

CHAPTER TWO

LSD, Ololiuhqui, Kykeon: The Ergoline Complex

I suddenly became strangely inebriated. The external world became changed as in a dream. Objects appeared to gain in relief; they assumed unusual dimensions; and colors became more glowing. Even self-perception and the sense of time were changed. When the eyes were closed, colored pictures flashed past in a quickly changing kaleidoscope. After a few hours, the not unpleasant inebriation, which had been experienced whilst I was fully conscious, disappeared. What had caused this condition?

Albert Hofmann
Laboratory Notes (1943)

On Friday, the sixteenth of April 1943, Albert Hofmann was abruptly overcome by the symptoms described above while working in his laboratory at the pharmaceutical firm Sandoz LTD. in Basel, Switzerland, just over the Rhine River from Nazi Germany. That day, Hofmann had recrystallized *d*-lysergic acid diethylamide tartrate (the tartaric acid salt of Lysergsäure-Diäthylamid, abbreviated LSD), a semi-synthetic compound prepared from lysergic acid that he had obtained by degradation of natural ergot alkaloids. Hofmann suspected a connection between the unusual inebriation and the LSD salt. Although he was accustomed to scrupulously clean working conditions and took pains to avoid contaminating himself with toxic ergot preparations, Hofmann speculated that some of the LSD-tartrate solution might have contacted his fingertips during recrystallization. Accordingly, he resolved to attempt a self-experiment with the tartaric acid salt of LSD.

That weekend, to rule out the possibility that he had become inebriated from breathing the solvent vapors, Hofmann went to his laboratory and intentionally inhaled vapors of the solvents with which he had been working, experiencing only slight dizziness (Hofmann 1977). The following Monday, 19 April, Hofmann prepared a 0.05% aqueous solution of LSD-tartrate, and ingested 0.5 cc of the solution,

representing 0.25 mg of LSD-tartrate (equivalent to about 0.17 mg or 170 micrograms of LSD base—the quantity taken was listed incorrectly in a popular book; Stafford 1983). Within 40 minutes Hofmann experienced “slight dizziness, restlessness... visual distortions, desire to laugh...” and it was evident that LSD had indeed been the cause of his inebriation the previous Friday. He soon found himself barely able to speak intelligibly, and asked his laboratory assistant to escort him home on bicycle, as in wartime Switzerland few automobiles were available. He began to experience bizarre alterations of perception, hallucinations, synaesthesia and out-of-body sensations. Fearing that his life (or at least his sanity) was endangered, Hofmann’s assistant summoned a physician, who was unable to find any abnormal symptoms, other than widely dilated pupils. After a few hours, and once he was assured by the attending physician that his life was not in danger, Hofmann’s terrifying perceptions slowly gave way to more enjoyable visual and auditory phenomena, and by late that evening, the bizarre effects had subsided altogether (Escohotado 1989B; Hofmann 1980; Holmstedt & Liljestrand 1963).

Subsequent experiments showed that LSD was active in doses as low as 10–20 mcg (10–20 millionths of a gram), and that Hofmann had inadvertently ingested some 5–10 times the minimum effective dose of the drug. Hofmann had thought he was being conservative in taking 0.25 mg of LSD-tartrate, for he was judging by comparison to the known activity of ergotamine and ergonovine, two ergot alkaloids which had been isolated in the Sandoz laboratories, and which by that time had found widespread application in therapeutics. Besides being an order of magnitude more potent than any other known ergot derivative, Hofmann’s LSD was approximately 4000 times the potency of mescaline (see Chapter 1) or harmine (see Chapter 4), the only other similar visionary substances known in 1943! It was, and remains, one of the most potent drugs known to science.

In 1947, Swiss psychiatrist W.A. Stoll (son of Hofmann’s superior at Sandoz, Arthur Stoll) published the first descriptions of the effects of the novel entheogen (Stoll 1947). Details of the synthesis of LSD had been published four years earlier (Stoll & Hofmann 1943). By the advent of the fifties, Sandoz had begun to distribute the new drug, under the trade name *Delysid*, as an experimental preparation. Throughout the fifties and into the early sixties, *Delysid* was widely used in clinical psychiatry (Grof 1973) and in brain research. Literally thousands of experimental reports dealing with *Delysid* were published in the scientific literature, testifying to the importance of Hofmann’s discovery. Besides proving to be a valuable tool in exploring the mechanisms of the brain, LSD has also shown great promise as a psychotherapeutic aid (Alhadeff 1962; Bender 1970; Delay *et al.* 1959B; Eds. 1963; Grof

1975; Grof 1980; Leuner & Holfeld 1962; Solomon 1964; Unger 1964; Yensen & Dryer 1995). After experiencing the LSD-like Mexican entheogenic mushrooms (see Chapter 5), physician V.P. Wasson predicted that their active principle would be valuable "in treating terminal illness accompanied by acute pain" (V.P. Wasson 1957). This proved to be an astute observation, as LSD has indeed shown value in treating terminal cancer patients, having both pain- and anxiety-relieving properties (Kast 1963; Kast & Collins 1964; Ocaña 1993; Pahnke 1971; Pahnke *et al.* 1970A).

LSD use was not to be confined to the research laboratory. By the late sixties, Hofmann's fungal entheogen was being used all over the world for the "not unpleasant inebriation" it provoked. LSD became illegal in most countries, and vigorous scare campaigns were mounted by the press and governments to dissuade users, painting a distorted picture of the dangers inherent in the use of this singularly potent and valuable drug. In this chapter I will trace the origins of LSD and related drugs, and document their rise as ludicrous drugs.

NATURAL HISTORY OF ERGOT

Our story begins with ergot, from which LSD and its psychoactive relatives are derived. Ergot is the sclerotium (the form the plant assumes to pass the winter) of the mushroom *Claviceps purpurea*,¹ which is parasitic on rye, wheat, barley and other cultivated grains, and which also infests wild grasses. After infection of the host grass with spores (technically ascospores), the mushroom forms purplish sclerotia, which project from the husk of the ripening grain. The sclerotia then fall to the ground, where they pass the winter. With the first spring rains, the sclerotia fruit, that is, they develop large numbers of tiny purple mushrooms that release ascospores, which are borne by the wind and which may contact immature ears of grain and again initiate infection (Bové 1970; Guggisberg 1954; Hofmann 1964). Some of the sclerotia, however, may be harvested with the grain and ground into flour, which they then contaminate with toxic alkaloids (Hofmann 1964).

During the Middle Ages, mass poisonings by ergot alkaloids occurred throughout Europe, whenever ergot-infested grain was consumed in large quantities (Barger 1931; Giacomoni 1985; Matossian 1989). A cool, wet growing and harvesting season was a prerequisite to the heavy infestation of the grain with ergot, and rye was especially susceptible (even with modern techniques of harvesting, small amounts of ergot are generally present in all harvested rye). The poor, who lived almost exclusively on bread, were particularly vulnerable to being poisoned by ergot al-

kaloids in their flour (Matossian 1989). Ergot poisoning, or ergotism, existed in two distinct types: the *convulsive* (characterized by epileptiform seizures) and *gangrenous* (characterized by gangrene of the extremities; Bauer 1973). The latter form was more prominent, and was called *ignis sacer* ("holy fire") or "St. Anthony's Fire" (*das Antoniusfeuer* in German; *feu de Saint Antoine* in French), because St. Anthony was the patron saint of a religious order dedicated to care of the numerous ergotism victims.² The convulsive form especially involved bizarre alterations of behavior, and has been blamed for strange outbreaks of "dance mania" or "St. Vitus' Dance" (Camporesi 1989; Heim 1957B). Not until the seventeenth century was the cause of ergotism understood to be poisoning by alkaloids from a fungus parasitizing grain, and since then, outbreaks of the disease have taken place only sporadically, the exception being the Soviet Union, which continued to suffer outbreaks of ergotism well into the present century (Barger 1931; Bauer 1973; Bové 1970; Hofmann 1978A; Matossian 1989).³ Vitamin A deficiency is thought to be a contributing factor to the development of convulsive, as opposed to gangrenous ergotism (Barger 1931), and of course the poor would have been more susceptible to such nutritional deficiency.

Ergot had also been used ethnomedicinally in Europe since antiquity, by "white witches" or midwives. It was employed as an ecbolic, or a drug to precipitate childbirth. Such use was first mentioned in writing in 1582, in an herbal by the German physician Adam Lonitzer or Lonicerus (Lonitzer 1582). In 1808, the use of ergot as a uterine-constricting agent was first reported in the scientific literature by the American physician John Stearns, who learned of it from an immigrant German midwife (Stearns 1808). By 1824 it was recognized that such use, which can cause uterine spasms and thereby imperil the life of the child, was too dangerous (Hosack 1824). Since 1824, ergot (and more recently ergot derivatives) has been used in obstetric medicine principally for the control of postpartum hemorrhage (bleeding after parturition; Hofmann 1964; Hofmann 1978A; Hofmann 1980).⁴ In honor of Stearns' introduction of ergot into scientific medicine, the ElectromyeloGram (EMG) traces showing the "oxytocic" or "uterotonic" effect of the ergot alkaloids remain known to this day as the "Stearns effect" (see Der Marderosian *et al.* 1964B, figure 1, which illustrates the Stearns effect on isolated rat uterus).

CHEMISTRY OF ERGOT

Chemical studies on ergot were begun in the nineteenth century, but the first breakthrough was not attained until 1918, when Arthur Stoll of the Sandoz laboratories

isolated the first pure alkaloid with medically-valuable properties, which Stoll named ergotamine (Stoll 1965). Earlier, in 1907, English researchers Barger and Carr isolated an alkaloidal preparation which they called ergotoxine, because it showed principally the toxic properties of ergot. Hofmann showed 35 years later, however, that ergotoxine was actually a mixture of three ergot alkaloids (Hofmann 1964).⁵ French pharmacist C. Tanret had isolated *ergotinine cristallisée* in 1875, which Hofmann later determined to be the alkaloid ergocristinine. Tanret had also isolated what he called *ergotinine amorphe*, from which Barger and Carr were able to isolate their ergotoxine mixture (Bové 1970; Hofmann 1964).

In 1935, the specifically uterotonic (uterine-constricting) and hemostatic (stopping bleeding) principle of ergot, which accounted for its use in medicine, was isolated independently in four different laboratories, including Sandoz. The new alkaloid was ultimately designated *ergonovine* (Hofmann 1978A).⁶

It was also in the late thirties that Albert Hofmann began work on ergot alkaloids. His first important project was the synthetic preparation of ergonovine, which he achieved using as starting materials natural lysergic acid (obtained from the ergotoxine mixture) and propanolamine. This was accomplished in 1937, and was the first synthesis of an ergot alkaloid. Besides proving the structure of ergonovine, Hofmann's synthesis was of considerable economic importance, as ergonovine was valuable in obstetrics, but occurred in low concentrations in ergot, and could now be prepared from other, less-valuable and toxic ergot alkaloids.⁷ Using techniques he had developed in the synthesis of ergonovine, Hofmann began to prepare a series of derivatives of ergot alkaloids, attempting to find substances with improved or novel pharmacological properties.

The 25th compound Hofmann prepared in this series was *d*-lysergic acid diethylamide, first made on 16 November 1938 and given the code-name LSD-25 (Hofmann 1955; Hofmann 1970B; Hofmann 1979A; Hofmann 1979B; Hofmann 1980; Horowitz 1976). Hofmann had hoped that this compound might have analeptic properties (that is, that it would stimulate respiration and circulation), as it was structurally similar to a known analeptic, nicotinic acid diethylamide (*Coramin*). He submitted the new drug to the Sandoz pharmacologists, who discovered it was not valuable as an analeptic, and that it possessed only 70% of the uterotonic effect of ergonovine. Significantly, the pharmacologists noted that LSD-25 produced "restlessness" (*Unruhe*) in the experimental animals. Because it showed no significant properties in pharmacological screening, the pharmacologists lost interest, and the compound was shelved. Hofmann, however, "liked the structure" and had a "striking presentiment" that his LSD-25 would be of pharmacological interest and, even

'though it was contrary to company policy (when once a new compound was screened pharmacologically and judged to be of no interest, it was to be dropped from the research program), he decided to prepare a second batch of the drug five years later in 1943, which led to the serendipitous discovery of its psychoptic effects, as I discussed in the introduction to this chapter (Hofmann 1980).

In the same series of experiments which led to the synthesis of LSD-25, Hofmann prepared *d*-lysergic acid amide, or ergine (code-name LA-III), and its isomer, isoergine (Hofmann 1963A). After his discovery of the visionary effects of LSD-25, Hofmann began to test in self-experiments a series of derivatives and analogues of LSD, searching for compounds with specifically entheogenic properties.⁸ In 1947 he tested ergine and isoergine in self-experiments, and found both to be psychoactive, especially ergine (Hofmann 1963A). This finding was confirmed independently in another laboratory nine years later (Solms 1956A; Solms 1956B). Although in 1947 these compounds were known only as artificial LSD congeners (Smith & Timmis 1932), in 1960 they were shown to be natural products, occurring in two different, widely disparate branches of the plant kingdom (Arcamone *et al.* 1960; Hofmann & Tschertter 1960). The significance of these experimental results will become evident after a necessary brief digression to discuss *ololiuhqui*, a Mexican ceremonial entheogen related chemically to ergot.⁹

NATURAL HISTORY AND CHEMISTRY OF *OLOLIUHQUI*

After the conquest of México in 1521, a number of sixteenth and seventeenth century Spanish writers, in reference to the religious practices of the Aztecs and other indigenous groups, described the ritual use of entheogenic seeds called *ololiuhqui*, "round things." The seeds were said to come from a plant called *coaxihuitl* or *coatlxoxouhqui*, "snake plant" or "green snake," illustrated in the *Florentine Codex* of Sahagún, and unmistakably a member of the Convolvulaceae, the bindweed or morning glory family (Hernández 1651; Hofmann 1980; Sahagún 1950; Sahagún 1982; Schultes & Hofmann 1980; Taylor 1944; Taylor 1949; Wasson 1963). Sahagún had described use of the *ololiuhqui* seeds in rituals and in phytotherapy as a topical treatment for gout, in combination with entheogenic mushrooms (see Chapter 5), *Datura* spp. (see Appendix A) and other plants. To treat an "aquatic fever" thought to have been malaria or a similar disease, the Aztec physicians prescribed ingestion of a super-entheogen—a combination of the *ololiuhqui* seeds, *péyotl* (see Chapter 1), the entheogenic mushrooms and a *Datura* species (Sahagún 1950; Sahagún 1982)!

In 1897, Manuel Urbina identified *ololiuhqui* as the seed of *Ipomoea sidaefolia* (today known by the synonyms *Rivea corymbosa* and *Turbina corymbosa*; Urbina 1897), an identification later accepted by B.P. Reko (Reko 1919; Reko 1929). Some incorrectly maintained that the Aztec “snake plant” was not a morning glory, but a species of *Datura*, in the nightshade family, Solanaceae (Hartwich 1911; V.A. Reko 1936; Safford 1915).¹⁰ Finally in 1938, Blas Pablo Reko and Richard Evans Schultes collected the first good botanical voucher specimens of *coaxihuitl* and *ololiuhqui*, and definitively identified the plant as *Turbina corymbosa* (Schultes 1941).

Reko had earlier sent *ololiuhqui* seeds to C.G. Santesson of Sweden, who reported they were psychoactive, but was unable to isolate the active principle (Santesson 1937A; Santesson 1937B; see also Chapter 5, Note 6). Santesson’s work suggested the presence of an active gluco-alkaloid, and a quarter of a century later two groups (including that of W.B. Cook, who was working for the CIA under project MKULTRA; see Chapter 5, Note 8) independently isolated a glucoside, turbicoryn, from seeds of *T. corymbosa* (Cook & Kealand 1962; Pérezamador & Herrán 1960). Since this glucoside did not also occur in more potent seeds of *Ipomoea violacea* (see below), it is probably not important in the psychopharmacology of the morning glory seeds (Hofmann 1963A), though it showed hints of activity at oral doses of 30 mg (Hoffer & Osmond 1967). However, synthetic mixtures of corresponding ergoline alkaloids mirrored effects of the alkaloid extract of *ololiuhqui* seeds (Isbell & Gorodetzky 1966). In some reports of self-experiments with *ololiuhqui* seeds, doubts were cast on their visionary properties (Kinross-Wright 1959; Reko 1934). In 1955, Osmond conducted self-experiments establishing psychotropic activity of *T. corymbosa* seeds (Osmond 1955).¹¹ In the summer of 1959, R. Gordon Wasson (an American banker investigating the Mexican sacred mushroom cults; see Chapter 5) sent a small sample (21 g) of *ololiuhqui* seeds to Albert Hofmann of Sandoz, together with a somewhat larger sample (204 g) of a related seed, called by the Zapotecs of México *badungás* or *badoh negro*, “black *badoh*,” as distinct from *badoh*, the true *ololiuhqui* (Hofmann 1963A; Wasson 1963). The second sample represented *Ipomoea violacea* seeds (synonyms: *I. rubro-caerulea*, *I. tricolor*), a morning glory commonly grown as an ornamental. Mazatec Indian use of *I. violacea* seeds was discovered by Blas Pablo Reko (1945); Zapotec use documented by T. MacDougall (MacDougall 1960). Wasson suggested that *I. violacea* represented the Aztec drug *tlitliltzin* (“sacred black ones”; Wasson 1963), and this species is known to the Mayans as *yaxce’lil* (Garza 1990). Both *I. violacea* and *T. corymbosa* are still used as shamanic inebriants in México, for example by the Mixe Indians of Oaxaca. *Ipomoea violacea* is commonly known in México as *quiebraplato* or “plate breaker,” which term likely derives from the Mixe

name *piH pu'ucte·sh* "broken plate flower" (Lipp 1990). The Mixe consider *I. violacea* to be more potent than *T. corymbosa* (which chemical studies have borne out) and make a cold water infusion of 26 seeds of the former, ground on a *metate* by a virgin (a practice Wasson observed among the Zapotec in 1963; just as the Mixtec served him juice of entheogenic mushrooms ground by a virgin in 1960, and as the Mazatecs served him juice of *Salvia divinorum* ground by a virgin in 1962; Wasson 1963). Before serving the infusion of the morning glory seeds, the Mixe, Zapotec and Mazatec Indians strain out the residual seed material with a cloth. A generic Mixe name for the morning glory seeds is *ma-sung-pahk*, "bones of the children" (Lipp 1991). The Zapotecs also call *Ipomoea violacea* seed *la'aja shnash* or "seed of the virgin," perhaps being the origin of the contemporary Mexican term *semillas de la virgen* for entheogenic morning glory seeds (Wasson 1963). Although it is widely assumed that the name *semillas de la virgen* refers to the Catholic virgin, it probably derives from the Zapotec term, which more likely refers to the virgin appointed to grind the seeds.

With the small initial samples of both seeds, Hofmann was able to establish the presence of indole alkaloids, which prompted him to ask Wasson to obtain larger quantities, to enable him to isolate the active principles. Early in 1960, Wasson sent Hofmann 12 kilograms of *Turbina corymbosa* seeds and 14 kilograms of *Ipomoea violacea* seeds (Hofmann 1963A). He had obtained the seeds with the assistance of the eminent anthropologist Robert Weitlaner, his daughter Irmgard, and Thomas MacDougall. Before the year 1960 was out, Hofmann and his assistants had isolated and characterized the active principles. The main active constituent of both species was discovered to be *d*-lysergic acid amide, or ergine (LA-III). Lesser amounts of isoergine, chanoclavine and elymoclavine were also found. Trace amounts of lysergol were isolated from *Turbina corymbosa* and trace amounts of ergonovine from *Ipomoea violacea* (Hofmann 1961; Hofmann 1963A; Hofmann & Tschertter 1960). It was later ascertained that some of the ergine and isoergine were present in the seeds in the form of *N*-(1-hydroxyethyl)amides, which readily hydrolyzed to ergine and isoergine (Hofmann 1971). Total alkaloid concentration was 0.012% in *Turbina corymbosa* and 0.06% in *Ipomoea violacea* (Hofmann 1963A). The alert reader will recall that ergonovine was the third pure alkaloid to be isolated from ergot. Ergine and isoergine had been prepared synthetically in the forties in the Sandoz laboratories, tested and found to be psychoactive in the same series of investigations that resulted in the synthesis and testing of LSD. Both were shown to occur also in ergot from the wild grass *Paspalum* (Arcamone *et al.* 1960). Chanoclavine and elymoclavine had earlier been isolated from ergot of *Pennisetum* and *Elymus* (Abe *et al.* 1955; Hof-

mann *et al.* 1957), whereas lysergol had existed only as an artificial derivative of ergot alkaloids (Hofmann 1963A). Elymoclavine and lysergol elicited “an excitation syndrome” in various animals (Yui & Takeo 1958; see Table 2, Note 13). Roquet and Favreau mistook ergine for “a glucoside with an amide function,” harking back to Santesson’s preliminary reports and the subsequent isolation of the glucoside turbicoryn from *T. corymbosa* (Pérezamador & Herrán 1960; Roquet & Favreau 1981).

Although there was some initial scepticism concerning ergot alkaloids in morning glories (Hofmann 1980; Taber & Heacock 1962), Hofmann’s finding was soon confirmed (Genest 1965; Taber *et al.* 1963A; Taber *et al.* 1963B), and these alkaloids have also been found to occur in numerous other species of morning glories (see Table 2; Der Marderosian 1967; Der Marderosian & Youngken 1966; Der Marderosian *et al.* 1964A; Der Marderosian *et al.* 1964B). Their highest concentration, 0.3%, was found in seeds of “baby Hawai’ian woodrose,” *Argyreia nervosa* (Chao & Der Marderosian 1973A; Chao & Der Marderosian 1973B; Hylin & Watson 1965). These alkaloids are also found in leaves and stems of *Ipomoea violacea* and *Turbina corymbosa* (Genest & Sahasrabudhe 1966; Hofmann 1963A; Taber *et al.* 1963B; Weber 1976; Weber & Ma 1976). In Ecuador, *Ipomoea carnea*, known as *borrachero* (“in-briating one”) or *matacabra* (“goat killer”) has been used traditionally as an entheogen, and its seeds have been shown to contain ergot alkaloids (Lascano *et al.* 1967; Naranjo *et al.* 1964). Numerous species of *Argyreia* and *Ipomoea* are now known to contain entheogenic ergoline alkaloids (see Table 2; Chao & Der Marderosian 1973B; Gardiner *et al.* 1965; Genest & Sahasrabudhe 1966; Staba & Laursen 1966), as is the species *Stictocardia tiliaefolia* (Hofmann 1961). Furthermore, based on their ethnomedicinal use, it is likely that species of *Convolvulus* (Albert-Puleo 1979; Genest & Sahasrabudhe 1966), *Ipomoea crassicaulis* (Zamora-Martínez & Nieto de Pascual Pola 1992), *I. involucrata* (Akendengué 1992; MacFoy & Sama 1983), *I. littoralis* (Austin 1991), *I. medium* (Beaujard 1988) and *I. pes-caprae* (Dagar & Dagar 1991; Ponglux *et al.* 1987; Pongprayoon *et al.* 1991) contain entheogenic ergoline alkaloids.¹² The elymoclavine-rich *Securidaca longipedunculata* of the Polygalaceae is reportedly used as an entheogen by the Balanta people of Guinea Bissau (Costa *et al.* 1992).

EFFECTS OF LSD, ERGINE, ERGONOVINE, METHYLERGONOVINE AND METHYSERGIDE

LSD: LSD and *Delysid* (LSD-tartrate) produce profound visual and auditory alterations and synaesthesia. The effective oral dose in human beings ranges from 50–

500 micrograms, above which a saturation level may be reached in most users, such that further augmenting the dose will not intensify the effects (Grof 1975; Shulgin 1980B). The effects of LSD generally begin within 45–90 minutes, and last for eight hours or more (Cohen 1964). Other than dilated pupils, side-effects are negligible, as are after-effects. Pharmacological studies have shown that little of an injected dose of LSD actually reaches the brain of experimental animals, and that the tissue concentrations reach a maximum within 10–15 minutes of injection, and rapidly subside thereafter. The drug is almost completely eliminated from the body before the peak effects commence, suggesting that it acts as some sort of catalyst, inducing the neurochemical changes which subsequently result in the visionary experience. Only about 1–10% of an injected dose of LSD is excreted unaltered, the remainder being metabolized to a variety of degradation products (Hofmann 1968).

ERGINE: Ergine or LA-III produces a mildly visionary effect, characterized by pronounced sedative side-effects. Hofmann first established its activity in 1947, 13 years before it was known to be one of the active principle of *ololiuhqui* (Hofmann 1961; Hofmann 1963A; Solms 1956A; Solms 1956B). He showed that the drug was active at doses of 500 micrograms to 1 milligram. No psychoptic effect was noticed by Hofmann after taking 2 milligrams of isoergine, although sedative symptoms similar to ergine inebriation were prominent. Hofmann's description of perceiving the "unreality and complete meaninglessness of the outside world" after taking 2 milligrams of isoergine (Hofmann 1963A), however, sounds like the paradoxical depressant effect experienced commonly with threshold doses of psilocybine and other entheogens, and it is possible that isoergine is visionary at higher doses.

ERGONOVINE and METHYLERGONOVINE: Ergonovine is, as already noted, the specifically uterotonic and hemostatic principle of ergot. It has been widely used in obstetrics to control postpartum hemorrhage, at doses of 100–250 micrograms of the hydrogen maleate salt (*Ergotrate*; *Syntometrine*). The drug was not known to be psychoactive until 1 April 1976, when Hofmann ingested 2 mg of ergonovine maleate (representing 1.5 mg ergonovine base). This was probably the highest dose ever utilized in a human subject, and within an hour Hofmann experienced colored hallucinations and other psychic effects, lasting for several hours (Hofmann 1978A). Jeremy Bigwood and I later verified Hofmann's findings as to visionary properties of ergonovine, taking doses of up to 10 mg (Bigwood *et al.* 1979), and P. Neely and I extended them to show psychoptic effects of methylergonovine hydrogen maleate (*Methergine*), a semi-synthetic derivative (Ott & Neely 1980) once mentioned

in the medical literature to have psychotropic side-effects (Waser 1965). Ripinsky-Naxon and colleagues (1993) found 6 mg of ergonovine maleate mildly entheogenic. See Postscriptum on pp. 141–144 for a rationale for these psychonautic experiments.

METHYSERGIDE: Methysergide is a potent serotonin antagonist (see Chapter 3 Note 5) widely used in medicine for the treatment of migraine. The normal medicinal dose is 2 mg of the hydrogen maleate salt (*Sansert* or *Deseril*) taken 2–4 times daily. At higher doses, however, the drug shows psychoptic effects, particularly above 7.5 mg. The visionary threshold dose, said to be equivalent to 25 mcg of LSD, has been calculated to be 4.3 mg (Abramson & Rolo 1967). Doses of 8–12 mg given orally to so-called “schizophrenic” children produced effects similar to 100–150 mcg doses of LSD (Bender 1970). Methysergide bears quite a close structural relationship to the above-mentioned methylergonovine (*Methergine*).

LSD AND MORNING GLORY SEEDS AS LUDIBLE DRUGS

While LSD, under its trade name *Delysid*, was circulating widely among members of the medical and psychological professions during the fifties, it was inevitable that the curiosity of some researchers would get the better of them, and they would decide to try the wondrous “psychotogen” outside of the laboratory. In some cases, subjects of experimental *Delysid* therapy cultivated an interest in trying the drug on their own, in a non-clinical setting, away from the prying eyes of individuals in white coats. Thus was born the first extra-scientific, or ludible use of LSD.

In the early sixties, John Beresford, who had been involved in LSD research, and Michael Hollingshead began to “turn on” people outside of a laboratory context (Hollingshead 1974). Beresford had purchased a gram of *Delysid* from Sandoz and some of the material, diluted in sugar in a mayonnaise jar, ended up in the possession of Hollingshead, who initiated a number of individuals, including prominent musicians, to the world of entheogens. Perhaps the most significant “turn on” by Hollingshead was of Timothy Leary, a Harvard lecturer in psychology who had been conducting research with *Indocybin*, Sandoz’s other pharmaceutical entheogen, better known as psilocybine (see Chapter 5). Leary’s introduction to LSD took place in the fall of 1961, and the drug so impressed him that he temporarily lost interest in psilocybine, and turned his attention to its more potent cousin (Leary 1968). In 1963, Leary placed an order with Sandoz for the then-unprecedented quantities of 100 grams of LSD and 25 kilograms of psilocybine (equivalent to about

one million and 2.5 million doses respectively; Hofmann 1980). By this time, Leary's work had already made the Harvard administration uneasy—they were uncomfortable with the fact that Leary and his colleagues Richard Alpert and Ralph Metzner had a penchant for ingesting the experimental drugs themselves, together with the research subjects, at times in a party-like session (Leary 1968; Weil 1963B). Many hard-line experimentalists scoffed at this approach, claiming that the experimenter could not maintain "scientific objectivity" (whatever that is) if (s)he personally ingested a mind-altering drug.¹³

A further problem with Leary's Harvard research project was the fact that entheogenic drugs were sometimes being administered without the supervision of a physician, a technical illegality. Moreover, one of Leary's associates created unfavorable publicity in Denmark, when he, Leary and Aldous Huxley attended a psychological conference in Copenhagen. Leary's colleague gave psilocybine to some journalists who were interviewing him, and made some rather sensational remarks (Wasson 1977).

Back in Cambridge, Massachusetts, many of the students who had participated in Leary's experiments began to cultivate a taste for entheogenic drugs, and a rudimentary black market for *péyotl*, mescaline, psilocybine and LSD came into being (Jones 1963; Kreig 1967; La Barre 1975; Lee & Shlain 1985; Stafford 1983; Stevens 1987; Weil 1963A; Weil 1963B). That interest was rampant is attested by the fact that the fourth issue of *The Harvard Review* (Summer of 1963) was devoted to entheogenic drugs, and featured articles by R. Gordon Wasson, Richard Evans Schultes and Leary (Weil 1963A). At first, this entheogenic drug scene revolved around the Beats, and several coffee shops in the Harvard Square area of Cambridge, notably the Club 47, began to proffer LSD-laced sugar cubes. At this time, extra-medical use of LSD was beginning also on the West Coast of the United States, and underground manufacture of the drug had commenced. B. Roseman is sometimes credited with being the first to manufacture LSD outside of the pharmaceutical industry (Horowitz 1985), a process he described openly in a hand-lettered book (Roseman 1966). Even though LSD was at that time legal, Roseman was arrested and charged with smuggling and "selling an unlabeled drug without a license" (Roseman 1966).

It must be said that Leary and his Harvard colleagues sincerely tried to stimulate responsible use of entheogens. They realized that the naive psychonaut (Jünger 1970) needed a "guide" to accompany him on his psychic "trip," and that the drug could not simply be given to an unwitting subject. Leary, Metzner, Alpert and others also started a scholarly journal, *The Psychedelic Review* (originally planned as

The Psychodelic Review, the name was altered to avoid association with the word “psychotic”—on 20 February 1963, editor Ralph Metzner wrote to R. Gordon Wasson about an article in *The Psychodelic Review*) which for several years published first-rate articles on entheogens. By the time it ceased publication, with the eleventh number dated Winter 1970/71, it had unfortunately degenerated to an underground “comix” format, replete with advertising for “Dynamite Dope Books,” and a corresponding erosion of editorial standards—the title of an article referred to “Cannibus” [sic] in treatment of alcoholism (Mikuriya 1971). The journal had also strayed from the scientific straight-and-narrow into politics, advocating the “fifth freedom,” the right to consciousness expansion (Barrigar 1964) and the pharmaceutical production of religious experiences (Leary 1964). Leary and colleagues, meanwhile, sought to introduce members of the intelligentsia to the spiritual aspects of entheogens. As Leary wrote (Leary 1964):

We have arranged transcendent experiences for over one thousand persons from all walks of life, including 69 full-time religious professionals, about half of whom profess the Christian or Jewish faith and about half of whom belong to Eastern religions. Included in this roster are two college deans, a divinity college president, three university chaplains, an executive of a religious foundation, a prominent religious editor, and several distinguished religious philosophers. At this point it is conservative to state that over 75 percent of these subjects report intense mystico-religious responses, and considerably more than half claim that they have had the deepest spiritual experience of their life [sic].

Leary and colleagues even produced a manual “based on the *Tibetan Book of the Dead*” to guide entheogen users to a religious experience (Leary *et al.* 1964).

Later on the West Coast, LSD “cults” began to receive media attention. The most famous, the Merry Pranksters (Perry 1990), began to foster large-scale, open use of LSD. This clique would hold concert-parties, with rock-and-roll groups such as the Grateful Dead, in which punch (“electric *Kool-Aid*”) doped with LSD was freely served. “Psychedelic” posters would exhort prospective customers to attempt to “pass the acid test” (Wolfe 1969). This unguided use of LSD inevitably led to adverse reactions in some few subjects, and LSD began to get a bad name (although the great majority of “acid test” takers apparently passed with flying colors, so to speak). Such sensational “happenings” led inevitably to the popular linking of LSD with “crazy

hippies,” a pejorative association, which unfortunately stuck, cemented firmly in the popular consciousness by the tragic association of LSD with the maniacal and murderous Charles Manson gang.

As an offshoot of experimental LSD therapy with a few Hollywood luminaries, LSD came to be associated with glamorous movie stars and was even called “Hollywood’s status-symbol drug” (Gaines 1963). One early LSD patient was actor Cary Grant. Grant apparently used LSD profitably in the course of psychotherapy (Hoge 1977), and when *Look* magazine published in September 1959 “The Curious Story Behind the New Cary Grant” there was an upsurge of interest in the new pharmacotheon. Two years later, in 1961, the famous nutritionist and writer Adelle Davis (writing under the pseudonym Jane Dunlap) described in glowing terms her experiences with LSD-25 in psychotherapy (Dunlap 1961). Davis had become interested in the substance after reading R.G. Wasson’s 1957 *Life* magazine article about Mexican entheogenic mushrooms (see Chapter 5; R.G. Wasson 1957). The following year, the sensational account of how parapsychologist Thelma Moss (also using a pseudonym; see Newland 1962) was cured of frigidity through LSD psychotherapy (see Ling & Buckman 1963; Ling & Buckman 1964), was a powerful stimulus to interest in LSD among laypersons. Another popular 1961 book (Ebin 1961) presented well-written descriptions of the experiences of users of LSD, *péyotl*, entheogenic mushrooms and other drugs. Mention should also be made of R.S. De Ropp’s seminal 1957 popular book *Drugs and the Mind* (De Ropp 1957) as well as the sequel *The Master Game* (De Ropp 1968) and other important books which stimulated interest in LSD and allied entheogens (Aaronson & Osmond 1970; Blum 1964; Braden 1967; Cohen 1964; Kreig 1964; Hoffer & Osmond 1967; Sankar 1975; Solomon 1964; Tart 1969).

In response to the attention-getting activities of Leary’s group and the Merry Pranksters, a large demand for LSD arose. On 23 August 1965, Sandoz LTD. voluntarily ceased distribution of *Delysid*, *Indocybin*, psilocine “and their hallucinogenic congeners” in response to what was increasingly viewed by the management as unfavorable publicity (Cerletti 1965; Hofmann 1980). Soon after this action was taken, laws began to be passed, proscribing LSD and other entheogens, which came under the same legal regimen as marijuana, cocaine and heroin. The new demand for LSD stimulated and was stimulated by the growth of illicit production of LSD (Lee & Shlain 1985; Stevens 1987). While Roseman may have been the first to manufacture LSD for non-pharmaceutical distribution (Horowitz 1985), the most notorious of the new breed of entheogenic chemists was probably Augustus Stanley, widely known by his middle name, Owsley (Lee & Shlain 1985; Stafford 1983).

Owsley was intimately connected with the Merry Pranksters and the Grateful Dead. Another notorious underground LSD chemist was R.H. Stark, who became involved with the "Brotherhood of Eternal Love," an organization devoted to distribution of LSD with evangelical zeal. Stark is credited with having made 20 kilograms of LSD—some 80–200 million doses—and was apparently a CIA contract agent, according to testimony in a sensational Italian trial (Escohotado 1989A; Lee & Shlain 1985). In the early days of the LSD market, many of the available tablets or capsules contained considerable doses—in the range of 300 micrograms and above (Brown & Malone 1973A). It was not uncommon for one tablet or capsule of LSD to provide impressive effects for four persons. By the end of the sixties, this situation had changed radically. A study of black-market LSD preparations in New York in 1972 showed each dose unit to contain an average of 110 micrograms of LSD, and extensive analyses of San Francisco "street acid" the following year by PharmChem Labs (a pioneering "street drug" analysis service) showed an average of only 65 micrograms of LSD *per* unit with individual samples rarely exceeding 100 micrograms (Ratcliffe 1973). PharmChem analyses also showed considerable quantities of iso-LSD, an inactive and harmless degradation product, testifying to the instability of black-market preparations. By the 1990s, average LSD doses fluctuated around 50 mcg (Marnell 1993). Owing to the inexorable decline in the potency of LSD tablets and capsules, by the seventies it was not uncommon for users to ingest two or three doses apiece, and units that could be shared among several persons were only a memory of the sixties' psychedelic "good old days."

While on the subject of nostalgia for the rough-and-ready "Psychedelic Sixties," it has been suggested that black-market LSD has been, by and large, badly made, tended to be contaminated by synthetic byproducts, and was incapable of producing the same "psychedelic" effect as LSD of higher purity made by Sandoz or Spofa (a Czech pharmaceutical firm which began to manufacture the drug when Sandoz's patents expired in 1963), available in the early to mid-sixties (Eisner 1977). This argument is specious, and is a product more of nostalgia than reason. If the effects of LSD were perceived as being any different in the early days of the "Psychedelic Age," this can easily be explained by two factors. First, as I have documented, and as many long-time users realize, the potency of LSD tablets and capsules declined considerably after 1969. Before then, users tended to take higher doses. More importantly, the early users were experimenting in a vacuum—there was little expectation, the effects were largely unknown, and the experience was entirely novel. Familiarity with the drug experience caused it to lose some of its wonder. As psychiatrist Norman Zinberg explained it in stilted, Freudian terms (Zinberg 1977):

Those people who used LSD early and had no significant cultural preparation, or social learning, experienced the symbolization in their thoughts as a breakthrough from the depths of the mind, which could be characterized as primary-process derivatives. When personality structural elements—that is, the ego—were prepared for the experience and, generally speaking, felt in control of it, the same ideation no longer represented a breakthrough in its meaning to the individual.

No, it was mostly illicit LSD which catalyzed the “Psychedelic Age,” and as numerous chemical studies have shown, it was chemically identical to its pharmaceutical prototype, *Delysid*.¹⁴

Similarly, frequently-repeated reports that black-market LSD was often adulterated with strychnine are false. While Albert Hofmann in 1970 detected strychnine in a putative LSD sample, the ingestion of which proved fatal to one unfortunate experimenter (Hofmann 1980), subsequent analyses of hundreds of black-market LSD samples failed to detect strychnine (Brown & Malone 1973A). Nevertheless, many users considered some LSD samples to be contaminated with strychnine. As Brown and Malone commented of their analytical work:

We have analyzed several samples thought to contain strychnine on the basis of toxic symptoms, but in each case only LSD was detected—however, the amount of LSD detected per ‘hit’ was excessive (ranging between 300 and 500 micrograms). None of the other groups doing street drug analyses has reported strychnine in any LSD-containing sample [the most common active adulterant being phencyclidine or PCP, also known as *Sernyl*]. The answer is that large doses of LSD mimic the symptoms of strychnine poisoning and large doses of LSD (over 200 micrograms) are frequently encountered on the street-drug market. (Brown & Malone 1973A)

Summarizing the analyses of 581 black-market LSD samples, Brown and Malone reported: 491 (84.5%) contained LSD while 31 (5.3%) contained LSD and PCP. There were 11 samples (1.9%) with PCP only, and 5 containing LSD plus amphetamine or methamphetamine. One sample was really STP or DOM (see Chapter 1), and 2 contained only amphetamines. In all, 527 of these 581 samples, or 90.7% actually

contained LSD (Brown & Malone 1973A). While occasional samples of LSD have been found to be adulterated with amphetamines (1.2% in the above sample), this was never a common practice, despite street folklore to the contrary. The common misapprehension that LSD was adulterated with amphetamines derives from the fact that LSD is itself a potent stimulant, more than two orders of magnitude more potent than methamphetamine, with which it shares some effects in common. Furthermore, methamphetamine and other amphetamines have always been worth more *per dose* wholesale than LSD on the illicit market, and one cardinal rule of adulteration is that one does not use a more expensive substance as an adulterant!

After the first publications in 1960 concerning the existence of psychoactive LSD-like alkaloids in morning glory seeds, ludicrous use of *Ipomoea violacea* seeds began to appear in the United States (Der Marderosian *et al.* 1964B). A number of horticultural varieties of *I. violacea* seeds were (and continue to be) widely and openly sold to gardeners. As chemical studies established the existence of alkaloids in *Argyreia* species, and that *Argyreia nervosa* was the most potent species, horticultural sources of seeds of this species began to be mined by entheogen users. As the seeds gained in popularity, many suppliers found themselves unable to keep up with the suddenly increased demand (Shawcross 1983). When LSD became more widely available, use of the less-desirable morning glory seeds appeared to decline. The seeds are still sometimes used today, and have been openly sold by mail order in countercultural drug magazines. It would appear, however, that they are not cherished as the most desirable of the entheogenic drugs, owing to side-effects (Bailin 1975; Shawcross 1983). Some of these undesirable effects may be due, however, to the ingestion of whole ground seeds, rather than filtered, cold-water infusions of the ground seeds as the Mexican Indians take them (Wasson 1963). In some cases, in a perverse and misguided effort at dissuading would-be users, the seeds may have been deliberately poisoned by suppliers, with warnings printed on the seed packets!

The reaction of the "establishment" to the rise in use of LSD and other entheogens in the sixties was rapid and drastic. Leary's contract was terminated by Harvard for non-performance in 1963, and Alpert was also dismissed that same year. This isolated Leary and Alpert from their professional peers, and effectively discredited them (Weil 1963B). Cut off from "legitimate" research, Leary and Alpert were reduced to the role of proselytizers for LSD. Three years later, as LSD use became the rage, the United States government decided to make an example of Leary. On 26 March 1966, Leary was arrested in Laredo, Texas for possession of scraps of marijuana, and shortly thereafter, on 16 April, his residence and headquarters at an estate called Millbrook in New York was raided by one G. Gordon Liddy, later to

become famous as a Watergate principal and “fall guy” (Stafford 1983). The Laredo arrest resulted in a conviction and a draconian 30-year prison sentence. The die was cast. States were racing to outlaw LSD, sweeping other entheogens like DMT, mescaline, psilocybine and psilocine along with it. California became the first state to outlaw entheogens, and federal prohibition was mandated.

Unfortunately for the government, these drastic actions were counterproductive. Leary’s arrest generated considerable publicity for LSD and other entheogens (Leary 1966A). Given the existing climate of social dissent, the government’s censure of entheogens gave them rather the aura of forbidden fruit to young people, many of whom became yet more eager to experiment with the drugs. The laws were a dismal failure at curbing drug use, and served to exacerbate social dissent by arbitrarily placing literally millions of citizens in the criminal category, citizens who had committed no crimes against life or property.

Having failed with force, the United States government opted for coercion and persuasion. When in 1967 a scientifically-flimsy report alleged that LSD caused chromosome damage in human lymphocytes or white blood cells (Cohen *et al.* 1967), the National Institutes of Health seized the opportunity to mount a vigorous propaganda campaign, as outlined in the first chapter (Weil 1972). Significantly, this federally-endowed research organization ordered no tests to verify the preliminary report, which was taken at face value since it was welcome news to the government. The then-docile information media fell hook, line and sinker for the great chromosome-damage scare, and LSD became the new scapegoat (Braden 1970). The media and the government played on fears generated in the public mind by the *Thalidomide* tragedy of the late fifties and early sixties, still a vivid and gruesome memory to LSD users and non-users alike (see Chapter 1).

No scientific report, however, had ever demonstrated that LSD was, like *Thalidomide*, a teratogen (a substance causing birth defects). When controlled studies were conducted with LSD and chromosomes, and when long-time LSD users were examined, it was found that there was no significant link between LSD use and chromosome damage (Bender & Sankar 1968; Dishotsky *et al.* 1971; Tjio *et al.* 1969). It was also found that viral infections as well as many drugs, including caffeine and aspirin, could cause chromosome breaks in lymphocytes *in vitro*. Although LSD use declined initially in the face of the big scare, the end result was the irreparable loss of the United States government’s credibility *vis à vis* drugs (Weil 1972). The government attempted to foist a few other spurious scares on the public: the “flash-back” scare, the LSD-produces-psychosis scare, *ad nauseam*. Given the U.S. government’s lack of credibility on drug-related issues, it is not surprising that these scare

tactics had only minimal, if any, efficacy at deterring the extra-medical use of LSD.

In fact, a climate of lies and deception grew to surround LSD in the media. When a prominent bureaucrat in the Pennsylvania state health apparatus told reporters of some youths who had blinded themselves by staring at the sun while under the influence of LSD, it made international headlines. At first it didn't occur to members of the press to ask for names or other details, and when someone finally dug a bit, the report turned out to be a complete fabrication—but that fact was not deemed especially newsworthy! At this time, all any murderer had to do was claim to have been under the influence of LSD when committing his crime, to escape full legal responsibility. It was, after all, “common knowledge” that LSD caused insanity, murder, self-mutilation, suicide, rape, *etc.*

In the meantime, during the onslaught of lies disseminated by the National Institutes of Health and the drug enforcement authorities, ostensibly motivated by concern for the public welfare, the U.S. central intelligence Agency (CIA) was engaged in an insidious research project called MKULTRA, dedicated to gathering intelligence on psychoactive drugs (Lee & Shlain 1985; Marks 1979). Among other horrors, it involved deliberate poisoning of unwitting subjects with LSD and other drugs. At least one such poisoning led to the suicide death of a government scientist. The CIA and U.S. Army contacted Albert Hofmann with requests for kilogram quantities of LSD, for use as a chemical warfare agent (Hofmann 1977) and, when Hofmann and Sandoz refused to cooperate, the CIA persuaded the Eli Lilly Company of Indiana to synthesize the drug, in violation of international patent accords. The MKULTRA chemical warriors, through their Mafia contacts, set up two brothels with one-way windows concealing agents and cameras, to observe unwitting subjects disporting themselves with the prostitutes in the agency's employ, who would “spike” their drinks with LSD and other drugs (just such a setup was fictionally depicted in the second James Bond movie *From Russia with Love*, based on the Ian Fleming novel, but in the fictional case, it was the government of the Soviet Union which ran the operation!). The CIA established phony academic fronts, to offer fake grants to academicians and appropriate the fruits of their research. When the CIA learned of the Wassons' Mexican mushroom research, they offered a grant through the fake “Geschickter Fund for Medical Research, Inc.” and thus managed to place a “mole,” chemist James Moore of the University of Delaware, on the Wassons' 1956 expedition to México (see Chapter 5, Note 8; Marks 1979; Ott 1978A; Singer 1982; Wasson 1982A). Thereby the CIA was able to get samples of psilocybian mushrooms, in hopes of isolating the active principle and making it part of a secret chemical arsenal. Surely it was a sad state of affairs, if a 60-year-old man of Wasson's stature

(he was at the time a Vice-President of one of Wall Street's largest banks) could not conduct an important scientific expedition, financed out of his own pocket, without clandestine government intervention!¹⁵

From the history of the U.S. government's actions regarding LSD and other entheogens, it is obvious that concern for the welfare of the public was not a factor in outlawing the drugs. Rather, the government perceived that entheogen use was associated with a dissident minority. By illegalizing entheogens, the dissidents became criminals by *fiat*. By exaggerating the dangers of LSD use in the press, a sense of urgency was instilled in the general populace, such that civil liberties of users (or suspected users—anyone, in short) could be grossly and repeatedly violated in the name of law enforcement. Of course, the thrust of the effort was directed against opposition to the government and its infamous war in Indochina, and against members of militant black groups like the Black Panther Party. The drugs themselves merely served as convenient scapegoats, as other drugs have in the past, and as do many drugs to this day (Szasz 1961; Szasz 1970; Szasz 1974; Szasz 1992).

The legal attack on LSD all but halted several promising lines of scientific and medical research. By being classified as a drug with a "high potential for abuse" (which is certainly true, as the CIA has amply demonstrated) with "no currently accepted medical use," (which is certainly not due to any lack of medicinal utility), LSD became unavailable to physicians for therapeutic use. Cancer patients and other patients suffering painful, terminal conditions, were thereby deprived of a promising pain- and anxiety-relieving agent. Unlike narcotics, LSD was able to suppress pain in a lasting way, without clouding consciousness (Kast 1963; Kast 1966; Kast & Collins 1964; Pahnke 1971; Pahnke *et al.* 1970A; Pahnke *et al.* 1970B). Psychiatrists and their patients were deprived of a medicament which showed far more promise at resolving fundamental psychological problems than anything currently in use (Janiger 1959); a potential curative agent in contrast to the aptly-named "chemical straightjackets" used to drug mental patients into submission. The science of brain chemistry was deprived of one of the most potent entheogenic substances ever discovered, a substance active in such infinitesimal amounts as to show promise in attacking the classic mind/body problem of philosophy, the chemistry of thought and consciousness itself. Meanwhile, the drug continued to be readily available on the black market to all comers; but users were effectively deprived of the protection of government agencies like the U.S. Food and Drug Administration, and were at risk of fraud and poisoning by adulterants, owing to unregulated activities of sometimes unscrupulous chemists and black-market businessmen.

One ray of hope is emerging on the horizon in the last decade of the twentieth

century. The government of Switzerland recently has sanctioned provisionally the experimental use of LSD in psychotherapy, placing the drug under medical, and not police, control. This farsighted policy will enable LSD to prove its worth as a medicinal aid to psychiatry, and effectively turns the clock back to the early sixties, when LSD was electrifying the psychiatric profession, opening up possibilities undreamed of before (Gartz 1992A; Hofmann 1991; Pletscher & Ladewig 1994; Rayl 1992).

CONTEMPORARY USE OF LSD AND MORNING GLORY SEEDS

Authentic LSD is commonly seen on the illicit drug market, and other drugs are seldom misrepresented as LSD. The exception is phencyclidine or PCP (*Sernyl*), which may be sold as LSD. It is far more common for LSD to be misrepresented as something else, sold usually as "mescaline" or "psilocybine" (see Chapters 1 and 5). So-called "blotter" or "windowpane" LSD is most likely to be genuine ("blotter acid" consists of bits of absorbent paper on which drops of LSD solution have been placed, it is also called "microdot acid," *etc.*; "windowpane" is a gelatinous material containing LSD, which is sliced into tiny, thin squares, also called "clear light," *etc.*). Authentic LSD is found on the black market all over the world, and a recent study estimated some 1.8 million users in the U.S. alone (Henderson & Glass 1994).

Caution with dosage is required of users of black-market LSD preparations. There is the possibility the user will feel nothing, or (s)he may have a massive effect (the former is the more likely). On the other hand, there is the chance of achieving just the desired level of intensity. Uncertainty results from vagaries of packaging doses of such a potent drug, sloppiness of illicit chemists or merchants, and the fact that LSD is not very stable, and has minimal keeping qualities in its illicit forms (especially "blotter acid," with maximal drug exposure to air and light). To be safe, experienced users ingest one dose-unit of a given sample, to ascertain potency. The dose may then be augmented (leaving an interval of a few days, to avoid problems of tolerance), if a more intense effect is desired. With this precaution, excessive dosage is still possible, as doses might not be uniform, even within a given sample of apparently identical tablets, capsules, "blotters" or "windowpanes." I must emphasize that there is no danger of death or injury from overdose of LSD, which must have about the highest therapeutic index of any drug known (the ratio of fatal dose to effective dose is unknown since no human being has ever died from an overdose of LSD, but must be very high, as individuals have mistakenly ingested hundreds of doses at a sitting; this is a way of saying that the drug is not at all toxic). The danger

here is of experiencing a more intense effect than one is prepared for. High doses of LSD (in excess of 250 micrograms) can lead to temporary loss of ego or identity, a consequence terrifying to some, but much sought-after by others.

There are only two species of entheogenic morning glory seeds commercially available in the horticultural trade, *Ipomoea violacea* and *Argyreia nervosa*. *Turbina corymbosa* grows wild along the coasts of the Gulf of México, but this subtropical species is not commonly grown as an ornamental. There are several cultivars of *Ipomoea violacea* available commercially, having intriguing names: "Heavenly Blue," "Pearly Gates" and "Flying Saucers." *Argyreia nervosa* is commonly grown for the use of its large and lovely seed capsules or "wood roses" in floral arrangements. One should not confuse "baby Hawai'ian woodrose," *Argyreia nervosa*, with "Hawai'ian woodrose," *Ipomoea tuberosa*, which is not entheogenic.

Argyreia nervosa seeds are about five times as potent as wild-type *Ipomoea violacea* seeds, and the cultivars of the latter species tend to be even less potent (Chao & Der Marderosian 1973A; Der Marderosian *et al.* 1964B; Hofmann 1963A). Some seed companies, such as J.L. Hudson and ... of the jungle, sell untreated seeds of ethnomedicinal strains of morning glories, which have been selected by shamans for visionary properties rather than the size and color of flowers. Experienced users of entheogenic morning glory seeds usually start with low doses, later working up to higher amounts if a more intense effect is desired. The wise user will begin with no more than 4 or 5 seeds of *Argyreia nervosa*, or no more than 20–25 seeds of *Ipomoea violacea*. Seeds of *Turbina corymbosa* are about one-fifth the potency of the seeds of *Ipomoea violacea*. In México, I have seen doses of the true *ololiuhqui* seeds, *Turbina corymbosa*, measured as the quantity of seeds which will fill a bottle cap, and Wasson also reported this volumetric dosage aid in the Sierra Mazateca (Wasson 1963). Osmond found 60–100 *Turbina corymbosa* seeds to be an active dose, though he chewed and ingested the whole seeds, rather than making a cold water infusion of ground seeds (Osmond 1955; see Note II).

The seeds are not ingested whole—they are not active in this form (Kinross-Wright 1959; B.P. Reko 1934). They are ground to a fine powder, which is then steeped for several hours in cold water, after which the solid matter is filtered off and discarded. The liquid is then drunk neat or with juice for flavoring.

Abdominal cramps in both sexes are commonly reported as a side-effect of inebriation with morning glory seeds (Bailin 1975; Shawcross 1983). When this happens, users have been observed to lie down facing up, breathing deeply until the cramps subside, which generally happens quickly. The morning glory seeds and LSD are strongly uterotonic, that is, they tend to cause contraction of the uterus. As such,

use of these drugs should assiduously be avoided by pregnant women who, for that matter, would do well to avoid using *all* nonessential drugs during pregnancy and parturition; including, and especially, alcohol, caffeine and nicotine.

POSTSCRIPTUM: THE SECRET OF THE ELEUSINIAN MYSTERIES REVEALED

In the most exciting recent development in the study of LSD and other ergoline entheogens, R. Gordon Wasson, Albert Hofmann and Carl A.P. Ruck have advanced a startling new theory concerning the Eleusinian Mysteries of ancient Greece. The theory was first presented on the morning of Friday, 28 October 1977, at the "Second International Conference on Hallucinogenic Mushrooms" held at Fort Worden, near Port Townsend, Washington (I organized this conference; see Chapter 5, Note II). A full-dress presentation followed in May 1978, when these three distinguished scholars published *The Road to Eleusis: Unveiling the Secret of the Mysteries* (Ruck & Staples 1994; Wasson *et al.* 1978; Wasson *et al.* 1980B). That the reader may appreciate the significance and meaning of this theory, I will review the history of the ancient Mysteries of Eleusis.

The Eleusinian Mystery was an annual celebration of a fertility cult, over which the goddess Demeter presided. Anyone speaking Greek could be initiated into the cult, but usually only once in a lifetime. The "Greater Mystery" was celebrated in the autumn, in a sanctuary at Eleusis, bordering the Rarian Plain, near Athens. For nearly 2000 years the annual celebration was held, but never was the secret of the Mystery revealed. Initiates passed the night in the darkened *telesterion* or initiation hall, where they beheld a great vision which was "new, astonishing, inaccessible to rational cognition." Of the experience, they could only say that they had seen *ta hiera*, "the holy"—it was forbidden by law, under penalty of death, to say more, and the seeing or *epopteia* converted the initiates or *mystai* into *epoptai* (Wasson *et al.* 1978).

Most of our information about the Eleusinian Mystery comes from the so-called *Homeric Hymn to Demeter*, an anonymous seventh century B.C. poem. The poem describes the mythical founding of the Mystery by Demeter, who was grief-stricken over the abduction of her daughter Persephone (also called Kore) by the god Hades, lord of the underworld. Demeter caused all of the plants on the Earth to die, and Zeus, fearing humankind would also die and there would then be nobody to make sacrifices to the gods, interceded with Hades, and forced him to return Persephone to Demeter. Persephone, however, had eaten a pomegranate seed in the underworld, and was therefore condemned to return to Hades for part of each year. This always

saddened Demeter, who would again cause the plants to die, to be reborn again in the glory of springtime, with the return of Persephone to the world of light. This lovely myth symbolized for the Greeks the natural mystery of the changing seasons, and the miracle of the springtime rebirth (after burial in the cold Earth) of the cultivated grain on which their civilization depended.

Demeter ordered the construction of the Eleusinian sanctuary and, refusing wine, directed the preparation of a special potion, the *kykeon* ("mixture"). The ingredients of the *kykeon* are spelled out in the *Homeric Hymn*: barley, water and *blechon* (or *glechon*, a mint, probably *Mentha pulegium*, a plant burned as an offering by some shamans to Pachamama in Perú; see Appendix B; Wassén 1967; Wassén 1979). From fragmentary ancient reports, including the remains of a fresco at Pompeii, it is known that initiates to the Mysteries drank Demeter's potion as a prelude to experiencing a soul-shattering vision (Hofmann 1981). The Eleusinian Mysteries were driven into extinction by the Christians in the fourth century of our era. The "secret" was not vouchsafed to us by the Christians, if in fact they themselves knew it, which is extremely doubtful (Mylonas 1961).

Much has been written concerning the Eleusinian Mysteries, but apparently it had never occurred to anyone before Wasson that the potion, the *kykeon*, might have had something to do with the vision! Classical scholar G.E. Mylonas, for example, wrote a detailed book on *Eleusis and the Eleusinian Mysteries*, and concluded that: "the act of drinking the *kykeon* was one of religious remembrance, of the observance of an act of the Goddess, and implied no sacramental mystic significance" (Mylonas 1961). Three years before Mylonas made this dubious pronouncement, Wasson had connected Plato's "ideas" and world of "archetypes" with entheogens (Wasson 1958; Wasson 1959A) and just the year before, he had tentatively suggested in a lecture subsequently published (Wasson 1961; Wasson 1972D): "I predict that the secret of the Mysteries will be found in the indoles, whether derived from mushrooms or from higher plants or, as in Mexico, from both." This idea was first suggested by Wasson in a lecture on 15 November 1956, shortly after his first experience of mushroomic ecstasy (see Chapter 5). A recent book (T.K. McKenna 1992) has wrongly credited Robert Graves with first proposing that the *kykeon* was entheogenic in 1964 (see Graves 1957; Graves 1962; for examples of his speculations regarding entheogenic mushrooms, inspired by his collaboration with the Wassons). A 1936 book published in French (Félice 1936) first explored the concept of *ivresses divines* ("divine inebriations," obtusely characterizing such as "inferior forms" of mysticism!) and mentioned the Eleusinian Mysteries, but advanced no specific theories on the nature of Demeter's potion. With this elegant and exciting proposal advanced by

Wasson, Hofmann and Ruck in 1977–1978, Wasson's perspicacious prediction has been placed on a strong and specific scientific footing.

It is the thesis of *The Road to Eleusis* that Demeter's potion, the *kykeon*, was entheogenic, and elicited the ineffable vision experienced each year by thousands of initiates. According to the theory, ergot growing on the barley added to the *kykeon* accounted for the potion's visionary properties. Hofmann argued that, by making an aqueous extract of ergot-infested barley, the ancient Greeks could have separated the water-soluble entheogenic ergot alkaloids (ergine, ergonovine, *etc.*) from any non-water-soluble toxic alkaloids of the ergotamine/ergotoxine group (Bigwood *et al.* 1979; Hofmann 1978B). Hofmann further suggested the Eleusinian priests may have employed ergot of the wild grass *Paspalum*, which produces only the entheogenic alkaloids, and none of the toxic peptide alkaloids. Hofmann pointed out that the psychotropic properties of ergot were known in antiquity, and that such folk knowledge of these properties lingers on in Europe, as evidenced by the names for ergot: *Tollkorn* ("mad grain") and *seigle ivre* ("inebriating rye"; Hofmann 1978A).¹⁶

This simple and elegant theory is buttressed by examination of the rich symbolism attending the cult. Eminent Greek scholar Ruck meticulously showed how the ergot theory fit the available evidence. One of the more telling pieces of evidence is the fact that Demeter was often called *Erysibe*, "ergot," and that purple, the color of ergot, was her special color. Furthermore, an ear of grain was the symbol of the Mystery. Ruck has adduced further evidence in support of the theory presented in the book. He has proposed that Socrates was executed for profaning the Mysteries and making the *kykeon* in Athens with his disciples, and that Aristophanes escaped legal problems by burying hints of this in *Birds* and *Clouds* (Ruck 1981). We know from Plutarch that Alcibiades was sentenced to death for the same crime—profaning the Mysteries in Athens. In an analysis of Euripides' *Bacchae*, Ruck discussed use of wines in ancient Greece as vehicles for ingestion of entheogens and other drugs, contrasting the "cultivated" (grain and civilization) with the "wild" (ergot, thought to represent degeneration of grain to its wild precursor; Ruck 1982; Ruck & Staples 1994). This fascinating study illuminates some linguistic curiosities of the Bible, in which "wine" (*yayin* in Hebrew) is repeatedly compared or contrasted with "strong drink" (*shekar* in Hebrew), evidently an entheogenic potion (Ruck 1982; Wasson 1914).¹⁷ Finally, Ruck identified the Hyperboreans with the Aryans, proposing that their first-fruit offerings were none other than their miraculous *Soma*—probably some entheogenic mushroom (see Chapter 6; Ruck 1983). The *amrta*, the immortal *Soma* potion, is etymologically identical to Greek *ambrosia*, which we now know, thanks to Ruck, Hofmann and Wasson, to have been some entheogenic potion.

Hofmann has often described the “magic circle” of his research on entheogens: starting with his discovery of LSD, a derivative of ergot alkaloids, he was brought into contact with R. Gordon Wasson, who supplied him with the sacred mushrooms of México, leading to Hofmann’s discovery of psilocybine and psilocine, and who then supplied him with *ololiuhqui*, another Mexican sacred drug, in which Hofmann found the same alkaloids he had begun working with two decades earlier (Hofmann 1966; Hofmann 1967). Now it would appear Hofmann’s “magic circle” has undergone a second revolution, again leading back to ergot as a sacred drug of ancient Greek culture, which is unmistakably our own, Indo-European culture.

A recent book extrapolated this theory of an ergotized, entheogenic *kykeon* to *Soma* (*vide* Chapters 4 Note 2 and 6 Note II), arguing this was also an aqueous infusion of some ergot-infested grain (Greene 1992), not *Amanita muscaria* as Wasson (1968) had proposed (he having already discarded ergot; Doniger O’Flaherty 1968; Riedlinger 1993). Oddly, the author made pharmacognostical arguments, outside his field of expertise, committing egregious blunders which undermined his already flimsy case, as I thoroughly detailed in a recent review (Ott 1994B).

Intrepid experimenters with ergot (a good quantity may be hand-picked from a sack of “organic” rye) desirous of imbibing Demeter’s *kykeon*, must exercise *extreme* caution. They should never forget that *ergot has poisoned and killed countless human beings throughout history. The ergot sclerotia should not be eaten whole!* To make Demeter’s potion (according to Hofmann’s theory), the sclerotia are reduced to powder, which is then steeped in cold water. The residual powder is then filtered off and discarded. *Extreme caution with dosage is mandatory*, and the wise user would try only a minimal quantity at first. The cautious experimenter would then wait at least a few days before trying a slightly higher dose, if a more intense effect were desired. Ergot, like LSD and morning glory seeds, is a powerful uterotonic drug, and should assiduously be avoided by pregnant women who should, as already mentioned, avoid *all* unnecessary drugs, especially nicotine, caffeine and alcohol.

NOTES

- ¹ The word *mushroom* is ordinarily used to designate all fleshy agarics, but in some parts of Great Britain may refer to only one species, the cultivated agaric, *Agaricus*. Wasson has proposed that the word be used to describe “all the higher fungi, whether Basidiomycetes or Ascomycetes, with conspicuous fruiting bodies” (Wasson 1980). In this book it will be used to describe *all* fungi, including the so-called “lower” fungi like ergot, to replace the invented, semi-scientific word, *fungus*. Ergot, after all, though it is best known in its sclerotial phase, produces tiny mushrooms as fruit bodies. See also: Shelley 1994.

- ² St. Anthony was born in Egypt in 251 A.D. and died in the Egyptian desert in 356 A.D., aged 105 years. At the age of 20 he retired to the desert and solitude, and is considered to be the founder of Christian monastic life. He became famous in Egypt and pilgrimages were made to seek him out. He was reputed to have had visions as well as repeated bouts with "daemons" or "devils." Although he had beseeched his two disciples to keep secret his burial place, to avoid his remains becoming relics, the location of his grave was "divined" some 200 years after his death and remains purported to be his transported to Alexandria and buried there in St. John's Church. More than a century later the Saracens took these remains to Constantinople for reburial; whence in 1070 they were taken by Crusaders to Dauphiné, France. Because of his reputed visions, St. Anthony became associated with ergotism victims, who also had bizarre visions. Gaston, a rich man of Dauphiné, vowed to donate his fortune to St. Anthony were his son to be cured of ergotism. The son subsequently got better, and Gaston made good his promise, financing a hospital for ergotism victims in which he, his son, and a neighbor worked as nurses. The Antonite Order came to specialize in caring for ergotism victims throughout Europe. There are many artistic representations of St. Anthony. The most famous are Bosch's "Temptation of St. Anthony" (Prado, Madrid) in which the saint, with his ever-present T-shaped staff and accompanied by a pig, contemplates a "daemon" rising from the water before him; and Matthias Grünewald's 15th century Isenheim Altar paintings (Unterlinden Museum, Colmar), a multi-panel work, one panel of which depicts St. Anthony being attacked by "daemons," his hands cramped in ergotism-like seizures and clearly showing gangrene of his fingertips (Bauer 1973; Bové 1970; Huysmans 1976).
- ³ The mass poisoning which took place in the French town of Pont-St. Esprit in 1951 has been widely presented in the lay and scientific press as an example of ergotism. While the poisoning was traced to bread, ergotism was not the cause of the syndrome, which was due to a toxic mercury compound used to disinfect grain to be planted as seed. Some sacks of grain treated with the fungicide were inadvertently ground into flour and baked into bread. Albert Hofmann arrived at this conclusion after visiting Pont-St. Esprit, and analyzing samples of the bread (which contained no ergot alkaloids) and autopsy samples of the four victims who succumbed (Hofmann 1980; Hofmann 1991). On the other hand, the Swedish toxicologist Bo Holmstedt insists the poisoning was in fact due to ergotism (Holmstedt 1978). An American writer published a sensationalized account of the poisoning, *The Day of St. Anthony's Fire* (Fuller 1968), evoking "the possibility that a strange, spontaneous form of LSD" might have been involved! Fuller was attempting to cash in on the great LSD scare—some few of the poisoning victims had jumped from buildings, and this, of course, was a "known" effect of LSD! To be sure, LSD is an artificial compound, and no strain of ergot has been found which "spontaneously" produces LSD. In 1976 an American psychologist proposed convulsive ergotism as the cause of the Salem Village, Massachusetts "witchcraft" hysteria in 1692, one of the few cases of witchcraft persecution in the American colonies (Caporael 1976). This theory was immediately rejected by two Canadian psychologists (Spanos 1983; Spanos & Gottlieb 1976), based on the following criticisms: 1) Vitamin A deficiency is believed to be a prerequisite for convulsive ergotism, and since it was close to Salem Town, a seaport presumably well

supplied with seafoods, a good source of Vitamin A, such deficiency could not have prevailed in Salem Village; 2) the "bewitchment" syndrome at Salem only affected individuals, not whole families, as would be expected in ergotism; 3) the symptoms were not the symptoms of convulsive ergotism; and 4) the "hysteria" later spread to other towns in Massachusetts and Connecticut, areas not purported to have been affected by ergotism. In the original paper, the author stated that lysergic acid amide (incorrectly called isoergine) occurs in ergot and, having "10 percent of the activity of D-LSD" could have caused the victims' hallucinations. The critics rightly pointed out that "subjects who have ingested LSD very rarely report... that they perceive formed persons or objects which they believe are actually out there," that is, that the drug doesn't produce true hallucinations (Siegel 1977; Siegel 1992; Siegel & West 1975). It appeared the critics had won the day, until 1982, when historian M.K. Matossian wrote an article defending the Salem/ergotism theory (Matossian 1982). Matossian later wrote a book, *Poisons of the Past* (Matossian 1989) and an article (Matossian 1992), both essentially reiterating her support. In the paper, Matossian incorrectly stated that "ergot is the source of lysergic acid diethylamide (LSD), which some mycologists believe can occur in a natural state" (Matossian 1982), whereas in the book, she stuck to the more tenable "ergot is the source of lysergic acid diethylamide (LSD), and it may include natural alkaloids that act like LSD" (Matossian 1989). Again, regardless of what "some mycologists believe," chemists have never found LSD to occur as a natural product. Matossian went on to propose ergot as a cause of witchcraft epidemics in early modern Europe, and as a cause of the "Great Fear" in France in the summer of 1789, which in part led to the vote of the National Constituent Assembly to abolish the *ancien régime*. She further proposed ergotism as a cause of the "Great Awakening" of religious revival in New England in 1741, and poisoning by tricothecene toxins from *Fusarium* molds as the cause of the epidemic of "throat distemper" in New England in 1735–1736 (Matossian 1989).

- ⁴ *Balansia cyperi*, a mushroom parasitizing *piripiri*, *Cyperus prolixus* or *C. articulatus*, has recently been found to be used in ethnogynecology in Amazonia. *Balansia cyperi* belongs to the Clavicipitaceae, the family of *Claviceps* or ergot, and tops of *Cyperus* clearly infected with *B. cyperi* are used by Achuar Jívaro (*Jívaro* is considered to be pejorative; Shuar and Achuar are the proper names) women of Amazonian Perú to prepare an infusion used as an ecboic (Lewis & Elvin-Lewis 1990). Cultures of *B. cyperi* from two Amazonian and one United States species of *Cyperus* have been shown to produce "several unidentified ergot alkaloids" (Plowman *et al.* 1990), and ergoline alkaloids are known from at least two other species of *Balansia* (Porter *et al.* 1979; see Appendix B). *Cyperus* species possibly infected with ergot-alkaloid-containing fungi are also used as a contraceptive in the Peruvian Amazon, as an abortifacient by Shipibo-Conibo Indians of eastern Perú, and against postpartum hemorrhage by the Kokama Indians of Perú. The Tucuna of Colombia also use this plant complex as an ecboic (Plowman *et al.* 1990; Schultes & Raffauf 1990). African ethnogynecological use of a *Cyperus* species suggests similar infestation by an ergot-alkaloid-containing fungus (Veale *et al.* 1992). A plant from a related genus, *Scirpus*, has been reported as a possible entheogen in México. Tarahumara Indians, who call this plant *bakánoa*, are said to regard the tubers as a powerful visionary medicine (Bye

1975; Bye 1979A). Another member of the ergot family, *Ustilago maydis* or corn smut, has also been reported to have been used traditionally by the Ojibway or Ahnishinaubeg as an ecboic, but paradoxically, the Ahnishinaubeg consider the corn smut to be an anticoagulant, rather than a hemostatic (Keewaydinoquay 1978). This is unusual, since the uterotonic ergot alkaloids show also hemostatic properties, and Hofmann has tested strains of this species and found them to contain no ergot alkaloids (Hofmann 1977). The corn smut, under the name *cuitlacoche* is widely used in Mexican cuisine, and although used medicinally as a hemostatic (Díaz 1976), does not appear to be known as an ecboic and has not been reported to be used in México against postpartum hemorrhage. Of course, like ergot, corn smut strains may show considerable chemical variation, and the Ahnishinaubeg may have had access to a strain containing ergot-type alkaloids. On the other hand, other uterotonic alkaloids such as ustilagine, ustilagine and ustilagotoxine may account for this Ahnishinaubeg ethnogynecological use of *Ustilago maydis* (Heim 1978; Samorini 1992D). Another mushroom in the ergot family, *Cordyceps capitata*, was reported to have been ingested along with a known psilocybian mushroom (see Table 4) of México, *Psilocybe wassonii*, in curing rituals (Guzmán 1958; Heim 1957A). *Cordyceps capitata* (as well as *C. ophioglossoides*) is called *tlakatsitsintli*, "little men" and is parasitic on a subterranean truffle, *Elaphomyces variegatus* (or *E. granulatus*), called *su mundo*, "its world." Divinatory use of *tlakatsitsin* in Veracruz state was attributed to the ancestors of informants (Reyes G. 1970), and this doubtless referred to *Cordyceps capitata*, although a recent book rather dubiously suggested *tlakatsitsin* represented *Psilocybe* [*Stropharia*] *cubensis* (see Chapter 5; Garza 1990). Curiously, a European species, *Elaphomyces cervinus*, is known traditionally in Germany as *Hexenspitzel*, "witches' point" (De Vries 1991A), and is reportedly used in traditional European ethnomedicine to treat "feeble conditions" (Singer 1958B). In México, these "little men" are taken with *siwatsitsintli*, "little women," *Psilocybe wassonii*. The chemistry of *Cordyceps capitata* is not known precisely, and in Tenango del Valle, where the "little men" and "little women" are consumed, they are taken with edible species, such as *Clavaria truncata* and *Nevrophyllum floccosum*, called *kustik nanákatl* (Heim & Wasson 1958). Hofmann found *Cordyceps capitata* to be devoid of psilocybine and psilocine, but to contain traces (0.004%) of a "different indolic substance" (Heim & Wasson 1958, p. 260). This intriguing compound remains unidentified, and the chemistry of this mushroom needs further characterization. A related species, *Cordyceps sinensis*, parasitic on the larvae of a Himalayan moth, which the mushrooms consume and transform into sclerotia, is a highly-esteemed tonic in Chinese traditional medicine (Davis 1983A), also used in Nepal as an aphrodisiac (Bhattarai 1992). Cordycepin, a nucleoside derivative (3'-deoxyadenosine) has been isolated from this species and from *C. militaris*, and has some anti-tumor activity (Rich *et al.* 1965). *Cordyceps ophioglossoides* is also used in Chinese medicine, and immunostimulatory glucans have been isolated from this species (Yamada *et al.* 1984). There is no evidence, of course, that these anti-tumor, immunostimulatory compounds are entheogenic. As in the case with the *Cordyceps/Psilocybe* "little men" and "little women" ingestion in Tenango del Valle, male/female pairing is involved in consumption of "female" psilocybian *Psilocybe mexicana* together with the "male" *Dictyophora phalloidea* in the Chinantec region of Oaxaca, México (Heim & Wasson 1958). Again, the chemistry of *D. phalloidea* is obscure, but Was-

son appended this intriguing footnote to his interdisciplinary study of Mexican entheogenic mushrooms, to wit: "Mr. Roger Heim, during his recent trip to Thailand (Nov. 1957), has assembled information on the use of *Dictyophora phalloidea* in sorcery in that country, and will publish an account elsewhere" (Heim & Wasson 1958, p. 99). Heim later described the use of *D. phalloidea* in Thailand for "criminal poisoning," but also mentioned its use in sorcery by the Tanala and Betsimisaraka of Madagascar (Heim 1978).

- ⁵ The three ergotoxine alkaloids were named ergocristine, ergocornine, and ergokryptine; the last existing in two isomeric forms, *alpha*- and *beta*-ergokryptine. Hofmann then prepared the dihydro-derivatives of these alkaloids, which resulted in a successful product, *Hydergine*. Later, another derivative, 2-bromo-*alpha*-ergokryptine (CB-154), became a successful product, under the trade name *Parlodel* (Hofmann 1979B; see Note 9). Ergokryptine is sometimes spelled *ergocryptine* or *ergocriptine*.
- ⁶ Since it was discovered simultaneously in four different laboratories, the compound at first received four different names: ergobasin(e) (Stoll & Burckhardt 1935); ergometrine (Dudley & Moir 1935); ergotocin(e) (Kharasch & Legault 1935) and ergostetrine (Thompson 1935). To avoid confusion, the International Pharmacopœia Commission proposed the name *ergonovine* (the "novel" ergot alkaloid) to replace all these synonyms. Nevertheless, in Great Britain and in some of the British Commonwealth countries, the drug is still widely known as ergometrine; and the naming of derivatives is sometimes confused. A publication may refer to ergonovine and its derivative, methylergometrine (instead of saying methylergonovine).
- ⁷ Most of the chemical studies described herein were made on ergot of rye, *secale cornutum*. Until fairly recently, this was produced by parasitic cultivation; that is, it was grown by intentionally infecting rye fields with ascospores of ergot, then separating the ergot sclerotia from the ripe grain. L. Hecke of Austria pioneered this methodology in 1921. By the 1940s Sandoz LTD. was mechanically injecting ascospores of ergot onto rye fields in Switzerland. Parasitic cultivation, however, was laborious and subject to the vagaries of weather. American A. McCrae was the first to work out the basic biology of ergot in saprophytic culture (direct growth of ergot mycelium on culture media) in the 1930s. This set the stage for submerged or "liquid" culture of ergot, first achieved on a laboratory scale by Americans Tyler and Schwarting in 1952. The following year, Stoll, Brack, Hofmann and Kobel of Sandoz were awarded a patent for production of ergot alkaloids in saprophytic culture of *Claviceps purpurea*. The group of Arcamone in Italy perfected saprophytic culture of *Claviceps paspali*, obtaining up to 2 grams *per* liter of simple lysergic acid amides. Also using *Claviceps paspali*, Kobel, Schreier and Rutschmann of Sandoz developed a means for producing a precursor to lysergic acid in high quantities (Bové 1970). Thus today lysergic acid is produced in ton quantities in submerged cultures in industrial fermentation tanks, and the various pharmaceutical preparations of ergot alkaloids (see following note) are synthesized from lysergic acid. Although W.A. Jacobs and L.C. Craig had isolated lysergic acid and reported its structure in the 1930s (Jacobs & Craig 1934A; Jacobs & Craig 1934B), the stereochemistry was not worked out until 15 years later, when

Hofmann's group solved the riddle (Stoll *et al.* 1949). A "total synthesis" of lysergic acid was achieved in 1954 and reported two years later (Kornfeld *et al.* 1954; Kornfeld *et al.* 1956). A superior method for synthesizing lysergic acid amides was published three years later (Garbrecht 1959), improving on Curtius' synthesis, used by Hofmann in 1937 for the first semi-synthesis of an ergot alkaloid, ergonovine (see Note 6); later applied to synthesis of LSD and a host of other lysergic acid amides (Stoll & Hofmann 1943). Hofmann's group also further refined the synthesis of lysergic acid amides (Hofmann *et al.* 1961).

- 8 Hofmann synthesized and tested psychonautically some derivatives and analogues of LSD (Hofmann 1980). The isomers of LSD, *l*-LSD, *d*-iso-LSD and *l*-iso-LSD were all found to be inactive in doses as high as 500 mcg (20 times the perceptible dose of *d*-LSD). Prominent among many LSD-derivatives are: ALD-52, *N*(1)-acetyl-LSD; MLD-41, *N*(1)-methyl-LSD; BOL-148 (2-bromo-LSD); LAE-32 (lysergic acid ethylamide); LSM-777 (lysergic acid morpholide); LME-54 (lysergic acid methylethylamide); LMP-55 (lysergic acid methylpropylamide) and LEP-57 (lysergic acid ethylpropylamide). Both ALD-52 and MLD-41, with substituents on the indole-ring nitrogen, are equivalent to LSD in potency (Rothlin 1957; Shulgin 1971), although the latter has also been described as having only one-third the potency of LSD (Abramson 1958; Metzner 1963). BOL-148, LSD with a bromine atom attached, was inactive in human beings up to 500 mcg (Abramson & Rolo 1967; Metzner 1963). LAE-32, lysergic acid monoethylamide, approaches LSD in potency, as does LSM-777 (Callieri & Ravetta 1957; Delay *et al.* 1959B; Giarman 1967; Gilberti & Gregoretti 1960; Shulgin 1971). LME-54, LMP-55 and LEP-57 were inactive or, in the case of 1 of 5 subjects given 100 mcg LMP-55, weakly-active, dosed up to 100 mcg (Abramson & Rolo 1967). Activity of LA-III (lysergic acid amide) will be discussed below. In cross-tolerance tests (see Chapter I, Note 8) it was found that MLD-41 and LEP-57 (despite the latter compound's inactivity) could elicit cross-tolerance to the effects of LSD and psilocybine, whereas LAE-32 produced mild cross-tolerance to LSD and none to psilocybine (Abramson & Rolo 1967). LSD was shown to produce cross-tolerance to psilocybine and *vice versa*. Hofmann has published details on a few compounds; most of his self-experiments remain unknown outside of Sandoz. EHLAD, *N*(6)-ethyl-LSD (with an ethyl-group *in lieu* of a methyl-, on the piperidine-ring nitrogen) appears to have double the potency of LSD (Jacob & Shulgin 1994); animal tests suggested ALLYLAD or *N*(6)-allyl-LSD, could be even more potent (Pfaff *et al.* 1994).
- 9 In the course of his work on the ergot alkaloids, Hofmann prepared a series of medicinally and financially valuable medicaments (Hofmann 1979B). *Methergine*, or methylergonovine, proved to be a more specific uterine hemostatic than ergonovine, and today is an important lifesaving medicine for obstetric control of postpartum hemorrhage. *Dihydergot*, dihydroergotamine, has found widespread application in therapy of migraine headaches, as has *Deseril* or *Sansert* (1-methyl-lysergic acid butanolamide). The most successful product has been *Hydergine*, the dihydro-derivative of the three "ergotoxine" alkaloids (see Note 5), valuable in geriatric medicine as a cerebral vasodilator. It so improves oxygenation of the brain that it is widely used in Europe as an adjunct to surgery, to give surgeons more time in the case of cardiac arrest, to resuscitate the patient before brain damage from lack of oxygen supervenes. *Hydergine* has also shown valuable stimulant effects even in healthy

young adults, and has been shown to improve mental processing and performance in 9–12 mg daily doses (Hindmarch *et al.* 1979), making it one of the most sought-after “smart drugs” (Jude 1991; Morgenthaler 1990; Morgenthaler & Dean 1991). It has long been Sandoz LTD.’s most successful product, one of the 10 best-selling pharmaceutical products in the world, with annual sales in excess of \$300 million. Finally, *Parlodel* or 2-bromo-*alpha*-ergokryptine (also known as CB-154) has found widespread use in the treatment of Parkinsonism. *Parlodel* has recently been used experimentally as a “cure” for cocaineism, but in cocaine *habitués*, the drug may itself be habituating (Holden 1989B). While today the discovery, testing and development of a new medicament is a decade-long project for a large team of scientists, this remarkable output of six successful pharmaceuticals (if we include *Delysid*, the trade name of LSD) was accomplished virtually single-handedly by Hofmann, at least the chemical and chemical engineering aspects (Hofmann 1980). The development of *Deseril* and *Parlodel* as pharmaceutical products involved collaborative work with other Sandoz scientists. Hofmann’s later research into the chemistry of the sacred mushrooms of México (see Chapter 5) was to lead to the development of yet another successful product, *Visken* (also known as *Pindolol* and, like psilocine, a 4-hydroxy-indole derivative), today widely used as a hypotensive agent. F. Troxler, Hofmann’s assistant in the mushroom research, was the discoverer of this product (Troxler *et al.* 1959).

- ¹⁰ While Urbina and Reko used the synonym *Ipomoea sidaefolia*, much of the modern literature on entheogens employs the synonym *Rivea corymbosa* (Schultes 1964). Blas Pablo Reko, who accepted Urbina’s 1897 identification in 1919, and who was the first modern researcher to identify the *teonanácatl* entheogen as a mushroom (B.P. Reko 1919), and the first, together with R.E. Schultes, to collect botanical specimens of the mushrooms (Schultes 1939), is not to be confused with his cousin, Victor A. Reko. Victor is perhaps better known outside of México, for the 1936 publication of a book in German, *Magische Gifte* (Reko 1936). However, Victor was a journalist, not a scientist, and the information in his book was rather inaccurately copied from his cousin Blas Pablo, who complained of Victor: “nor has he any personal experience with the drugs described, most of which he has not seen and would not recognize if he saw them” (letter to H. Wassén, 31 January 1937; quoted in Holmstedt 1967). As Mexican expert J.L. Díaz commented of Victor: “at best his book is a minor piece of newspaper sensationalist account that merely lists some plants of interest. There is good evidence that Victor took notes in bars and other places from his cousin Blas Pablo (Schultes and Ing. Aguirre Benavides independently told me of these scenes) so that the reliable ethnobotanical information that he has came from Blas Pablo” (Díaz 1980). R. Gordon Wasson had rightly dismissed Victor as “a notorious *farceur*” (Wasson 1963). It was thus surprising when prominent American chemist V.E. Tyler published “The case for Victor A. Reko—An unrecognized pioneer writer on new-world hallucinogens” (Tyler 1979), falsely claiming that *Magische Gifte* represented the modern rediscovery of *teonanácatl* as a mushroom. Tyler was unaware that Blas Pablo had published this identification 17 years before the appearance of *Magische Gifte*, and two years before Victor first came to México. Tyler was also wrong in concluding that Victor participated in the clarification of the *ololiuhqui* problem, inasmuch as the drug had been correctly identified 39 years before the publication of *Magische Gifte*, an identification

seconded by Blas Pablo in 1919; and as Tyler himself admitted, Victor A. Reko inclined to the misidentification of *ololiuhqui* as seeds of *Datura* in his 1936 edition (Tyler 1979). Blas Pablo had even published a paper two years before the publication of *Magische Gifte*, describing his self-experiments with morning glory seeds (B.P. Reko 1934). Tyler summed up his argument by conjecturing that Blas Pablo's presumed loss of priority (for the modern recognition that *teonanácatl* was a mushroom) explained why he had criticized his cousin Victor when he wrote to Henry Wassén in 1937. Tyler then stated that the only alternate explanation for Blas Pablo's deprecation of his cousin Victor was that his book *Magische Gifte* might indeed have been a "superficial" tome with no scientific value (Tyler 1979). Since I have shown that there was no loss of priority on the part of Blas Pablo Reko, that this had been secured seventeen years before Victor A. Reko published his book, it would seem that Tyler will have to accept his self-avowed only alternate explanation for Blas Pablo's displeasure—that *Magische Gifte* was indeed, as Wasson, Díaz, Holmstedt and others have concluded, an inaccurate and unscientific book lacking in originality. A recent German article (Haseneier 1992) wrongly credited Victor A. Reko (together with Schultes, Wasson and Heim) with the contemporary scientific "rediscovery" of the Mexican entheogenic mushrooms, failing even to mention Blas Pablo Reko, the true pioneer in these studies. To redress the injustice done to Blas Pablo, I dedicated my first book to him (Ott 1976B; Ott 1979B), and recently translated his pioneering 1919 paper.

- ¹¹ Santesson reported that his ethanolic extracts of *ololiuhqui* produced a "semi-narcosis" (*Halbnarkose*) in frogs and mice, and his chemical tests indicated the possible presence of a gluco-alkaloid (Santesson 1937A; Santesson 1937B). A quarter of a century was to pass before Santesson's glucoside, later named turbicoryn, was isolated from *ololiuhqui* and identified (Cook & Kealand 1962; Pérezamador & Herrán 1960). However, Santesson was unsuccessful in isolating the active principles, which later turned out to be ergoline alkaloids, not the glucoside. In their recent book on entheogenic psychotherapy, Roquet and Favreau mix up turbicoryn and ergoline alkaloids, calling ergine a "glucoside with an amide function" (Roquet & Favreau 1981). In 1934, Blas Pablo Reko (see preceding note) became the first scientist to test *ololiuhqui* in a self-experiment (B.P. Reko 1934), finding the seeds inactive. Reko failed to grind the seeds to a powder for extraction, as the Indians do (MacDougall 1960; Wasson 1963). One Dr. Marsh of the U.S. Agricultural Service likewise found the seeds to be inactive, owing either to insufficient dosage or failure to grind the seeds prior to ingestion (Schultes 1941). The seeds are not active if taken whole. Another experiment, in which eight male volunteers took up to 125 *ololiuhqui* seeds, also found no effect from whole seeds (Kinross-Wright 1959). It was H. Osmond who first reported psychoptic effects of *ololiuhqui* seeds, after conducting a series of four experiments on himself, taking doses of 14–100 seeds (Osmond 1955). While Osmond's first two experiments with 14 and 26 seeds chewed and swallowed produced mild but noticeable symptoms, he concluded that the higher doses were necessary to elicit the drug's full effects. Chewing and swallowing 60 seeds produced a definite trip, and Osmond's final experiment ingesting the powder of 100 ground seeds produced a stronger effect with "heightened visual perception and an increase in hypnagogic phenomena... which is very pleasant" (Osmond 1955). There is some evidence for ingestion of (presumably ground)

ololiuhqui seeds in antiquity in the form of enemas (De Smet & Lipp 1987). In an interesting historical aside to Osmond's pioneering experiment, he had intended to entitle his paper "Ololiuqui: Flower-her-Mother," this subtitle being a literal translation of the Mazatec name *na-so-le-na* for the seeds of *Turbina corymbosa*. R.E. Schultes, who edited the paper, felt this would be confusing, since the title *Ololiuqui* was an Aztec word meaning "round things." Osmond changed the title, but fortunately mentioned his original choice in a footnote, "so that readers who enjoy a lovely word should not be deprived of its euphony." See also Chapter 5, Note 6.

- ¹² The *ololiuhqui* seeds have also been reported in use in contemporary México as an ecbolic, one of the principal medical indications for ergot (see Note 4). The uterotonic effect of extracts of *Ipomoea violacea* has been demonstrated experimentally (Der Marderosian *et al.* 1964B). The Chinantec Indians of Oaxaca, México, employ seeds of *Turbina corymbosa* as an ecbolic, under the name *m' 'oo quidá' sée* (Browner 1985; Ortiz de Montellano & Browner 1985). Among the Mayans, honey of stingless bees was used as a uterotonic to aid in expelling the placenta, and as an ecbolic. This likely involved *xtabentún* honey, a medicinal agent in Yucatán, honey made by stingless bees from flowers of *xtabentún* or *Turbina corymbosa* (Roys 1931; Schwarz 1948). In a chemical study of Costa Rican *Ipomoea carnea*, a morning glory used as an entheogen in Ecuador and known to contain ergot alkaloids (Lascano *et al.* 1967; Naranjo *et al.* 1964), the nectar from extrafloral nectaries was reported to be devoid of alkaloids (Keeler 1977). Many other *Ipomoea* species possess extrafloral nectaries, including *I. violacea* (Keeler & Kaul 1979), and like *I. carnea*, extrafloral nectars from *I. leptophylla* and *I. pandurata* were devoid of alkaloids (Beckmann & Stucky 1981; Keeler 1980). It is not yet known whether *xtabentún* floral nectar or honey contains ergot alkaloids, but use of *xtabentún* honey as a medicament would suggest that it does. Studies are underway to clarify this point. In the Old World, a paste of young leaves of *Ipomoea pes-caprae* is used as an ecbolic by the natives of the Nicobar Islands, India (Dagar & Dagar 1991), and the leaves are used as a rheumatism remedy in Samoa (Uhe 1974). Samoan *I. pes-caprae* was shown to be active in pharmacological screening (Cox *et al.* 1989). In the Cook Islands leaves of this morning glory are used to treat sprains (Whistler 1985) and an infusion of *I. pes-caprae* var. *brasiliensis* is used in Tonganese ethnomedicine (Singh *et al.* 1984). Extracts of the plant are used in Southeast Asia as an antidote to jellyfish venoms (Ponglux *et al.* 1987; Pongprayoon *et al.* 1991) and in Vanuatu the juice of "nearly wilted leaves" of this cosmopolitan beach morning glory is used as an antidote to "ciguatera" poisoning (Bourdy *et al.* 1992), a sort of food poisoning involving ingestion of fish that feed on algae which produce ciguatoxins (Lange 1987). Extracts of leaves of *Ipomoea crassicaulis* are used as an ecbolic in contemporary Mexican ethnogynecology (Zamora-Martínez & Nieto de Pascual Pola 1992). The seeds of scammony, *Convolvulus scammonia*, known to contain alkaloids, were used in the classical world as a uterotonic and abortifacient (Albert-Puleo 1979). Use of pulverized root of *Ipomoea leptophylla* by North American Pawnee Indians to treat nervousness and bad dreams (Gilmore 1919) may point to psychotropic ergoline alkaloids in this species, and the same can be said for *I. medium*, used as a pediatric anticonvulsant in Madagascar (Beaujard 1988). Since leaf juice of *I. involucrata* is used as a hemostatic in Sierra Leone, Africa

(MacFoy & Sama 1983), and since juice of whole plants is used by the Fang of Africa as a stimulant and “medico-magic” remedy (Akendengué 1992), the presence of ergoline alkaloids in this species is also likely. Finally, use of flowers of *I. littoralis* as a hemostatic and of leaves of this morning glory against postpartum pain (Austin 1991) underscores the probability that this species, too, contains uterotonic ergoline alkaloids.

¹³ This point is still a topic of debate in the halls of academia. To the *cognoscenti*, it is obvious that self-experiments by the researcher are a necessary prerequisite to investigations on entheogens. The effects of entheogens are so much a product of set and setting that the naive researcher is in danger of projecting his own biases onto the experiences of the experimental subjects. As R. Gordon Wasson so eloquently put it: “two psychiatrists who have taken the mushroom and known the experience in its full dimensions have been criticized in professional circles as being no longer ‘objective.’ Thus it comes about that we are all divided into two classes: those who have taken the mushroom and are disqualified by our subjective experience, and those who have not taken the mushroom and are disqualified by their total ignorance of the subject!” (Wasson 1961). Moreover, it should be noted that the three most important entheogens—mescaline, LSD and psilocybine—were all discovered by psychonauts, chemists evaluating their own chemical preparations in self-experiments. Those chemists, like Louis Lewin, who attempted to isolate the entheogenic principles of *péyotl* (see Chapter 1), and like James Moore, who attempted to isolate the entheogenic principles of *teonanácatl* (see Chapter 5); by relying exclusively on animal experiments to determine activity of extracts, uniformly failed. It was Arthur Heffter, testing a series of *péyotl* extracts on himself, who discovered mescaline; and Albert Hofmann and colleagues, testing *teonanácatl* extracts on themselves, who discovered psilocybine and psilocine (Heffter 1898; Hofmann *et al.* 1958). On the basis of animal tests in 1938, Sandoz pharmacologists had concluded that LSD was of little pharmacological interest—it was Albert Hofmann’s hunch five years later which led him again to make the drug, opening the way for his serendipitous discovery of its extraordinary, human-being-specific effects in his own body (Hofmann 1980). In spite of this, researchers have used many different animals, from spiders (Christiansen *et al.* 1962; Witt 1960) to housecats (Díaz 1975) to elephants (Cohen 1964), in vain, in this case immoral, pursuit of the elusive animal model of “hallucinosi.” See also Chapter 4, Note 6.

¹⁴ Many black-market LSD preparations actually contained *N*(1)-acetyl-LSD, or ALD-52. This compound readily hydrolyzes to acetic acid and LSD. Its effects are identical to LSD, and it is virtually equipotent. The most famous preparation of ALD-52, “Orange Sunshine” (containing up to 300 mcg ALD-52 per “barrel”) appeared in 1969, and was widely sold for a few years. This was the prototype of the so-called “designer drug.” See Note 8 above.

¹⁵ LSD has been classified as a drug with a “high potential for abuse,” and the story of the use of the drug by the United States CIA and by the U.S. Army, certainly shows how the drug may be abused. Using phony funding agencies, like the above-mentioned “Geschickter Fund for Medical Research, Inc.,” the “Society for the Study of Human Ecology” (this, before most Americans would have known what *ecology* meant!) and the “Josiah Macy,

Jr. Foundation" the CIA began to employ academic scientists to test LSD and other drugs. One such scientist, L.J. West, injected 300 milligrams of LSD into an elephant, hoping to induce an elephant psychosis—instead, the hapless animal collapsed and was killed by the good doctor who administered a combination of drugs in an attempt to revive him. A Canadian psychiatrist, E. Cameron, used LSD in experimental "treatments" on unwilling "patients," nine of whom later sued the U.S. government for the trauma this occasioned. These unfortunate inmates of Cameron's Allain Memorial Institute were sedated for months at a time, then subjected to repeated electroshock and doses of LSD, followed by "psychic driving"—being exposed under prolonged sedation to tape-recorded messages. This was in violation of the Nürnberg Code of medical ethics (ironically, Cameron had been a member of the Nürnberg tribunal which judged Nazi war criminals and sent some physicians to the gallows; Annas & Grodin 1992; Lee & Shlain 1985), as were the CIA-sponsored drug experiments on prisoners in the Lexington, Kentucky narcotics "farm." The latter "experiments" were under the control of H.S. Isbell, who dosed individual prisoners (mostly black) with ever-increasing quantities of LSD for more than 75 successive days! In 1953, CIA officials authorized the purchase of 10 kilograms of LSD (about 100 million doses), which Sandoz was not able or willing to provide. In violation of patent laws, the CIA then ordered the Eli Lilly Company of Indiana to synthesize LSD. That year one of the CIA scientists involved in the drug testing program, F. Olson, who had been given LSD unknowingly in his cocktail at a CIA retreat at Deepcreek Lake, Maryland, became depressed and killed himself some weeks after being dosed surreptitiously. Although the CIA kept the true circumstances leading up to the suicide secret, they became public following release of documents resulting from a journalist's "Freedom of Information Act" lawsuit, and doleful then-President Gerald Ford was forced publicly to apologize to Olson's family. In 1955 "Operation Midnight Climax" commenced, setting up the CIA-financed brothels. The "safehouse experiments" continued for eight years, and when G.H. White, the man in charge of the operation, retired in 1966, he said: "I toiled wholeheartedly in the vineyards because it was fun, fun, fun. Where else could a red-blooded American boy lie, kill, cheat, steal, rape, and pillage with the sanction and blessing of the All-Highest?" Where else, indeed? Meanwhile, the United States Army (when its infamous Chemical Corps wasn't killing livestock with nerve-gas in Colorado) commenced testing of LSD as an "unconventional chemical warfare agent." Major General W. Creasy, chief officer of the Army Chemical Corps, was an enthusiastic supporter of the concept. The Army, too, had its little mishaps. In 1953, as part of experiments funded by the Army Chemical Corps, a tennis player named H. Blauer was killed with an intravenous injection of 500 mg of EA-1298 or MDA (see Chapter 1; Shulgin & Shulgin 1991). An Army researcher blithely commented: "we didn't know if it was dog piss or what it was we were giving him." The Army tested LSD on some 1500 military personnel, some of whom later claimed they were coerced by officers into "volunteering." General Creasy even wished to test LSD on a large scale, in a subway system or in surface spraying of a large city, bemoaning the fact that permission to do so "was denied on reasons that always seemed a little absurd to me." All of this unethical, illegal and scientifically unsound "research" (in many respects analogous to medical "research" by Nazi doctors in Dachau and other concentration camps), was justified on the grounds of "national security" and the presumption that similar work was

going on in the Soviet Union and China; although internal CIA documents failed to substantiate this, and there is no evidence the so-called "iron curtain" governments of these two "enemies" were as obsessed with chemical mind control as were their "free world" counterparts (Lee & Shlain 1985; Marks 1979). See also: Chapter 3, Note 2; Chapter 4, Note 6 and Chapter 5, Note 8.

- ¹⁶ There is fragmentary evidence of folk knowledge of the inebriating potential of ergots. *Darnel* or *tares*, *Lolium temulentum*, has been known since antiquity as an inebriant, and recent research shows it owes its inebriating potential to common infestation by ergot or other mushrooms (Dannhardt & Steindl 1985; Hofmann 1978A; Katz 1949). Darnel was mentioned as an ingredient in three different recipes for witches' psychotropic "flying ointments" (De Vries 1991A; Hansen 1978). In the Canary Islands darnel seeds are said to be used as a tranquilizer and are known as *borrachera* ("drunkenness"), suggesting use as an inebriant (Darias *et al.* 1986). Similarly, darnel or *cizaña* is also known in Spanish as *borrachuela*, betraying traditional knowledge of inebriating properties. A nineteenth century Scottish chemist commented that darnel "creeps occasionally into our fermented liquors and our bread" and that it had "long been known to possess narcotic and singularly intoxicating properties. When malted along with the barley [darnel seeds] impart their intoxicating quality to the beer, and render it unusually and even dangerously heady" (Johnston 1857). A similar phenomenon was reported in Britain where it was said of darnel: "when brewed with barley, it communicates a very intoxicating quality to the beer" (Johnson & Johnson 1861). In Perú, seeds of *cizaña* or *L. temulentum* are added to the fermented beverage *chicha* to enhance its potency (Soukup 1970). Writing of darnel, Duke recently reported "the Lebanese hint that there is a mystic cult 'in the mountains' which infuses the grass or soaks the seeds to extract the ergot which is then used to induce religious ecstasy" (Duke 1983). Tremorigenic compounds lolitrem B and peramine have been found in *L. perenne* strains toxic to livestock, and derive from the fungus *Acremonium loliae* (Gallagher *et al.* 1984; Rowan *et al.* 1986). *Acremonium*-infested "sleepy grass" or *Stipa robusta* (likewise toxic to livestock) was recently reported to contain high concentrations of lysergic acid amide or ergine (Anon. 1992C; Petroski *et al.* 1989). In India, kodo millet, *Paspalum scrobiculatum*, also commonly infested with ergot, is known to be poisonous after a rain, causing "delirium and violent tremors" (Aaronson 1988; De Wet *et al.* 1983). The "outer covering of dehusked grains" of kodo millet (which is where the ergot would be found) has been reportedly used as an entheogen by the Lodha of Midnapur District, West Bengal (Pal & Jain 1989). In 1959, Indian researchers isolated a "tranquillizing principle" from *Paspalum scrobiculatum* grain, which showed the properties of a water-soluble alkaloid and had pharmacological effects similar to lysergic acid amide or ergine (Bhide & Aimen 1959). In Samoa, *P. scrobiculatum* seeds are thought to be poisonous (Uhe 1974). In the Ecuadorian Amazon, infusions of *Paspalum conjugatum* are used by Shuar Indians as a headache remedy, suggesting infestation by ergot-alkaloid-containing *Claviceps paspali* (Russo 1992). Finally, a *Cyperus* species known to be infested by ergot-alkaloid-containing *Balansia cyperi* (see Note 4), has been reportedly used as an additive to entheogenic *ayahuasca* potions in Amazonia (Chaumeil 1982; Plowman *et al.* 1990). Another *ayahuasca* additive, the fern *Lomariopsis japurensis* (Pinkley 1969; Rivier

& Lindgren 1972; Schultes & Hofmann 1979), may likewise contain ergoline alkaloids. Both this species and *L. nigropalatea* are used in Amazonian ethnomedicine in contexts suggesting possible content of ergoline alkaloids. The former is used by Quijos Quichua Indians against postpartum hemorrhage (Marles *et al.* 1988) and by the Runa of Ecuador as an abortifacient (Kohn 1992); the latter employed by Makú Indians as a general hemostatic (Schultes & Raffauf 1990).

- ¹⁷ Given the fact that contemporary western society is obsessed with ethyl alcohol or ethanol as inebriant, we tend to consider alcohol to have been the dominant inebriant throughout history. Dionysus, the ancient Greek god of inebriation, is widely associated with the vine and wines, and it is commonly assumed that inebriation with Greek wines was a form of alcoholic inebriation. Yet we now know that Greek wines were very powerful infusions of various inebriating plants which required dilution with water to render them safe to drink. Since the ancient Greeks lacked distillation technology (Forbes 1948), their wines were limited to 12–15% alcohol content (at which point in the fermentation the yeasts which produce the alcohol as waste product would die from alcohol poisoning). These wines required dilution because they contained high concentrations of alkaloids and other plant secondary compounds. In effect, their inebriating properties proceeded from the drugs infused in them, and their alcohol content served more as a preservative than as an inebriating active principle (Samorini 1995). Dionysus was the son of Persephone and Zeus, key figures in the *Homeric Hymn to Demeter* which underlay the Eleusinian potion, the entheogenic *kykeon* (see Postscriptum). Dionysus represents the “wild” in Ruck’s scheme (Ruck 1982; Ruck & Staples 1994), and he has been associated, in my opinion correctly, with shamanism (Emboden 1977; Samorini 1995)—the preliterate, matritheistic, autochthonous strain onto which was grafted the “cultivated,” or the patritheistic Indo-European “civilized” strain—represented mythologically as the marriage of Persephone and Zeus; or indeed of Zeus with the whole pantheon of Earth Mother goddesses who preceded him. In ancient Greek there was no word for alcohol. Dioscorides described a wine infused with mandrake (*Mandragora officinarum*; see Appendix A) and so soporific as to be useful as a surgical anesthetic (Rätsch 1994; Stillman 1922). As Carl Ruck described it: “we hear of some wines so strong that they could be diluted with twenty parts of water and that required at least eight parts water to be drunk safely, for, according to the report, the drinking of certain wines straight actually caused permanent brain damage and in some cases even death... we can also document the fact that different wines were capable of inducing different physical symptoms, ranging from slumber to insomnia and hallucinations” (Wasson *et al.* 1978). Homer described how clever Odysseus got Polyphemus (the Cyclops) drunk by giving him straight a wine meant to be diluted with twenty parts water, and wines of this potency still existed in Pliny’s day. The addition by Helen of *nepenthes* (thought to have been opium) to Telemachus’ wine to assuage his grief is a well-known episode in the *Odyssey*. Plutarch described a distinctly visionary wine drunk in a Dionysian festival called the *Anthesteria*, a drugged wine which, according to Ruck “was responsible for opening the graves and allowing the departed spirits to return to Athens for a banquet” (Wasson *et al.* 1978). According to Xenophon and Aristophanes, a wine’s quality was called its “flower,” and a wine “deficient in flower” lacked potency—

literally it didn't have enough of the flowers (and/or leaves) of the plants which accounted for its particular effects. The ancient Aztecs similarly used the word "flower" (*xóchitl* or *ihuinti*) as a metaphor for the entheogens, even calling entheogenic mushrooms *xochina-nácatl*—literally, "flower-mushrooms" (see Chapter 5, Note 3; Wasson 1980). The Aztecs, too, fortified alcoholic *Agave* wine—*octli* or *pulque*—with sacred inebriants, preparing a ceremonial *teoctli* or "wondrous *pulque*" for captured warriors before they were led in glory to the sacrifice, and for their priestly executioners (Gonçalves de Lima 1956; see Chapter 6, Note 12). In the *Old Testament*, a repeated distinction is made between wine and "strong drink," both of which were inebriants. Collectively they are mentioned nearly 200 times, and some eleven Hebrew words for wine are used, of which the most common is *yayin* (which appears nearly 150 times) and secondarily *tiros* (appearing 38 times). *Tiros* evidently was the word for grape juice and new wine, and when fermentation was complete, the product was called *yayin*—both *tiros* and *yayin* were inebriating (Wasson 1914). But the *Old Testament* also refers repeatedly to *shekar*, or "strong drink" which was not the same as *yayin* or *tiros*, but which could also inebriate, as for example in 1 Samuel 1.14, when Eli said to Hannah "How long wilt thou be drunken? put away thy *yayin* from thee," to which she replied proudly: "I have drunk neither *yayin* nor *shekar*." Like the ancient Greeks, the ancient Israelites did not know distillation technology, but possessed an inebriant other than wine, which apparently was more potent. Was the Biblical *shekar*, "strong drink," not an inebriating draught analogous to the ancient Greek wines, some of which were entheogenic potions? Down through history there have been innumerable instances of the addition of psychoactive plants to wines and other alcoholic beverages. Two celebrated nineteenth century examples are *Vin Mariani*, a fine Bordeaux wine infused with cocaine-containing *coca* leaves (Mariani 1890) as well as the various *absinthe* liqueurs made by distilling alcohol, into which volatile thujone-containing *Artemisia absinthium* plants were infused (see Appendix A; Conrad 1988). A modern survival of this common practice is the use of soporific hops (*Humulus lupulus*) as an additive to contemporary beers, thereby combining the sedative effects of 2-methyl-3-butene-2-ol to those of alcohol (Tyler 1987). An in-depth study of the many psychotropic additives to alcoholic beverages remains a *desideratum* of psychopharmacognosy, and the German ethnopharmacognosist Christian Rätsch has now attacked the Braumeister's side of the problem, with his new book *Urbock: Bier Jenseits von Hopfen und Malz* [*Urbock: Beer Beyond Hops and Malt*] (Rätsch 1996). See also Rätsch's appendix on the entheogenic "mead of inspiration" in Ralph Metzner's recent book *The Well of Remembrance* (Metzner 1994), as well as the "Inebriantia" section in Dale Alexander Pendell's *Pharmako / Pœia: Plant Powers, Poisons, and Herbcraft* (Pendell 1995).

TABLE 2
ERGOLINE-ALKALOID-CONTAINING PLANTS*

I. CLAVICIPITACEAE:	
<i>Acremonium coenophialum</i>	Porter 1995
<i>Acremonium</i> sp.	Anon. 1992C; Petroski <i>et al.</i> 1989
<i>Balansia claviceps</i>	Porter <i>et al.</i> 1979 ¹
<i>B. cyperi</i>	Plowman <i>et al.</i> 1990 ¹
<i>B. epichloë</i>	Porter <i>et al.</i> 1979 ¹
<i>Claviceps paspali</i>	Arcamone <i>et al.</i> 1960 ²
<i>C. purpurea</i>	Stoll & Burckhardt 1935
<i>Cordyceps capitata</i>	Heim & Wasson 1958[9] ³
<i>C. ophioglossoides</i>	Heim & Wasson 1958[9] ³
<i>Epichloë typhina</i>	Porter <i>et al.</i> 1981
<i>Hypomyces aurantius</i>	Yamatodani & Yamamoto 1983
II. CONVULVACEAE:	
<i>Argyreia acuta</i>	Chao & Der Marderosian 1973B
<i>A. barnesii</i>	Chao & Der Marderosian 1973B
<i>A. cuneata</i>	Chao & Der Marderosian 1973B
<i>A. hainanensis</i>	Chao & Der Marderosian 1973B
<i>A. luzonensis</i>	Chao & Der Marderosian 1973B
<i>A. mollis</i>	Chao & Der Marderosian 1973B
<i>A. nervosa</i>	Chao & Der Marderosian 1973A; Chao & Der Marderosian 1973B; Hylin & Watson 1965
<i>A. obtusifolia</i>	Chao & Der Marderosian 1973B
<i>A. philippinensis</i>	Chao & Der Marderosian 1973B
<i>A. speciosa</i>	Montgomery 1990 ⁴
<i>A. splendens</i>	Chao & Der Marderosian 1973B
<i>A. wallichii</i>	Chao & Der Marderosian 1973B
<i>Convolvulus tricolor</i>	Genest & Sahasrabudhe 1966 ⁵
<i>Ipomoea amnicola</i>	Amor-Prats & Harborne 1993
<i>I. argillicola</i>	Amor-Prats & Harborne 1993
<i>I. argyrophylla</i>	Stauffer <i>et al.</i> 1965
<i>I. asarifolia</i>	Jirawongse <i>et al.</i> 1977
<i>I. carnea</i>	Lascano <i>et al.</i> 1967
<i>I. coccinea</i>	Gröger 1963 ⁶
<i>I. crassicaulis</i> ⁷	
<i>I. diamantinensis</i>	Amor-Prats & Harborne 1993

*Ipomoea involucrata*⁸

<i>I. leptophylla</i>	Chao & Der Marderosian 1973B ⁹
<i>I. littoralis</i> ⁸	
<i>I. muelleri</i>	Gardiner <i>et al.</i> 1965
<i>I. nil</i>	Genest & Sahasrabudhe 1966 ¹⁰
<i>I. orizabensis</i>	Amor-Prats & Harborne 1993
<i>I. parasitica</i>	Amor-Prats & Harborne 1993
<i>I. pes-caprae</i> ¹¹	
<i>I. piurensis</i>	Jenett-Siems <i>et al.</i> 1994
<i>I. purpurea</i>	Hylín & Watson 1965 ¹²
<i>I. turbinata</i>	Banerjee & Bhatnagar 1974
<i>I. violacea</i> (= <i>I. rubro-caerulea</i>)	Hofmann 1963A; Gröger <i>et al.</i> 1963; Der Marderosian <i>et al.</i> 1964A
<i>Stictocardia tiliaefolia</i>	Hofmann 1961
<i>Turbina corymbosa</i> (= <i>I. sidaefolia</i> ; <i>Rivea corymbosa</i>)	Der Marderosian <i>et al.</i> 1964A; Hofmann 1963A; Hofmann & Tschertter 1960; Taber <i>et al.</i> 1963B
III. POLYGALACEAE:	
<i>Securidaca longipedunculata</i> ¹³	Costa <i>et al.</i> 1992

NOTES

- ¹ Certain *Cyperus* species infected with *Balansia cyperi* are used in ethnogynecology by Achuar "Jívaro" Indians of Peruvian Amazonia (Lewis & Elvin-Lewis 1990). Cultures taken from two Amazonian and one U.S. strain of this fungus produced "several unidentified ergot alkaloids" (Plowman *et al.* 1990). Since these same *Cyperus* species are also used as additives to entheogenic *ayahuasca* potions (see Chapter 4; Schultes & Raffauf 1990), there is the likelihood that psychoactive ergot alkaloids are involved (see Chapter 2, Note 4).
- ² Lysergic acid amides have been isolated from ergots of *Paspalum* species, and (see Chapter 2, Note 7) *Claviceps paspali* has become the industrial source of lysergic acid (Bové 1970; Hofmann 1977). Ergot of *Paspalum scrobiculatum* or kodo millet is toxic after rains (Aaronson 1988; De Wet *et al.* 1983), and Indian researchers isolated a "tranquillizing principle" which showed the properties of lysergic acid amide (see Chapter 2, Note 16; Bhidé & Aimen 1959). "Outer covering of dehusked grains" of kodo millet is used for psychop-
tic effects by Lodhas of West Bengal, India (Pal & Jain 1989). *Lolium temulentum*, darnel or tares, has an inebriating reputation (Duke 1983; Hofmann 1978A; Johnson & Johnson 1861; Johnston 1857). Known in Europe as *Taumellolch* ("delirium grass") and as *ivraie* ("inebriating"), psychotropic properties of this wild grass may derive from alkaloids produced by fungi commonly infesting it (Hofmann 1978A; Katz 1949). Loline and "two minor alkaloids" were isolated from caryopses of *L. temulentum*, perloline from stems (Dannhardt & Steindl 1985). Loline was found to be non-toxic up to doses of 200 mg/kg after

i.p. injection into mice. Since caryopses were all "invaded by a fungus," there is the possibility loline is a fungal alkaloid. Since loline was non-toxic, ergoline alkaloids remain the best candidates for producing well-known psychoptic effects of *L. temulentum*. Tremorigenic compounds lolitrem B and peramine were found in *Lolium perenne* strains toxic to livestock, deriving from fungus *Acremonium loliae* (Gallagher *et al.* 1984; Rowan *et al.* 1986).

- ³ As described in Chapter 2, Note 4, *Cordyceps capitata* and *C. ophioglossoides* are ingested together with psilocybian mushrooms (see Chapter 5) in mushroom curing rituals in México (Guzmán 1958; Heim 1957A). Although Hofmann had found the former species to be devoid of psilocybine, it did contain "une substance indolique différente, à l'état de traces (0.004%)" ; "a different indolic substance in trace amounts of 0.004%" (Heim & Wasson 1958). This compound remains unidentified and the similarly-used *C. ophioglossoides* (which is of considerable value in Chinese medicine) has evidently not been examined for potentially psychotropic indolic compounds.
- ⁴ Bioassay of five seeds of this African species found it to be visionary (Montgomery 1990).
- ⁵ Although preliminary screening of seeds of *Convolvulus tricolor* detected traces (0.001% of fresh weight) of alkaloids in one (from Denmark) out of seven strains tested (Genest & Sahasrabudhe 1966), the authors suspected that "possibly seed contamination by *I. violacea*" occurred, referring to *Ipomoea violacea*, a known psychoactive species used ritually in México. A subsequent report failed to detect indole alkaloids in a strain of this species from Hungary, nor in *C. siculus* nor *C. sepium* (Der Marderosian & Youngken 1966), and *C. tricolor* was tentatively listed in a recent paper on Italian psychotropic plants (Festi & Alliota 1990). However, *C. scammonia* has been known since antiquity as an abortifacient and headache remedy (with pharmacological properties common to psychoactive ergot alkaloids), and *C. arvensis* was described by Dioscorides as a "birth-quickener" (Albert-Puleo 1979). Dioscorides suggested that seeds of *C. sepium* might be psychoactive, mentioning that their ingestion "is related to cause many and troublesome dreams." Recently Bahraini ethnomedicinal use of *C. arvensis* roots and leaves as a topical hemostatic was reported (Abbas *et al.* 1992). There is thus reason to suppose that at least some *Convolvulus* species may contain psychoactive ergoline alkaloids.
- ⁶ Although *Ipomoea coccinea* was reported to contain ergot alkaloids (Gröger 1963), a subsequent analysis of a single commercial strain of *I. coccinea* var. *hederifolia* failed to detect indole alkaloids (Der Marderosian & Youngken 1966). Furthermore, in the original report, only agroclavine and elymoclavine were detected in this species. These alkaloids are not known to be entheogenic (but see Note 13 below), and this species is probably not psychoactive. As *I. hederacea*, seeds of a single French strain were found to contain only a trace of elymoclavine (Genest & Sahasrabudhe 1966), and traces of a few other ergot alkaloids were found in seeds of wild *I. hederacea* in a recent study (Wilkinson *et al.* 1986).
- ⁷ Although *Ipomoea crassicaulis* has not yet been shown chemically to contain psychotropic ergoline alkaloids, extracts of leaves of this species were recently reported to be used as an

ecbolic (to precipitate childbirth) in contemporary Mexican ethnogynecology (Zamora-Martínez & Nieto de Pascual Pola 1992). Similar use of entheogenic and uterotonic seeds of *Turbina corymbosa* has been reported from Oaxaca, México (Browner 1985; Ortiz de Montellano & Browner 1985). Since ergonovine and ergine both occur in *I. violacea*, and are at once entheogenic and uterotonic, it is possible, even probable, that the uterotonic principle of *I. crassicaulis* is a psychoactive ergoline alkaloid.

- ⁸ Although not reported to contain ergoline alkaloids, the use of leaf juice of *Ipomoea involucrata* as a hemostatic in Sierra Leone, West Africa, makes it likely this species contains potentially visionary ergoline alkaloids (MacFoy & Sama 1983). The Fang of Central Africa take juice of fresh whole plants of this species as a stimulant and "medico-magic" therapy for illnesses thought to be related to sorcery (Akendengué 1992). Similarly, *I. littoralis* flowers have reportedly been used as a hemostatic and its leaves for postpartum pain and as a pediatric anticonvulsant, likewise suggesting content of ergoline alkaloids (Austin 1991; Whistler 1992). The use of *I. medium* as a pediatric anticonvulsant in Madagascar also recommends study of this species for alkaloids (Beaujard 1988).
- ⁹ *Ipomoea leptophylla* roots were burned by North American Indians to treat sufferers of nervousness and "bad dreams" with the smoke (Gilmore 1919). This potentially psychoactive use points to possible content of visionary ergoline alkaloids.
- ¹⁰ Although preliminary screening of 14 strains of *Ipomoea nil* had detected trace amounts (0.001% of fresh weight) of total alkaloids in seeds of two strains from California (Genest & Sahasrabudhe 1966), in both cases the authors suspected there had been "possibly seed contamination by *I. violacea*," admixture of seeds of the well-known psychotropic species *Ipomoea violacea*. In a subsequent study, no indole alkaloids were detected in any of five American strains of *I. nil* tested (Der Marderosian & Youngken 1966; see also Der Marderosian *et al.* 1964A, where one of these strains was also mentioned). That same year, seeds of three Japanese strains of *I. nil* ("Matzukaze," "Yuki" and "Chiyo no okina") were found to contain traces (0.007–0.011% of fresh weight) of total alkaloids (Staba & Laurson 1966). This last-mentioned Japanese strain of *Ipomoea nil*, "Chiyo no okina" is evidently named for Kaga no Chiyo, well-known poetess, who wrote a famous and suggestive *haiku* poem to the morning glory, "Asagao ya!" (Bates 1964).
- ¹¹ As is the case with *Ipomoea crassicaulis*, a preparation of the leaves of *I. pes-caprae* (the common sandy beach plant) is used in contemporary ethnogynecology as an ecbolic (a drug to precipitate childbirth) by the natives of the Nicobar Islands, India (Dagar & Dagar 1991). Similarly, extracts of the plant are used as an antidote to jellyfish venoms in Southeast Asia (Ponglux *et al.* 1987; Pongprayoon *et al.* 1991) and as an antidote to ciguatera poisoning in Vanuatu (Bourdy *et al.* 1992). Since *I. violacea* contains both ergine and ergonovine (ergoline alkaloids at once visionary and uterotonic), it is possible that the reported properties of *I. pes-caprae* likewise derive from these psychoptic alkaloids.

- ¹² Although a preliminary report described substantial quantities of alkaloids (0.423–0.813

mg/g) in seeds of two cultivars of *Ipomoea purpurea*, the strains were identified as “Heavenly Blue” and “Pearly Gates,” known horticultural names for strains of *Ipomoea violacea*, one of the psychoactive species used ritually in México (Hylin & Watson 1965). An earlier report (Taber *et al.* 1963A), which has been criticized for lack of taxonomic and chemical rigor (Der Marderosian *et al.* 1964A), likewise suggested that *I. purpurea* seeds contained alkaloids. In 1964, one American strain of *I. purpurea* (“Crimson Rambler”) was found to be devoid of alkaloids (Der Marderosian *et al.* 1964A). In 1966, 13 strains of genuine *I. purpurea* (with trade names like “Crimson Rambler” and “Double Rose Marie”) were all found to be devoid of alkaloids (Genest & Sahasrabudhe 1966). In another study, five strains (with colorful names like “Crimson Rambler,” “Sunrise Serenade,” “Rose Marie” and “Tinkerbelle’s Petticoat”) of *I. purpurea* were likewise found to be devoid of alkaloids (Der Marderosian & Youngken 1966). A recent study found small traces of ergot alkaloids in *I. purpurea* seeds (Wilkinson *et al.* 1986). The evidence indicates that Hylin and Watson committed a nomenclatural error, in substituting the specific name *purpurea*, “purple-colored” for what they really meant, *violacea* or “violet-colored.” We must consider *I. purpurea* to be a mistaken attribution to *I. violacea*, as three separate studies have failed to detect alkaloids in a total of 19 strains of *I. purpurea*, with only one report of small traces of alkaloids in seeds of this species. A recent paper on Italian psychotropic plants noted that self-experiments with seeds of this species failed to demonstrate psychoactive properties (Festi & Alliota 1990). Unfortunately, this confusion has been perpetuated in secondary literature. In a 1969 paper reprinted in 1990, the seeds of “Heavenly Blue” and “Pearly Gates” varieties of *I. violacea* were mistakenly referred to as *I. purpurea*, citing the Taber group’s paper (Savage *et al.* 1990). Even more recently, a “radical history” ofentheogens and human evolution mistakenly referred to *I. purpurea* in a discussion of the ritual use of *I. violacea* in México (T.K. McKenna 1992).

¹³ *Tchúnfki* roots, traditionalentheogens of the Balanta of Guinea Bissau, contained elymoclavine—evidently psychoptic—also known from Mexicanentheogenic morning glories.

* This table reports the occurrence of known psychotropic ergoline alkaloids in fungal and flowering plant species. The natural ergot alkaloids known to be psychoptic are: 1) lysergic acid amide or ergine (LA-III), first ingested by Hofmann and active at doses of 0.5–1.0 mg (Hofmann 1963A; Solms 1956A; Solms 1956B); 2) lysergic acid *N*-1-hydroxyethylamide (which readily hydrolyzes *in vivo* to lysergic acid amide; Hofmann 1971) and 3) lysergic acid-L-2-propanolamide or ergonovine (also known by the synonyms ergobasin[e], ergometrine, ergotocin[e] and ergostetrine; see Chapter 2, Note 6), first found by Hofmann to be visionary at doses of 2.0 mg of the hydrogen maleate salt (Hofmann 1978A) and subsequently tested in doses as high as 10 mg (Bigwood *et al.* 1979). It is possible there are other psychoactive compounds in these plants (such as elymoclavine; see the preceding Note), and many also contain pharmacologically-active non-psychotropic alkaloids. A number of species, such as *Cuscuta monogyna* (Ikan *et al.* 1968), *Argyreia capitata*, *A. maingayi* and other species of *Argyreia* and *Ipomoea* (Chao & Der Marderosian 1973B) have been reported to contain a great variety of ergoline alkaloids, but none of these are as yet known psychoactive compounds, nor have any of these species been reported to beentheogenic.

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