary school children and adults prefer neither figures of low variability (5 or 6 independent turns) nor figures of high variability (31 or 40 turns), but show a striking preference for figures of intermediate variability (10 turns).

In our study, newborn humans were exposed to pairs of shapes, each member of a pair differing from the other in number of angles. Preference for a particular shape was estimated from the number of times it was fixated by each infant. The apparatus, procedures, and scoring techniques are described elsewhere (*2*). The study was conducted in a small room containing a table on which an experimental chamber was mounted. Babies were placed on a cushioned cradle to constrain lateral movements of the head and hips. Stimuli were projected onto two ground-glass screens which were suspended 45.7 cm above the infant's eyes, 15 degrees on either side. Eye fixations were recorded on 35-mm infrared film by means of a motion picture camera mounted above the infant. The positions of the stimulus screens were marked by infrared lamps so that eye fixations could be measured in terms of relative positions of the stimulus markers to that of the pupil itself. The film was calibrated to determine the criteria for "looking at" one or the other stimulus.

Three shapes were presented in pairs so that each shape appeared once on each side; thus six stimulus pairs were shown in all. The pairs were presented to each infant in a predetermined random order. Each pair was presented for approximately 30 seconds with a dark period of from 5 to 10 seconds between presentations. Photographs were taken at the rate of one frame per second during the entire session, which lasted approximately 5 minutes.

The shapes were constructed according to a procedure previously described by Munsinger and Kessen (*4*). Coordinates in a 100 by 100 matrix were selected and connected at random to generate a shape which was then traced on drawing paper, cut out, and photographed. The resulting negatives, when projected, produced black figures on white backgrounds. The two sets of shapes used were selected to be approximately equal in brightness and complexity (*5*).

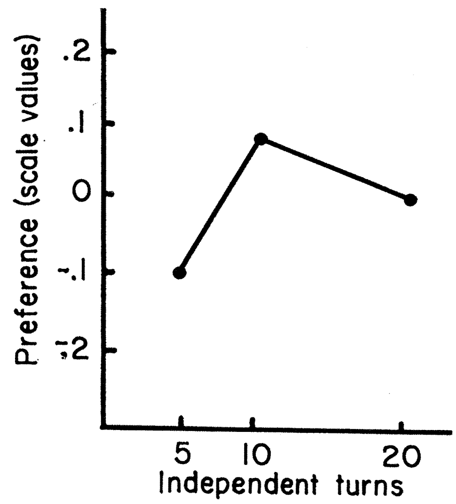

Fig. 1. Scaled preferences for figures varying in number of independent turns.

To measure the infant's tendency to look toward one of a pair of stimuli, chi-squares were calculated, both positions of the pair—AB and BA—as well as side preference being taken into account. Z scores based on the chi-squares (*6*) were used to test the hypothesis that the number of frames in which an infant fixated one member of a pair did not differ from the number of frames in which he fixated the other member of the pair. Seventeen newborns, 2 to 4 days old, were tested in this experiment.

Figure 1 shows the pattern of scaled preferences for figures varying in number of independent turns. The figures with ten angles were preferred to those with five angles ($p < .001$), indicating that newborns prefer greater variety of stimulation if given a choice between a fairly simple figure and a somewhat more variable one. This would suggest that the mediating variable had some relation to the amount of "information" in the stimuli. To be sure, the stimuli did vary minimally in complexity, but the results indicated a preference for stimuli of intermediate complexity, and the overall preferences show that the least complex stimuli were the least preferred. This is in marked contrast to the complexity-preference function for newborns previously reported by Hershenson (*2*) and suggests that complexity was not a contributing variable in the present study.

While the single significant preference should make one cautious in assigning the mediating role to the dimension manipulated (*7*), these data may be added to the accumulating evidence which now strongly suggests that the perceptual system of the newborn human is much more highly organized than previously thought. Moreover, the pattern of preferences is strikingly similar to that described by Munsinger and Kessen (*4*) and may be taken as partial support for the postulated limited capacity of human beings to process environmental variability.

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5. The figures encompassed from one-quarter to one-half of the total stimulus-screen area. Relative values of complexity, defined as number of light–dark transitions in a stimulus (*2*), may be approximated by the perimeter: 36, 55, 68 cm for the 5-, 10-, and 20-turn figures of set 1, respectively, and 27, 40, 80 cm for those of set 2, respectively.
6. For each subject, we calculated the value of chi-square for each of the six stimulus combinations, using the respective number of frames with the infant looking at either stimulus as the observed frequencies and the relative number of frames with the infant looking at either side proportional to the overall side preference as the expected frequencies. The signed z score equivalent of the chi-squares were then averaged for the pairs of comparisons which contained the same stimuli, with sign being taken into account. Thus each subject received a signed z score for each of the three stimulus pairs. A paired-comparison scaling procedure was used for simultaneous comparisons of the stimuli.
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