nately, the yellow color was almost entirely lost in the black-and-white reproduction. At the lowest rate of flow, distances between the centers of color bands were 7 mm, red to yellow, and 3 mm, yellow to blue, with colorless spaces in between. Thus it was possible to perform a complete separation with the knife-edged flow splitter at the top of the column.

It should be emphasized that these are preliminary results; no protein mixtures have been tested as yet. The technique seems sufficiently novel, however, to merit early reporting (*9*).

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Perception of the Shortest Noticeable Dark Time by Schizophrenics

In an earlier paper by Saucer and Deabler (*1*), it was suggested that the generalized intellectual deficit exhibited by schizophrenics is in part a functional loss of ability to organize complex perceptual processes. This deficit may be related to Koffka's (*2*) concept of vigilance by considering the schizophrenic as an individual characterized by a lower level of vigilance and hence as one less able to produce good articulation.

Concerning vigilance, Koffka has said: "When the organism is active, at a high state of vigilance to use Sir Henry Head's term, it will produce good articulation; when it is passive, in a state of low vigilance, it will produce uniformity" (*2*).

Articulation may be defined as (i) a sharp separation between figure and ground or (ii) the isolation and preservation of *Gestalten* in an ambiguous situation. Our concern here is largely with the first definition, since critical flicker fusion (CFF) is studied in terms of a rigidly organized figure-ground relationship, although it must be stated that the light phase may be either figure or ground.

Critical flicker fusion clearly provides the necessary poles of articulation as flicker and uniformity as fusion. Therefore, CFF techniques may be expected to show a lowered ability to produce good articulation in schizophrenia.

Such a relationship has not yet been clearly demonstrated. This may be in part due to the choice of stimulus parameters. Conventional CFF studies have for the most part been carried out by the use of the General Radio Strobotac which has a light-dark ratio of approximately 1:5000 at fusion or by the use of the Tachisticope with a 1:1 light-dark ratio. Tanner (*3*) reported a study in which the light time was held constant and fusion was obtained by shortening the dark interval between flashes. He found that, under these conditions, correlations as high as .513 at the 5 percent level of significance between the shortest noticeable dark time and American College Entrance test scores could be demonstrated. It is his suggestion that neither a short light-dark ratio nor a 1:1 light-dark ratio presents optimal stimulus conditions for the study of relationships between CFF and psychological variables.

It is hypothesized that if Tanner's technique is applied to the question of articulation by schizophrenics, then the expected significant relationship between schizophrenia and CFF may be shown to exist. This paper is the report of an experiment in which schizophrenic and control subjects are compared with respect to the shortest noticeable dark time, it being expected that the schizophrenics will have a significantly longer shortest noticeable dark time at fusion.

Stimulation was provided by a fluorescent neon bulb (Westinghouse Nitelite) arranged to shine through a ¾-in. aperture. A ⅛-in. opal Lucite filter was interposed between the light and the aperture to provide uniform and diffuse illumination. The length of the light flash was fixed at 50 msec (a compromise between the 38- and 84-msec periods used by Tanner), and the intensity adjusted until a pilot group of normal observers reported fusion at SND times approximately the same as the 6.44-msec time reported by Tanner.

The light was gated by an asymmetrical multivibrator (*4*). On and off times could be varied independently over a range of 0.4 to 400 msec. The light fraction and the dark fraction were measured by means of a Tektronix 360 cathode-ray synchroscope and 162 pulse generator.

Control subjects were seven psychologically naive hospital staff members, six nonpsychotic neuropsychiatric patients, and six nonneuropsychiatric patients from the medical service of the Perry Point (Md.) VA Hospital. The experimental subjects were 20 acute and chronic schizophrenic patients from the neuropsychiatric wards of the hospital.

Subjects were brought into the laboratory and given a brief period of dark adaptation. For half the subjects, this period was 1 minute, for the other half, 3 minutes. After the dark-adaptation procedure was finished, it was demonstrated that the operator could vary the light from a clearly flickering state to a state of fusion.

The subjects were again shown the flickering phase and asked to report "when the light stops flickering." The shortest noticeable dark time was recorded, and the dark fraction was decreased well beyond this point. The subject was then asked to report "when the light starts to flicker." No further instructions were given. An ascending-descending series of six measures was taken.

There were no significant differences due to dark adaptation. The mean shortest noticeable dark time for the schizophrenic group was 11.58 msec with a standard deviation of 5.87 msec. The mean shortest noticeable dark time was 7.47 msec for the control group with a standard deviation of 0.833 msec. Although it is evident that there are gross differences in variance between the two groups (F ratio = 37.71 for 19 degrees of freedom), a t of 3.12, significant at the .002 level for a one-tailed test was computed.

Since the variances were obviously noncommensurate, nonparametric statistics were applied. For the rank order differences a Mann-Whitney CR of 3.72, significant at the .0001 level of confidence, was obtained. If the 19 high scores were taken as "normal" and the 20 low scores were taken as "schizophrenic," then 34/39 of the group could be correctly identified.

We feel that the null hypothesis of no true difference in shortest noticeable dark time between the control and schizophrenic group can be rejected at an adequate level of confidence.

Under these conditions of stimulus presentation, the schizophrenic is evidently less able to maintain good articulation. It is believed that the term *lowered vigilance* may be applicable to the schizophrenic. As a clinical concept, vigilance is useful in that it may serve to unify demonstrated relationships between CFF and a variety of psychological factors.

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Leukemia in Hiroshima City Atomic Bomb Survivors

It has become generally accepted that an increased incidence of leukemia follows the acute or chronic exposure of various experimental animals and of man to ionizing radiation (*1*). Recently an attempt has been made to establish a quantitative relation beween the probability of radiation-induced leukemia and the unit-dose of radiation received, on the basis of data from studies of various groups of radiation-exposed human beings (*2*).

The survivors of the atomic bombings in Hiroshima and Nagasaki, Japan, comprise two such groups. Reports concerning the occurrence of leukemia in these populations over a period, through June 1956, have been published at intervals by various staff members (*3*) of the Atomic Bomb Casualty Commission (*4*). In addition, an unpublished compilation of certain specific detailed information requested by the British Medical Research Council was prepared in September 1955 (*5*). An analysis of these data appeared in a publication of the Medical Research Council (*6*), and a portion was also published in a report of the National Research Council (*7*).

Since that time a review has been made of all the leukemia cases known to the Atomic Bomb Casualty Commission, and a master list has been compiled. Some of the cases on the September 1955 listing have been dropped for various reasons, and many cases have been added. No detailed official report has been published recently, in the hope that more adequate dosimetry data might become available. This wish is nearing fulfillment because of the joint initiation of a large program of dosimetry studies in 1955 by the Atomic Bomb Casualty Commission and a group of interested organizations, including the Atomic Energy Commission's Division of Biology and Medicine, the National Academy of Sciences–National Research Council, the U.S. Air Force School of Aviation Medicine, Los Alamos Scientific Laboratory, and Oak Ridge National Laboratory. The program is designed to make possible the assignment of a specific neutron or gamma ray dose, or both, in rads to the record of each survivor in the Atomic Bomb Casualty Commission's files for whom sufficient pertinent information is available.

A detailed interim report on leukemia in the Hiroshima atomic bomb survivors is presently being prepared by various staff members of the Atomic Bomb Casualty Commission and the National Research Council. It will include the best currently available dosimetry information resulting from the afore-mentioned collaborative effort. However, because of the present interest in data pertinent to radiation leukemogenesis and the desirability of making available current information obtained by the Atomic Bomb Casualty Commission, Table 1, summarizing results of the leukemia survey in Hiroshima as of December 1957, is presented at this time.

Certain limitations of these data should be pointed out. The program was initiated in 1947, but the present level of intensity of effort was not achieved until about 1950. Therefore, while it may be assumed that the numbers of cases shown for the years 1950 through 1956 are fairly accurate, the numbers that arose in the preceding years may be understated rather seriously. With respect to 1957, it is probable that additional cases remain to be discovered with onset in that year.

The denominators of the incidence rates are estimates, subject to errors of presently unknown magnitude. The 3 June 1953 residential census of Hiroshima was conducted by the Hiroshima Census Bureau and was presumably of a reasonable degree of accuracy. The categorization by distance from the hypocenter was made on the basis of Atomic Bomb Casualty Commission investigations of 50.8 percent of the males and 44.6 percent of the females who reported themselves exposed to the bomb. However, it was found that 3.1 percent of those reportedly exposed were in fact not in the city at the exact time of the bombing.

Apart from the uncertainties regarding the population on 3 June 1953, it may be incorrect to assume that migration in and out of the city during the period from 1950 to the present was the same for persons exposed in different distance categories. However, despite the current lack of pertinent information, the simple expedient of multiplying the June 1953 population values by eight to obtain estimates of person-years at risk has been adopted, since the census date is roughly near the mid-point of the interval under study. This procedure seems reasonable at present, although the magnitude of any resultant error is hard to estimate.

In addition to the above-mentioned points, which have to do with the in-

Table 1. Leukemia in Hiroshima atomic bomb survivors who were residents of Hiroshima City at the time of diagnosis (diagnoses verified by the Atomic Bomb Casualty Commission), as of December 1957.

Year of onset	Total	Distance from hypocenter (meters)				
		Under 1000	1000–1499	1500–1999	2000–2999	3000 and over
1945						
1946						
1947	3		1		2	
1948	7	2	4		1	
1949	5	1	1	1	1	1
1950	9	3	5			1
1951	11	3	7	1		
1952	11	3	5	1		2
1953	12	2	6	2	1	1
1954	6	2	2	1	1	
1955	8	1	4	2		1
1956	6		1	1	1	3
1957	5	1	3			1
Total	83	18	39	9	7	10
		*Estimated population**				
	95,819	1,241	8,810	20,113	32,692	32,963
		Number of cases with onset in 1950–1957				
	68	15	33	8	3	9
		Estimated person–years at risk				
	766,552	9,928	70,480	160,904	261,536	263,704
		Annual incidence of leukemia per 100,000				
	8.9	151.1	46.8	5.0	1.1	3.4

* Based on Hiroshima Census Bureau's daytime population census of Hiroshima City, 3 June 1953.