bombs were, by a factor of approximately five, "cleaner" than those tested in 1957 and 1958. This finding seems to agree with the following statement made by the AEC on 9 December 1961: "Of special interest is the small fission yield of the 55–60 megaton test conducted on October 30. The total fission yield for the series is estimated to be about 25 megatons, out of the total yield of about 120 megatons for the approximately 50 atmospheric tests" (*4*).

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Hallucinations in Sensory Deprivation—Method or Madness?

Abstract. Ten-minute observations of visual fields in binocularly patched subjects, and self-observation for dreams yielded visual imagery similar to sensory deprivation hallucinations. The latter probably arise from fragments of normal imagery whose origins are unrecognized because of reduced awareness.

The hallucinations (*1*) of sensory deprivation experiments are poorly understood, partly because of the large number of variables (*2*). In our earlier studies (*3*), reduced awareness was one of the more significant variables. Patients binocularly patched for detachment of the retina and for cataract extraction had hallucinations and other behavioral symptoms with increased frequency while going into or coming out of sleep (*4*). We wondered whether there might have been failure to identify some normal imagery occurring at the time (sleep dreams, hypnagogic hallucinations, and wakeful reveries) as such. We therefore decided to check the hypothesis that sensory deprivation hallucinations consist of fragments of one or more types of normal imagery occurring during reduced awareness.

Ten normal subjects and five patients with eye disease were binocularly patched for 10-minute periods. Instructions and methods of reporting were those utilized in the experiments of Hebb and his group at Montreal (*5*). The subjects were told to report what they saw in their visual fields, including on-going changes, and in particular to describe any visual images. Reporting was contemporary, sporadic, and retrospective (by recall) in randomized experiments for each subject.

The visual imagery recorded in these methodologic experiments was similar to that noted in the Montreal studies on sensory deprivation. It ranged from simple dots, lines, and geometric forms to more complex objects, persons, and scenes. There was a greater tendency toward secondary elaboration in the retrospective reporting. Hebb had commented that although the imagery was usually fleeting, it was at times prolonged and could be described while it was occurring. This "on-the-griddle" feature, as he called it, was duplicated in our "contemporary" recordings. Other less distinctive features reported by the Montreal group, as well as the similarities to hypnagogic imagery emphasized by Freedman and Greenblatt (*6*) and others, were also noted. In our experiments, even without the additional strong positive or negative suggestions utilized by Kandel, Myer, and Murphy (*7*) and by Jackson and Kelly (*8*), imagery of the kind reported in sensory deprivation experiments was obtained. However, these experiences occurred in alert subjects who were not in doubt about the source of the imagery.

In order to ascertain whether reduced awareness obscures the origins of normal visual imagery, one of us (E.Z.), on awakening, recorded self-observations with pad and pencil. Gradual arousals proved more productive than abrupt ones. The content of many of the dreams was forgotten before transcription; in many instances only fragments were recorded. The bizarre imagery of one dream and the normal imagery of another occurred in juxtaposition. On several occasions there were mixtures of kaleidoscopic hypnagogic hallucinations, dream fragments, and wakeful reveries. At times there was uncertainty as to which one or which combination of these mental processes gave rise to the imagery.

The Montreal group also described significant impairment of awareness. At a certain stage the subjects were unable to concentrate on goal-directed thinking. Then they were not sure whether they were daydreaming or sleep-dreaming, awake or asleep, and at times they spoke of being confused or in a dazed state.

Had we been less sophisticated we might not have isolated so readily the different types of normal imagery. Other investigators, who have used the Dement-Kleitman technique (*9*) and have also recorded dreams on arising, have made similar observations (*10*). Klüver (*11*) and Schilder (*12*) have described perceptual fragmentations in eidetic imagery. The former referred also to similar findings in dreams and hallucinations.

It is apparent, therefore, that our two sets of data support the hypothesis that sensory deprivation hallucinations are fragments of normal imagery. Our experiments show that some of the characteristics of sensory deprivation hallucinations are related to the type of instructions and methods of recording, which indeed serve to make much subliminal imagery conscious. Self-observations during arousal establish the fact that reduced awareness can obscure the origins of normal imagery.

The extent to which the increased incidence and duration of such periods of reduced awareness in sensory deprivation situations (*3*) is also necessary in the formation of hallucinations is not known, but these factors may well be contributory. In any event, the conclusion seems warranted that sensory deprivation hallucinations are not mental aberrations but are normal imagery largely, but not entirely, highlighted by methodological procedures. Confusion from reduced awareness obscures the origins and hence had given the impression of a new type of imagery.

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27 July 1962

New High-Pressure Polymorph of Zinc Oxide

Abstract. Zinc oxide exists in a sodium chloride structure form in the 100-kilobar pressure range. The cell edge of the high-pressure form is 4.280 A, the theoretical density is 6.912, and the enthalpy of transition is 785 cal/mole.

Zinc oxide (zincite) has a slightly distorted hexagonal wurtzite structure, and Bragg and Darbyshire (*1*) have claimed, after electron diffraction of thin films, that it can also exist in a cubic modification with the sphalerite structure. From a qualitative consideration of the effects of high pressures on ionic radii, zinc oxide, if subjected to high pressures, should invert to a NaCl structure. This polymorphic transition would produce a primary change in coordination number from four in the wurtzite structure to six in the NaCl structure.

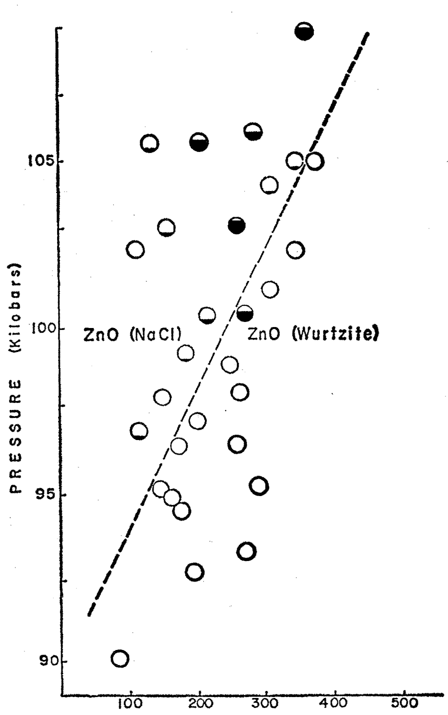

Fig. 1. Plot showing the *P-T* conditions for the formation of the NaCl form of ZnO. The dotted line is the approximate equilibrium curve.

We have synthesized a high-pressure polymorph of zinc oxide with the cubic NaCl structure.

The apparatus used and its accuracy, reproducibility, and limitations are essentially those described by Dachille and Roy (*2*), who used Bridgman (*3*) compound anvils. A Rene alloy anvil with a conical insert of grade 886 carboloy with 3/16-inch effective surface diameter was used for most of the runs. A small drop of saturated ammonium chloride solution was placed on the sample as a catalyst before the pelleted sample was covered with platinum–10-percent rhodium disks and placed between the anvils. The variation in recorded pressure during a single run was not more than ±6.5 kbar, as indicated on the Foxboro pressure controller.

In several runs above about 100 kbar a new form of ZnO appeared, and a univariant equilibrium curve between the two polymorphs based on such runs is presented in Fig. 1.

The new phase is identified and characterized by its x-ray powder pattern, which contains the distinctive reflections shown in Table 1. No higher angle peaks could be detected in a diffractometer pattern. The a_o for the NaCl structure phase is 4.280 A, which gives a theoretical density of 6.912, whereas the density for the zincite structure is 5.680. Conversion could be effected only with ammonium chloride as a catalyst. Other substances, including distilled water and 0.1*N* sodium carbonate solution, produced no detectable conversion even at pressures well above the equilibrium curve. It would appear that the catalytic action of the ammonium chloride comes from formation of zinc-ammonia complexes. The rate of conversion appears to be very slow and usually a period of 36 to 48 hours is required to produce an appreciable amount of the new phase. Even with long runs the yield is only 30 percent. So far the new phase has not been prepared free from contamination by zincite.

The effect of shear on the phase transition was also studied, by the technique described by Dachille and Roy (*4*), but no conversion could be detected. However, with shear under pressures of about 100 kbar only short runs without catalyst could be made.

Table 1. Distinctive reflections in x-ray powder pattern of new zinc oxide phase.

hkl	*d* (A)	I/I_o
111	2.479	60
200	2.140	100
222	1.5135	40

Sample extrusion and anvil failure under the high stresses produced were the controlling factors.

The high-pressure polymorph showed no tendency to revert to the wurtzite form even after it had stood for several weeks at room temperature. However, the high-pressure form does revert to the wurtzite structure at as low as 120°C (in 3 weeks). This may suggest that the inability to obtain the NaCl-phase pure may be due to failure of quenching.

The value of dP/dT as obtained from the equilibrium curve gives a value of 42.5 atm/°C, yielding a ΔH of transition from the Clapeyron relation of 785 cal/mole at 25°C (*5*).

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2 August 1962

A Gene in Drosophila That Produces a New Chromosomal Banding Pattern

Abstract. A change in the banding pattern of the distal end of the third chromosome in *Drosophila pseudoobscura* has been found. It appears to be produced by homozygosis for a recessive gene, which is called "salivary" (sal) in this report.

In the course of an experiment dealing with inversion polymorphism in *Drosophila pseudoobscura* (*1*), a new banding pattern, at the distal end of the third chromosome, was observed by one of us (L.L.) (Fig. 1). It was