different shapes of the curves imply that the effects of various reactions which compete for sulfur shift with changing temperature and Na_2S concentration.

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Occurrence of Serotonin in a Hallucinogenic Mushroom

Although some doubt has been cast recently upon the identification of *teonanacatl,* the sacred fungus of the Aztecs, as a species of *Panaeolus* (*1*), members of this genus are well known for their hallucinogenic properties and remain as the classical examples of mushrooms producing mycetismus cerebralis (*2*).

A preliminary chromatographic survey of a number of toxic mushrooms collected in western Washington (*3*) revealed the presence of several compounds in *Panaeolus campanulatus* (Fr.) Quélet (*4*) which gave, with Ehrlich's reagent, color reactions characteristic of indole derivatives. Subsequent investigation revealed that the most abundant of these compounds exhibited properties identical with those of serotonin (5-hydroxytryptamine). Although this compound has previously been detected in animals (*5*) and higher plants (*6*), this is the first report of its occurrence in a fungus. Its dimethyl derivative, bufotenin, has been reported to exist in certain species of *Amanita* (*7*).

It should not be assumed that serotonin, per se, is the hallucinogenic principle in *Panaeolus campanulatus* since Waalkes *et al.* (*6*) have established that large (20 mg) oral doses of the compound do not produce physiologic effects in human beings. The presence of serotonin may be indicative of the presence of related indole compounds, possibly of the type recently isolated from *Psilocybe mexicana* Heim (*8*). This compound, which has been named psilocybin, causes psychotropic effects in human beings following oral administration.

One gram of the dried mushroom was extracted with 70 percent ethanol, the extract was concentrated in a vacuum at 45°C, and the residue was purified by partition between n-butanol and water essentially as described by Udenfriend *et al.* (*5*). The purified extract was concentrated, and the entire quantity deposited as a line on a sheet of Whatman No. 3 filter paper which was subjected to ascending formation with a wash liquid composed of n-propanol and 1N ammonia (5:1). The section of the sheet corresponding to serotonin was eluted with water, concentrated, and again purified by partition between n-butanol and water.

The residue thus obtained was identical chromatographically with serotonin (*9*) in four solvent systems: the n-propanol–ammonia system described above, n-butanol–acetic acid–water (4:1:5), n-butanol saturated with 1N hydrochloric acid and methyl ethyl ketone–acetone–water (20:2:5). It gave reactions identical in all respects with serotonin with Ehrlich's reagent, Pauley's reagent, cinnamic aldehyde followed by hydrochloric acid, and with Jepson and Stevens' reagent, the latter being highly specific for certain tryptamines (*10*).

The ultraviolet absorption spectrum of an aqueous solution of the compound at pH 5.4 had a minimum at 250 mμ, a maximum at 275 mμ, and a shoulder with a point of inflection at 300 mμ. This is in good agreement with the absorption characteristics previously reported for serotonin (*11*). From these data it was concluded that the compound obtained from *Panaeolus campanulatus* was serotonin.

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Passage of Bacteriophage Particles through Intact Skin of Mice

It has long been known that two highly infectious species of bacteria, *Pasteurella tularensis* (*1*) and *Brucella melitensis* (*2*), can set up systemic infections in experimental animals when suspensions of such organisms are placed in contact with the apparently normal skin of animals. Rickettsia producing Rocky Mountain spotted fever can infect guinea pigs through the unabraded skin (*3*). Since bacteriophage particles are within the size range of most animal viruses but do not undergo either specific adsorption or multiplication in sensitive host tissues and have the added advantage of being assayed by relatively easy and accurate techniques, they lend themselves admirably to studies on the physical interactions of viruses in animals. Recent results from this laboratory (*4*) present evidence that bacteriophage particles can pass rapidly through the gastrointestinal barrier and into the blood circulation of mice. In view of the afore-mentioned results, experiments were initiated to ascertain whether particles of the size of bacteriophage could pass through the intact skin of mice.

The phage strain utilized in this study was derived from *Bacillus megatherium* 899a (lysogenic) and is the clear plaque mutant, strain C, as described by Gratia (*5*). The sensitive indicator strain *Bacillus megatherium* KM growing on a medium containing 2 percent Bacto Peptone was used for the production of phage stock suspensions, and assays were made by the pour plate method. Two different anatomical sites of adult white Swiss mice, strain C.F.W., Carworth Farms, were chosen as experimental areas—namely, the tail and the abdomen. These areas were not manipulated by any means such as depilation, shaving, or clipping of hair. In fact, great care was taken to choose only mice which by gross observation manifested normal and continuous dermis in these areas. In order to minimize the obvious effect that microscopic abrasions would have on these experiments, mice utilized in the tail experiments were isolated for 2 days prior to the experiments.

The mice were anesthetized for the duration of each experiment by the intraperitoneal administration of Pentathal sodium. In the first set of experiments the tail of each mouse was exposed to the virus solution (approximately 1×10^{10} phage/ml) by immersing it in a test tube to a level approximately 1 inch from the body proper. The tail was allowed to stay in contact with the virus solution for 15 minutes. In the second set of experiments, which were concerned with passage of bacteriophage through