the threshold light intensity for survival. By linear interpolation this value is about 240 erg cm^{-2} sec^{-1}. On this basis the useful energy obtained by these cells is only about 9 percent of normal.

When the DNP concentration was increased to $5 \times 10^{-5}M$, the mean survival time was independent of the light intensity, being 2 days at each of the three light intensities. Cells kept in the control solution in darkness survived 33 days on the average; this appreciable survival time is attributable to a slow utilization of energy storage products. No estimate of the absolute magnitude of the energy requirement for survival of control cells in light can be made without an assumption regarding the photosynthetic efficiency. About two-thirds of the incident light is absorbed by *Nitella* cells (*1*).

The way in which DNP reduces the energy available for cellular functions would appear to be through the uncoupling of respiratory-chain phosphorylation or the stimulation of adenosine triphosphate hydrolysis, or both, rather than through the inhibition of photophosphorylation (*3, 4*). Although DNP can be reduced to 2-amino-4-nitrophenol both by isolated chloroplasts (*5*) and animal cells (*6*), the extent of this detoxication process in the present work is not known. In respiratory chain uncoupling, the diversion of metabolic electrons into net DNP reduction is not an important factor, since oxygen uptake remains normal or is even increased (*3*). We know of no direct effect of light on DNP.

The toxicity of DNP depends on its concentration at the site of action, and thus is related to the rate at which it enters the cell. Passage through the cell membrane appears to be chiefly in the undissociated form (acid dissociation constant, 8×10^{-5}), as no detrimental effects were observed at *p*H 8.3. For the main results at *p*H 6.7 and a total DNP concentration of $2 \times 10^{-5}M$, the concentration of undissociated DNP is $5 \times 10^{-8}M$.

An interesting feature of *Nitella* cells surviving under prolonged DNP treatment was the migration of most of the chloroplasts from their stationary positions in the outer, gel-type cytoplasm to the inner, streaming cytoplasm. The release of the chloroplasts from their very regular arrangement in the outer plasm (like bricks in pavement) suggests that DNP may cause a gel-sol transformation of the cytoplasmic gel. Under normal conditions only a few chloroplasts of a total of about 2 million are present in the streaming cytoplasm. The characteristic smoothness of streaming did not appear to be affected by this alteration in the internal arrangement of the cell parts.

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4 November 1965

Attention in the Newborn: Effect on Motility and Skin Potential

Abstract. *Newborn infants showed lower motility and greater reactivity of the skin potential while attending to a visual target than when equally alert but inattentive.*

Many studies demonstrate that the human newborn attends to appropriately presented patterned visual stimuli (*1*). He can also make some rudimentary perceptual discriminations. Still unanswered are questions regarding the adaptive or regulatory significance of these earliest states of attentive fixation or visual orientation.

Evidence indicates that during the first 10 days of life a baby lying relatively still, with eyes open, typically reacts to the presentation of a patterned visual target with orientation to the target, visual fixation on the target area, widening of the eyes, and reduction of the mild, steady activity of limb and trunk that is usually present in the waking but undistressed state. By contrast, from about 15 days of age the orientation-quiescence reaction still occurs upon appropriate presentation of a stimulus, but, after some 15 to 30 seconds of quiet looking, certain stimuli will elicit manifest excitation characterized by kicking, squirming, panting, and sometimes smiling and cooing (*2*). We have attempted more systematic exploration of the nature of this response of the newborn, particularly as it relates to the regulation of motor activity and autonomic reactivity.

Fifteen normal full-term infants between 2 and 6 days of age were observed and tested under two conditions: they were lying in their cribs in a quiet, wakeful state with eyes wide open, either with no target (condition A) or with a vivid visual target of random nonintersecting black lines on a white background presented at a distance of 20 cm in a plane normal to their line of vision (condition B). The stimulus card measured 24 by 27.5 cm; its lines were 6 mm wide (Fig. 1). Room lighting was normal. The sides of the cribs were made of a smooth light-blue plastic material so that under condition A no patterned visual target was available. Each condition was maintained for 1 minute and was alternated with the other condition for a total of 12 trials for each baby, six under each condition. The initial condition for each experimental run was randomly selected.

Approximately 15 seconds after the onset of each condition, and under condition B only when the baby had gazed at the target for at least 10 seconds, a puff of nitrogen was directed at an area just above the umbilicus. The 1-second puff was delivered from a hose held 5 cm above the abdomen under a pressure of 200 g/cm^2. The jet was just strong enough to slightly indent the skin.

The three dependent variables recorded were motility, skin-potential reaction, and heart-rate reaction. Because of technical failures in the cardiotachograph, the data on heart rate were not analyzable. Motility was recorded by use of a mattress constructed of polyurethane foam enclosed in an airtight rubber casing. Slight positive pressure was introduced into the casing. Movements of the baby on the mattress produced transient pressure changes in the system, which were registered by means of a Statham PM5

Table 1. Analysis of two parameters of motor activity: frequency of movements during the 10 seconds of each condition preceding the puff of gas ($\bar{x}$: condition A, 4.4 movements; condition B, 2.37 movements); and magnitude of the most intense movement during the same 10-second period [$\bar{x}$: condition A, 2.76 mv; condition B, 1.76 mv (arbitrary scale proportional to pressure change in the air-mattress system]. Abbreviations: C, condition; R, replications; S, subjects.

Item	*df*	Motor activity: Mean square	
		Frequency	Magnitude
C	1	192.20*	43.02†
R	5	5.78	1.63
S	14	36.35	19.39
C×S	14	17.03	3.66
C×R	5	8.36	4.93
R×S	70	10.71	4.82
C×S×R	70	4.39	2.00
Total	179		

* F, 33.1; $P < .005$. † F, 26.7; $P < .005$.

± 0.15 pressure transducer writing-out on one channel of a Grass model-7 polygraph.

To our knowledge there is no previous report of skin-potential recording from human infants. Crowell (*3*) recently reported some success in recording the galvanic skin reflex of newborn babies, but the number of clearly measurable changes in response to varied stimuli was relatively low—18 percent. To a puff of air similar in pressure and duration to the puff used by us, he found that only 11 percent of the stimuli produced criterion responses. In recording skin potential we found that 63 percent of the total of 180 puffs produced easily discernible electrodermal responses of 2 mv or greater. Furthermore, the relative absence of movement artifacts in the record greatly simplifies the analysis (*4*). For all but one baby a standing d-c potential between −20 and −40 mv was found. In response to the puff stimulation both positive-going and negative-going reactions were seen; more rarely, biphasic responses, of both positive-first and negative-first types. For the present analysis these four types of reaction were pooled, the magnitude of the response being measured at the point of maximum deflection from the prestimulus base line, disregarding the direction of the change. We do not yet understand the specific significance of each of these four types of reaction.

In general, base-line shifts tend to correlate well with change in overall state, so that, as the baby becomes agitated, the base line shifts in a negative direction, typically moving from a resting base line of −30 mv to one of −40 or −50 mv at the plantar electrode, with reference to the calf electrode. Conversely, when a pacifier is given to an agitated baby the base line starts to move in a positive direction almost as soon as the sucking starts, changing from −50 to −30 or −20 mv. Acute reaction to a sudden stimulus such as the puff is not so easily predictable, and we have found no way to determine, immediately before application of the uniform stimulus, whether the reaction will be positive- or negative-going or whether it will be monophasic or biphasic; we can only say that on an actuarial basis the biphasic responses are rarer, accounting for only 19 percent of all responses. Magnitude of the responses ranged from 2 to more than 35 mv; the more intense responses—greater than 10 mv—were always in a negative direction.

On the basis of our previous observation and the well-noted association between the orienting reflex and the temporary abatement of motor activity, it was hypothesized that motility would be significantly lower under condition B (target) than under condition A (no target). Table 1 presents the mean values and the analyses of variance for two measurements of body motility: "frequency" represents the number of deflections on the motility tracing during the first 10 seconds of each trial under each condition before introduction of the puff; "magnitude" represents the amplitude of the greatest deflection during the same period.

Both measurements clearly show that the babies moved less while looking at a target than when no target was available. Since there was no trend to habituate over the six pairs of trials, replication within subjects was chosen as the most sensitive error term; if the subjects-times-conditions interaction is chosen as the error term, the main effect remains significant.

The prediction regarding autonomic reactivity under the two experimental conditions was more difficult. One could imagine the visual sensory input activating the nonspecific sensory arousal systems, thereby enhancing reaction to the puff stimulus; or one could equally well predict a condition of focal attention, with concomitant elevation of thresholds to extraneous stimuli.

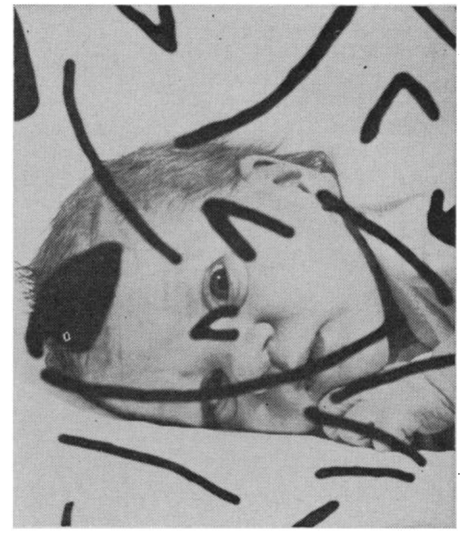

Fig. 1. Four-day-old infant looking at the stimulus drawn on transparent material; for the experiment it was drawn on an opaque white card. The target consists of a random distribution of line segments made by cutting up a stylized face stimulus used in an earlier study.

It is also possible for both these factors to operate simultaneously, with thresholds raised but with reactivity to suprathreshold stimuli enhanced. Table 2 shows the means and the analyses of variance for the two measurements of skin potential: the reciprocal of latency shows that the skin-potential response is more rapid under condition A, while the second analysis shows that it is also of greater magnitude. Neither of these physiologic measurements showed a significant trend to habituation over the six pairs of trials, so

Table 2. Analysis of two parameters of skin-potential reactivity: speed of the reaction following onset of the puff of gas, measured as the reciprocal of the latency ($\bar{x}$: condition A, 0.95/second; condition B, 1.86/second); and magnitude of the reaction measured between the prestimulus base line and the point of greatest deflection ($\bar{x}$: condition A, 3.10 mv; condition B, 6.48 mv). Abbreviations as in Table 1.

Item	*df*	Skin-potential reaction: Mean square	
		Latency^{-1}	Magnitude
C	1	34.00*	516.81†
R	5	4.54	21.68
S	14	11.30	206.29
C×S	14	7.38	56.99
C×R	5	2.14	140.73
R×S	70	3.59	34.54
C×S×R	70	3.86	3.40
Total	179		

* F, 7.55; $P < .05$. † F, 24.6; $P < .005$.

that the replication within subjects was again used as the error term. As with the motility data, the findings are not altered if the subjects-times-conditions interaction is used as the error term.

It is clear that electrodermal reactivity is enhanced during the state of target fixation, which fact indicates that the relative motor quiescence during this state is not simply an indication of overall inhibition. This state corresponds perhaps best to one of vigilance in more mature individuals, when spontaneous activity by the organism is held in check while receptivity to new stimuli is enhanced. This study, with its uniform, fairly powerful evocative stimulus, produced no information regarding threshold.

Analysis of skin-potential base-line values showed no significant differences in the following comparisons: (i) mean level immediately preceding the puff under condition B (−27.9 mv) and condition A (−28.9 mv); (ii) mean level at the termination of condition B (− 28.6 mv) and of condition A (−28.9 mv); (iii) mean level under condition B immediately before the first puff (−28.4 mv) and before the sixth and last puff (−26.1 mv); (iv) mean level under condition A immediately before the first puff (−29.7 mv) and before the sixth and last puff (−27.3 mv).

Of the widely ranging individual differences between subjects in the four dependent measurements, none was significantly related to any of the independent variables against which they were tested: birth weight, sex, age, birth order, or amount of medication administered during labor.

These findings have several implications. One is purely methodological, showing skin-potential recording to be feasible and useful in assessment of autonomic activity in the newborn.

Other implications concern the place of visual attention in the economy of the infant organism. The act of attending to a visual stimulus can now be regarded, even in the newborn, not simply as an interesting but isolated piece of behavior; rather it can be appreciated as part of the great complex of regulatory and adaptive mechanisms that one observes in normal individuals from the moment of birth. This particular regulatory complex, in which motility is reduced and at least one aspect of physiologic reactivity is enhanced by the presence of a visual target, may be of special interest because it may well serve to maximize the potentialities for flow of information from the environment to the organism.

The empiric support for the existence of a vigilant-like state in the newborn may also provide a basis for further investigation of the developmental relations between perception and excitation. The manifest excitation that has been observed, beginning at about 15 days, may have an even earlier precursor in the apparently innate readiness to excite while focused on a target.

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5. Supported by NIH grants 5-K3-MH-18521, NIH-M-RG-MH-08367 (to G.S.), 5-T2-MH-6001-10 (to S.B.), and BU-32-214-2585-7 (to H.L.).

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Racial Preference and Social Choice

At the conclusion of their article "Race and shared belief as factors in social choice" (14 Jan., p. 167), Rokeach and Mezei say: "Our three experiments . . . suggest that the importance of racial attitudes per se as determinants of racial discrimination have been greatly overestimated and the importance of congruence of belief correspondingly underestimated. Whatever racial attitudes our subjects may have had seem to have exerted little or no influence on actual choices in social situations. . . ." As the authors point out, however, there is strong evidence that racial attitudes *did* influence choice, in that the subjects avoided choosing racially homogeneous (SS or OO) pairs. Of the 118 subjects, 104 chose racially mixed (SO) pairs. The experimental design was such that by choosing a pair of people with congruent beliefs (++ or −−) the subject automatically chose a racially mixed pair. Restricting our attention to those instances in which a pair with conflicting beliefs (+−) was chosen, however, we still find a preponderance of choices of racially mixed pairs; there were 53 choices of S + O − or S − O +, as compared with 14 choices of O + O − or S + S −. Since a +− pair could be either homogeneous or mixed racially, these choices indicate a significant tendency to choose mixed pairs.

This preference for racially mixed over racially homogeneous pairs shows up in the data as an interaction between race of one member of the pair and race of the other. This interaction is illustrated in the following table, in which the entries indicate the number of choices of the pairs defined in the margins:

	S +	O +
S −	7	31
O −	22	7

Reading across, we see that an O+ person is preferred to an S + person when paired with an S − person, but an S + is preferred to an O + when paired with an O − person. The same effect is evident when the table is read in the other direction.

Thus, the results clearly support the authors' statement that "similarity of race is rarely a basis of choice." That is, there is no main effect due to race. But there is an interaction effect due to race; the racial characteristics of the pair *qua* pair do serve as a basis of choice. The racial attitudes of the subjects, as well as their beliefs, were a major determinant of choice—possibly because in the North it is impolite to form racially homogeneous groups (that is, to segregate) whenever there is a clear possibility of forming racially mixed groups.

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