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Michael Winkelman

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Psychointegrators: Multidisciplinary Perspectives on the Therapeutic Effects of Hallucinogens

Michael Winkelman
Arizona State University
Tempe, AZ

Vision-inducing plants ("hallucinogens") are important in many societies, evoking powerful emotional, psychological, cognitive, religious, spiritual, therapeutic and political reactions. These substances' psychophysiological properties shape cross-cultural similarities in patterns of use and experiences, while political factors shape their cultural desirability. Neurological studies illustrate that common effects are based in intervention in serotonergic neurotransmission. Effects upon neural, sensory, emotional, and cognitive processes stimulate integrative information processing, justifying a new term—"psychointegrators." Psychointegrators disinhibit sensory and emotional processes. They stimulate systemic integration of brain information-processing functions, enhancing integration of limbic system self and emotional dynamics with neocortical processes. Their therapeutic applications are reviewed from perspectives of cross-cultural and clinical studies.

The use of hallucinogens or psychedelics as therapeutic and religious agents is reported in many cultures (Dobkin de Rios, 1984; Furst, 1972, 1976; Harner, 1973; Rätsch, 1989; Schultes & Hofmann, 1979; Stafford, 1992; Winkelman & Andritzky, 1996). Although broadly prohibited for private and therapeutic use by U.S. and international law in the late 1960s, these substances have a continued importance illustrated by the recent increases in self-application (Beck, 2000; Gold, 1994a & 1994b; Miller & Gold, 1993; Schuster, Lieb, Lamertz & Wittchen, 1998; Werner, 1993; Zoccolillo, Vitaro, & Trimblay, 1999) and the governmental decisions to renew limited human subject studies (Mathias, 1993). These substances are often viewed as sources of spiritual inspiration, mystical participation and personal transformation, but also as dangerous agents to be controlled or prohibited.

This article integrates ethnographic, cross-cultural, clinical and neurophysiological data to develop a neurophenomenological perspective (Laughlin, d'Aquilli, & McManus, 1992) for explaining psychotherapeutic and sociocultural patterns of use of these substances. Cross-cultural similarities in social and therapeutic use derive from their effects upon serotonergic neurotransmission, enhancing brain wave coherence (synchronization), emotional processing, and self- and information integration. A review of physiological and psychological data justifies the term "psychointegrator" as

more accurately characterizing these substances' effects, avoiding misleading implications and inaccurate assumptions associated with commonly employed terms such as hallucinogen. A cross-cultural review of the use of these substances illustrates similarities in effects and interpretations, and political conditions predicting their use and prohibition. Diverse therapeutic applications attested to cross-culturally are related to different clinical paradigms of the effects of LSD. These are shown to reflect effects upon serotonergic transmission and sensory, emotional, behavioral and cognitive processes. The article concludes with a brief consideration of psychointegrators' continued therapeutic and research applications.

PSYCHOINTEGRATION: HALLUCINOGENS' ACTIONS UPON SEROTONERGIC TRANSMISSION

Cross-cultural similarities in uses and effects of psychointegrators suggest a common botanical and chemical basis for these substances. The so-called hallucinogenic substances do not share a single common botanical or chemical classification, being found in nearly 100 species and a wide range of genera and families (Schultes & Hofmann, 1979). Although hallucinogenic plants are principally fungi and angiosperms, angiosperms are the principal group of plants on the earth, and most are not hallucinogenic (Schultes, 1972; Schultes & Hofmann, 1979). Similarly, most hallucinogenic chemicals are alkaloids, but most alkaloids do not have hallucinogenic effects. Classification as a hallucinogen (or psychedelic) has not been based upon specific chemistry or physiology, but upon effects on human experience, producing visions, voices and effects upon perception, mood, and thought *in non-toxic doses* (Siegel, 1984). This distinguishes them from substances that produce hallucinations because of toxicity.

In spite of the absence of a botanical grouping or chemical classification for these notable plant substances, there are common neurophysiological effects of many of these substances. Lysergic acid diethylamide (LSD), phenylethylamine (e.g., mescaline) and indolealkylamines (e.g., psilocybin) differ in terms of their potency but otherwise have virtually identical clinical effects (Aghajanian, 1994; Hollister, 1984; Jacobs, 1984a; Mandell, 1985). Most[1] substances classified as hallucinogens (e.g., indoleamines such as psilocybin and LSD, phenylethylamines such as mescaline, and tetrahydrocannabinols) have similar neurochemical mechanisms of action involving intervention in serotonin pathways and mechanisms (Aghajanian, 1994; Jacobs, 1984b). Their effects provoke limbic discharge patterns that produce enhanced interhemispheric synchronization and increased communicative interaction between the frontal hemispheres, and between the lower brain areas and frontal cortex (Mandell, 1980, 1985). The psychointegrators most similar to serotonin and interacting with it are as follows: LSD, other ergot compounds, and lysergic acid amide found in morning glories (*Ipomoea spp.*); psilocybin (e.g., from mushrooms from the genera *Psilocybe*, *Conocybe*, *Panaeolus*, and *Stropharia*); and DMT (dimethyltryptamine) and similar substances from the genus *Virola* and species of *Anadenanthera*. Mescaline (from peyote), similar synthetic drugs (STP, DMA, MDA, MMDA), and myristicin and elemicin from the genus *Myristica* (e.g., nutmeg) resemble norepinephrine, but their end effects are similar to LSD-like substances.

Because of its availability, standardization and potency, LSD has been the most extensively investigated psychointegrator. Recognition of a primary role of the serotonergic system in the effects of LSD-like substances resulted in extensive studies of their

serotonergic interactions. The effects of LSD on neurotransmitters besides serotonin have not been as extensively investigated; although it appears to affect dopamine and norepinephrine systems, the primary effects of LSD do not appear to be mediated by these systems (Freedman, 1984; Jacobs, 1984b). LSD does have significant interactions with other neurotransmittor systems (e.g., GABAergic) (Carlsson, Waters & Carlsson, 1999). Since they interact with serotonin, a neuromodulator with effects on many neurotransmitter systems, psychointegrators affect other systems as well.

Although these substances share physiological and experiential effects, questions have been raised as to the basic nature of the effects and the appropriateness of the terms used. Medical and lay characterizations of their effects as "hallucinations," and therefore false and delusional, are inaccurate and point to the need for new terms. Psychedelic is politicized for many, and its meaning of "mind manifesting" is limited. Grof (1975) proposed *holotropic*, reflecting the psychodynamic actions of these substances in forcing an orientation toward wholeness. Holotropic reflects central experiential effects of these substances, but without emphasizing the spiritual, emotional, and mental experiences. The term *entheogen* was introduced as an alternative, with "*entheos*" referring to the "god within" and "*gen*," "the action of becoming" (Wasson, Kramrisch, Ott & Ruck, 1986). Entheogen accurately reflects the views of many cultures on these substances' effects, but its exclusive focus on the spiritual alienates the scientific and clinical approaches needed to understand these substances.

Common systemic effects of these substances include the stimulation of mental and emotional processes in an integrative personal and spiritual experience. The experiential effects of integration are mirrored in the neurophysiology of the substances, suggesting that *psychointegrator* is a more appropriate characterization. Psyche reflects the meanings of mind emphasized more recently, and the broader and older meanings of *soul* and *spirit* central to the interpretations of these effects in other cultures. Psychointegrator reflects the integration of mind, soul, and spirit as attested to by laboratory, clinical, and cross-cultural research. The term psychointegrator does not preclude further terminological differentiation of the variable effects of these substances (e.g., Naranjo, 1996; Stafford, 1992). "Psychointegrator" supersedes value-laden terminology and misconceptions with a neurophenomenological grounding. The justification for this term is provided by the following examinations of cross-cultural, clinical, and neurophysiological data.

CROSS-CULTURAL PATTERNS OF PSYCHOINTEGRATOR USE

Cross-cultural use of psychointegrator plants is associated with the belief that they are powerful spiritual forces, provide access to spiritual realities, and have religious and therapeutic applications (see Dobkin de Rios, 1984; Furst, 1972, 1976; Harner, 1973; Schultes & Hofmann, 1979; Winkelman, 1996). Psychointegrators dramatically alter experience, shifting self-awareness to what is interpreted as an "other worldly" sacred or spiritual domain of important personal and social significance. The ubiquitous aspects involve the following: personal relations with the supernatural world; participation in a mythical time; spiritual relationships with animals as a source of power and self-identification; ego dissolution, resurrection and transformation; healing and divination; and promotion of social solidarity and community relations (Dobkin de Rios, 1984). The interpretations of these plants as having therapeutic, religious, and spiritual roles have implications for understanding human consciousness, mystical and spiritual

experiences (Smith, 2000), and the pre-historical origins of religion. La Barre (1972) called attention to their potential to stimulate visions and supernatural experiences, giving rise to religious traditions.

Psychointegrator use is frequently found in training, divination and healing in shamanistic traditions. It is used in inducing altered states of consciousness (ASC) and for training shamans in diagnosing diseases. Another pattern of psychointegrator plant use involves their administration by elders in initiation and resocialization rites, often collective puberty rites that channel the individual in transition to adult status (Grob & Dobkin de Rios, 1992). These substances may be used in sorcery to kill or control others (Davis, 1985). In the contemporary Amazon basin, they are used to facilitate symbolic synthesis of traditional and new beliefs through emotional images that symbolically represent social confrontations and facilitate psychosocial adjustment (Andritzky, 1989). Ritual processes transform individual personality and social relations through *ayahuasca's* enhancement of symbolic integration of psychological, social and cosmological meaning.

Societal Differences in Use of Psychointegrator Plants

Therapeutic use of psychointegrator plants is not universal but varies as a function of social conditions. Different types of societies make different assessments of their value, adaptive functions and potentials. Major regional differences in their use have been reported, with dramatically larger number of hallucinogenic plants used in the indigenous cultures of the Americas in comparison to pre-Christian Eurasian cultures (La Barre, 1970). These differences have been attributed to cultural factors, since many hallucinogens are present but not used in Eurasia (Furst, 1972; La Barre, 1970). Increasing political complexity leads to reduction in the use of psychointegrator plants, which are not typically institutionalized in healing and religion in complex societies (Dobkin de Rios & Smith 1977; Winkelman, 1991). Changes in society and the institutionalized bases and functions of religious healing (Winkelman, 1986b, 1990, 1992) are responsible for cross-cultural differences in institutionalization of psychointegrator plants. Cross-cultural data show their ritual use is negatively correlated with levels of political integration (Winkelman, 1991). The negative relation with political integration reflects inherent conflicts of the needs of hierarchical politically integrated societies with the psychosocial and cognitive dynamics produced by psychointegrators.

Dobkin de Rios and Smith (1977) suggest hallucinogenic plants are typically repressed in state-level societies because they constitute a threat to the interpretations of those who hold social and religious power. Psychointegrators are typically used in social contexts where influences derived from the set and setting (personal expectations and the local situational influences) play powerful roles in shaping the experiences and interpretations. These local set and setting influences on interpretation can pose a threat to the centralized hierarchical control of religious consciousness, and undermine control in religious, political and social arenas. In contrast, typical cross-cultural use of psychointegrators for therapeutic purposes is in small-group community settings, where they enhance group cohesion and reaffirm local social and cultural values and beliefs rather than the state-level ideological and political orders (Dobkin de Rios & Smith, 1977). Repressive legislation enacted against these substances in the 1960s reflects this pattern of political control of threats to the established hierarchy and cosmological orders.

The social context of contemporary psychointegrator use cross-culturally suggests it facilitates psychosocial adaptations required by rapid social change and changing psychosocial circumstances (Aberle, 1966; Andritzky, 1989; Dobkin de Rios, 1984). Psychointegrator plants play a role in mediation between conceptual systems. Ayahuasca is widely used in the Amazonian basin in collective rituals that strengthen social cohesion and group identity and assist in the management of acculturation problems by mediating between indigenous world views and the imposed European systems (Andritzky, 1989). The psychointegrators are used in rituals that serve as a means for mediating between the individual and the cultural systems, integrating the ancient traditions into current adaptations.

The historical adoption of the Peyote religion (Native American Church, NAC) among the Navajo as reported by Aberle (1966) also illustrates its role in psychosocial adjustment, as the early Navajo adherents were primarily those who experienced the greatest relative deprivation due to federally imposed livestock reduction programs. The NAC ethical code facilitated an adjustment of the Navajo values of collectivism to the American society's emphasis on individualism. The NAC fostered resistance to colonizing influences, maintaining socially valued community experiences and religious consciousness (Calabrese, 1997).

Variation in Therapeutic Applications

Review (Schultes & Winkelman, 1996) of therapeutic uses among the indigenous cultures of the Americas of psychointegrators of the families *Strophariaceae*, *Myristicaceae*, *Leguminosae*, *Malpighiaceae*, *Cactaceae* and *Convolvulaceae* illustrates quite a variable action. These substances are used for both physical and spiritual illness, mediation of conflict, treating dysfunctions in social or sexual relations, and directing healing energies. They evoke a range of emotional experiences, including terrifying visions and cathartic reactions. Psychointegrators may be used to prophesize the future, to send messages to others, to contact distant relatives, to discover enemies' plans, and to assist in learning myths, chants, and dances. They are used for all sorts of physical problems, including stomach, bladder, intestinal worms, hemorrhoids, malaria, mouth sores, rheumatism, cuts and wounds, and childbirth difficulties. Diagnostic applications include determination of: the cause of illness, death or other problems; the means of treatment; direction in life; and the meaning of dreams. Social uses include annual harvest festivals, fertility rites, cremation ceremonies, ancestor worship, and inter-village alliances. They are used to treat culture-bound syndromes (e.g., hexes, soul/spirit loss, witchcraft, spirit affliction and exorcisms) and for protection against witches and ghosts. They provide control of emotions and release from guilt and illness caused by resentment and envy, balancing spiritual and natural forces in the patient's life to overcome misfortunes and find peace and harmony.

Highly developed traditional healing systems selectively use variations across species, varying admixtures of species, different doses and routes of administration, and ritual processes to obtain a range of effects. Variable effects also reflect their functions as nonspecific amplifiers of pre- and unconscious content (Metzner, 1998; Riedlinger & Riedlinger, 1994). These substances' effects integrate pharmacotherapy and psychotherapy through interactions of biological and social factors.

Clinical Paradigms in Research on LSD

Since the same plant is used for a variety of purposes, this suggests the same substance can produce a variety of effects. Clinical research revealed a range of effects from LSD (see Bliss, 1988; Bravo & Grob, 1989; Grof, 1975, 1980; Lukoff, Zanger & Lu, 1990;

Riedlinger & Riedlinger, 1994; Yensen, 1985, 1996). Legal prohibitions enacted in the late 1960s severely reduced clinical research, but earlier (e.g., see Abramson, 1967) and limited subsequent research (Passie, 1997) provides evidence of the therapeutic effects of LSD. A primary finding is that effects differ as a function of expectations, producing several different medical paradigms—psychotomimetic, psycholytic, and psychedelic (see Bravo & Grob, 1989; Yensen, 1985, 1996;). The different paradigms reflect "set and setting" influences, extra-pharmacological factors derived from expectations and situational circumstances. "Set" refers to personal beliefs, attitudes, and expectations, while "setting" refers to the situational influences upon the experience. These are considered the primary determinants of the psychointegrator's effects.

The psychotomimetic perspective emphasized that LSD induces effects such as dizziness, weakness, tremor, nausea, hallucinations, depression, depersonalization, psychotic reactions, and delusions. This clinical profile better represents side effects rather than the phenomenologically and personally most relevant experiences. While psychosis and disturbed cognitive functioning may occur, particularly under adverse set and setting influences, psychointegrators typically produce positive outcomes, inducing new ways of perceiving and understanding ordinary experience. Induced emotional liability can lead to changes in sense of self, including powerful mystical experiences of union with the universe and oceanic feelings (Cohen, 1971).

These realizations lead to the psycholytic approach, which viewed LSD as a "mind dissolving" agent that facilitates psychoanalytic therapy by altering the relationship between the conscious and unconscious (Yensen, 1985). LSD was used as a therapeutic aid for weakening psychological defenses, eliciting conflicts and emotional impulses, releasing unconscious or blocked material, and increasing awareness and emotional responsiveness. The ability to activate and deepen psychoanalytic processes helped shorten psychotherapy, facilitating restructuring of the personality and accelerating the maturation process (Passie, 1997). The psycholytic approach is reflected in the NAC, where peyote plays a role in meaning therapy involving therapeutic emplotment and reinterpretation (Calabrese, 1997).

The last pre-prohibition development in LSD-assisted therapy was the psychedelic approach, based on the recognition that the greatest benefits occurred when mystical experiences resulted. The psychedelic approach used large doses to evoke mystical experiences which produced major personality changes. LSD activated repressed memories, evoking catharsis, enhancing self-awareness, and providing an opportunity for life changes. A significant application of the psychedelic approach was in the treatment of alcoholism and pain and end-of-life management for terminal cancer patients (see Abramson, 1967; Kurland, 1985).

In summary, the cross-cultural patterns in social, religious, and therapeutic applications of psychointegrators and their psychocognitive effects reflect both biological mechanisms and psychosocial effects (set and setting). Even the same substance can induce quite varied experiences since cultural traditions provide integral inputs through ritual, song, myth and other symbolic elements that shape experiences, reactions and outcomes. Cross-cultural commonality in uses of psychointegrator plants in therapeutic activities, and the similarities in experiences and interpretations, nonetheless reflect biological mechanisms and require a neurobiological explanation. The specific neurotransmitter mechanisms through which general and specific effects are achieved illustrate why these pharmacological agents should be called psychointegrators and why they have such important therapeutic applications.

Psychointegrators and Neurotransmitter Functions

The effects of psychointegrator constituents upon neurotransmission produce cross-cultural similarities in physical, emotional, and cognitive experiences. Neurotransmitters act through at least four known mechanisms: stimulating neurons, creating inhibitory or excitatory effects, altering the responsiveness of neurons to other neurotransmitters, and modulating the effects of other neurotransmitters. Psychointegrators interact with neurotransmitters through initiating responses in receptors (agonists) by substituting for neurotransmitters, and by diminishing their effectiveness by functioning as antagonists (or blockers), preventing normal response of a receptor. Studies on these effects in humans have been limited in recent decades, but psychointegrator effects (particularly LSD) upon brain function in humans and other animals have been extensively investigated (Jacobs, 1984a; Mandell, 1985). These studies provide diverse and apparently contradictory findings, derived from different procedures, dosages, phase effects, and set and setting factors (Freedman, 1984). Basic mechanisms of action of LSD-like psychointegrators are fundamentally the same across mammalian species (Jacobs, 1984a; Jacobs & Gelperin, 1981) and are one of the best understood of psychoactive substances (Mandell, 1985). The primary neurotransmitter affected by LSD-like psychointegrators is serotonin (Aghajanian, 1994; Jacobs, 1984b; McKim, 1991). The following section briefly reviews the serotonergic system and effects of LSD-like substances upon neurotransmission. The information about the systemic effects of psychointegrators upon neurotransmitters is primarily derived from Aghajanian (1994), Jacobs (1984a), Jacobs and Gelperin (1981), Kruk and Pycock (1991), McKim (1991), and Ryall (1989).

The Serotonergic System

Serotonin (5-HT) is the most extensive monoaminergic neurotransmitter system in the brain (Role & Kelly, 1991), performing a wide range of functions (Fischbach, 1992; Kruk & Pycock, 1991; Ribeiro, 1991). Serotonin plays an important role in regulating sleep, arousal, thermoregulation, vasoconstriction, blood pressure, growth hormones, hunger, pain, smooth muscles, perception, sensory processing, vigilance, learning, memory, moods, motor activity, cognition, and decision making (Glennon, 1990, p. 39; Kruk & Pycock, 1991, pp. 122-123). Serotonergic dysfunctions are associated with fear, anxiety, depression, sleep disturbances, schizophrenia, pain dysfunctions and psychosomatic complaints (Ribeiro, 1991, p. 37).

The central importance of serotonin in many different processes reflects its role as a modulatory neurotransmitter, a mediator of processes, receiving sensory and internal information, and modulating the strength of responses. The serotonergic neurotransmitter cells are primarily located in the reticular formation, the limbic system and the basal ganglia, with descending projections into the spinal cord and ascending projections to the forebrain; the limbic system and visual areas have the highest levels of serotonin fibers (Ribeiro, 1991). The primary projections are ascending and exert diffuse influences on neuronal systems. The primary concentrations of serotonin neurons in the central nervous system (CNS) are in the midline area of the brain stem, particularly the raphe nuclei; its upward projections into the thalamus, hypothalamus and amygdala of the limbic system; the corpus striatum and basal ganglia; and frontal cortex (Kruk & Pycock, 1991; Parent, 1981). The projection systems of the raphe (and reticular activating) systems of the midbrain carry sensory input from axons to the

cortex. Interconnected nuclei of the limbic system are responsible for mediating emotion and motivation. Serotonin input to the cortex mediates integration of sensory information and coordination of bodily movements.

Serotonin Receptors. There are at least four different types of CNS serotonin receptors that mediate different kinds of effects in different parts of the brain (Aghajanian, 1981, 1994; Glennon, 1990; Kruk & Pycock, 1991; Ribeiro, 1991; Schmidt & Peroutka, 1989). Serotonin 5-HT_{1A} receptors are primarily in the raphe system and limbic region; they mediate responses of the serotonergic neurons with respect to their own transmitters and have a strong sensitivity to indoleamines (Aghajanian, 1994, p. 140). Primary effects of LSD upon serotonergic systems are on 5-HT_2 neurons (Aghajanian, 1994), for which they have a high affinity (Glennon, 1990). 5-HT_2 receptors are concentrated in the limbic system in the hypothalamus and basal ganglia, and play a role in the control of anxiety and reduction of schizophrenic symptomology (Ribeiro, 1991). Primary effects of LSD-like psychointegrators upon the cerebral cortex, the locus coeruleus, and other areas of the brain are mediated by the 5-HT_2 receptors of postsynaptic neurons (Aghajanian, 1994). LSD has a high affinity for 5-HT_{2A} and 5-HT_{2C} receptors (Miller & Gold, 1993), facilitating the functioning of the locus coeruleus, which receives numerous somatosensory and visceral inputs and projects them diffusely to most of the brain.

Effects of LSD-like Psychointegrators on Serotonergic Receptors

Serotonergic effects of the LSD-like psychointegrators are complex and variable because: the modulatory functions of serotonin are a function of other neural conditions; serotonin has different actions and effects in different areas of the brain, including presynaptic, axon terminal and postsynaptic sites; psychointegrators have different actions upon different types of serotonergic neurons; and psychointegrators have dose- and phase-dependent effects (Aghajanian, 1994, Hamon, 1984; Hollister, 1984). Psychointegrators may act as agonists (serving in the place of serotonin) and as an antagonist, blocking its action. LSD induces sustained hyperpolarization of some serotonergic neurons, but with prolonged effects beyond maximal levels induced by serotonin (Aghajanian, 1984). Uptake and binding of LSD is primarily in postsynaptic serotonin receptors in the visual and auditory areas of the cerebral cortex, and the amygdala, hippocampus, hypothalamus and striatum of the limbic system (Hamon, 1984). Jacobs suggests action at postsynaptic (rather than presynaptic) serotonergic sites is central to hallucinogenic effects. The focus upon hallucinations may undervalue the importance of other effects, such as the stimulation of systemic information integration.

LSD-like psychointegrators' effects upon the serotonin autoreceptors in the raphe neuron sites induce a selective and potent inhibition of the tonic firing of the dorsal raphe nucleus, and results in a dysinhibiting of forebrain neuron targets. LSD blocks the activating effects of the serotonin neurons in the reticular formation and in the cortex, which releases the tonic inhibitory serotonin influences upon postsynaptic neurons, and increases activity in the lateral geniculate nucleus and amygdala. LSD-like psychointegrators also facilitate or potentiate serotonin's excitatory effects upon areas of the brain stem and spinal cord, resulting in excitation of target cells (Jacobs, 1984b, p. 188). Psychointegrators activate serotonergic neurons in the locus coeruleus, a nodal point for convergence of somatosensory and visceral information from all regions of the body. The locus coeruleus' projections innervate most areas of the neuraxis, principally

the thalamus, hypothalamus, cerebellum, basal forebrain, hippocampus, and neocortex (Aghajanian, 1994; Role & Kelly, 1991). LSD affects the hippocampus by blocking or suppressing the typical depressant functions of serotonin. This stimulates mesolimbic temporal lobe structures by dysinhibiting postsynaptic neurons in the limbic and visual areas (Mandell, 1985), releasing the habitual blocking on emotional and visual centers, and contributing to production of visual experiences similar to dreaming.

LSD-like psychointegrators interact with the serotonergic system in the brain stem, limbic system, and frontal cortex. They both stimulate and suppress the effects of serotonin, substituting for it in neurotransmission, and blocking it, reducing habitual repressions and stimulating processing centers. Psychointegrators effect: reactivity of the raphe and reticular formations of the brain stem area; the limbic system, particularly the hippocampus and amygdala; and the visual and auditory areas of the frontal cortex. Psychointegrators have effects on: attention, awareness and environmental orientation; motivation, memory, emotions and cognitive processes; visual conceptualization and cognitive representation; and synthesis of information from the entire brain. An effect of serotonin is to depress the action of target neurons in the forebrain; consequently, the blocking effect of LSD upon serotonin neurons is a dysinhibition of their typical repression. This dysinhibition results in synchronous brain-wave patterns that drive impulses into the frontal cortex, replacing the normal desynchronized fast wave activity characteristic of the frontal cortex with slower, more coherent wave patterns. These coherent systematic discharges drive synchronous slow-wave patterns (3-6 cps theta) into the frontal lobes, synchronizing the cortex (cf., Aghajanian, 1982, 1984; Mandell, 1980).

Psychointegrators and Systemic Brain Function. Psychointegrators enhance activation of brain systems that MacLean (1990) refers to as the R-complex (reptilian brain) and the paleomammalian brain (limbic system). Stimulation of the R-complex provides an enhanced integration of information across all areas of the brain, producing heightened arousal and awareness and interference with habituated behavioral routines that the reptilian brain manages. The paleomammalian brain provides social and emotional influences on mentation and behavior involved in species survival, sex, aggression, family and social relations, learning and memory, and self-identity. The activation of the paleomammalian brain and its functions by the psychointegrators (and ASC in general) enhances systemic integration of the psyche through cognitive processes based in nonverbal communication, mentation and social representations that manage processes of emotional and social life.

Psychointegrator Effects Upon Behavior. The macro-level effects of psychointegrators include a range of sensory, behavioral, emotional and cognitive effects (Freedman, 1984; see Winkelman, 1996 for discussion). Psychointegrators heighten sensory receptivity, increasing arousal and responsivity to the environment. They also reduce or reverse habituation of typical response patterns, forcing the organism into new patterns of behavior. While low dosages lead to a more thorough, random and complete examination of the environment, high dosages tend to lead to withdrawal and a focus upon the internal imagetic, emotional, and cognitive environment. The internal focus, alteration of consciousness, and limbic activation forces material from the sub- or unconscious into awareness and brings repressed memories into consciousness where through catharsis and abreaction they are resolved and integrated. Their tendency to elicit distressing personal material, unresolved conflicts, repressed experiences, and un-integrated aspects of self and behavior suggests that psychointegrators provoke

manifestations of conflicts and traumas not yet integrated into long-term stable memories. Psychointegrators stimulate emotions and interpretations related to one's sense of self and social attachments.

Cognitive Dynamics: Interhemispheric Fusion. Psychointegrators' neurophysiological effects produce general integration of information from all parts of the body, enhancing significance and meaning, and producing insight and new understandings. The focus on internal experience is often accompanied by an enhanced clarity of consciousness (Freedman, 1984, p. 209) and the maintenance of intact memories subsequent to the experiences that permits reflection and integration. This also reflects activation of paleomammalian brain functions that subserve memory functions and provide the basis for our sense of certainty and conviction (MacLean, 1990). The characteristic cognitive integration found with psychointegrators reflects an "interhemispheric fusion" (Mandell, 1985), a result of the increased coupling (bilateral coherence) in hemispheric oscillations that improves information exchange and integration between the two frontal hemispheres. This integration of the specialized roles in cognition and affect (thought and emotion) of left and right hemispheres, respectively, improves the integration of feelings and thoughts, the right hemisphere intuition and left hemisphere rationality. This underlies the insight experiences and perceptions of wholeness and oneness associated with psychointegrators. The integration of feelings with thoughts enhances insight. Integrative experiences are produced physiologically through high voltage synchronous brain waves generated by hippocampal-septal discharges in the mesolimbic temporal lobe structures (Fink, 1978; Hoffmeister & Stille, 1982; Mandell, 1980) that drive synchronization of the cortex. The limbic-frontal driving and interhemispheric synchronization integrates unconscious material into the cerebral cortex. These common patterns have general therapeutic effects, permitting expression and reprogramming of repressed aspects of the self. Enhanced awareness of repressed memories, increased emotional lability, disruption of habitual behavior patterns, and dissolution of egocentric fixations permit an alteration of psychodynamic processes.

Altered States of Consciousness. Dysinhibition of the serotonergic system and the resulting loss of inhibitory effects upon mesolimbic temporal lobe structures underlies common effects of psychointegrators and other means of producing ASC or "transcendent states" (Mandell, 1980). Systematic changes in brain functioning are common to many means of inducing ASC (Winkelman, 1986a, 1992) and the basis for universal shamanistic healing practices (Winkelman, 1986b, 1990). Therapeutic use of psychointegrators reflects the effects of ASC in healing (Winkelman, 1986a, 1992). Healers using ASC are found in all cultures, reflecting the biological basis of ASC and its functional effects that produce physiological changes facilitating healing (Winkelman, 2000). Diverse ASC constitute different means of accessing a common mode of consciousness that represents an optimized homeostatic balance among functional systems of the brain, permitting the emergence of integrative operations. This integrative mode of consciousness is as fundamental to human psychobiology as the dream, deep sleep, and waking modes of consciousness (Winkelman, 2000). Integrative consciousness is manifested in the common patterns associated with ASC (e.g., limbic-frontal integration, interhemispheric synchronization, parasympathetic dominance). It has general therapeutic effects, both physiological and psychological (Winkelman, 2000). ASC in general permit expression of repressed aspects of the self, enhancing right hemisphere processes by inhibiting critical screening by the left hemisphere, permitting expression and reprogramming of

normally repressed aspects of brain functioning. These conditions of consciousness are known around the world in contemplative traditions (Laughlin et al., 1992), reflecting high levels of integrative functioning. Psychointegrators are a means of providing experiences within this integrative mode of consciousness, but do not substitute for the rigorous mental discipline necessary for sustained functioning in these conditions of consciousness (Naranjo, 1996).

In summary, the LSD-like psychointegrators have global effects upon awareness, behavior, emotions and cognition. They heighten sensory receptivity, arousal and responsiveness to the environment, reducing or reversing habituation of typical behavior patterns. They force new perspectives and patterns of behavior, phasicly moving from a more random and complete examination of the environment to withdrawal and focus upon internal emotional and cognitive material from the sub- or unconscious. The blocking effect of LSD upon serotonin neurons, whose function is to depress the action of target neurons in the forebrain, results in a dysinhibition of typical repression and therefore more activity. The greatest activity is in the densest serotonin axon terminals in the limbic system's emotional processing areas and the visual areas of the cortex. The dysinhibition of the mesolimbic temporal lobe structures drives synchronous slow-wave impulses into the frontal cortex, replacing the normal desynchronized fast-wave activity with coherent theta wave discharges from the limbic system. The limbic-frontal driving also produces interhemispheric synchronization and an integration of unconscious material into the cerebral cortex. This results in an integration of feelings with thoughts, enhancing insight. Activation of repressed memories permits catharsis and abreaction, facilitating resolution of psychodynamic and interpersonal conflicts. This enhanced awareness, increased emotional lability, disruption of habitual behavior patterns, and dissolution of egocentric fixations permits an alteration of psychological relationships and processes and psychodynamic reprogramming.

Contemporary Applications

The application of these substances as therapeutic agents might seem a mute question given their general illegality. Current classification of many psychointegrators in the Schedule I category inhibits their legitimate use as therapeutic agents. This classification implying no recognized medical use and high abuse potential ignores the substantial clinical and cross-cultural data on their therapeutic applications.

The continued and increasing use of hallucinogens, particularly in the form of new "designer" drugs such as "ecstasy" (MDMA) that have reported adverse consequences, indicates a need for therapists to be able to provide education for their patients. The widespread reports of organic and cognitive dysfunction, brain damage and fatalities associated with "ecstasy" use (e.g., Burgess, O'Donohoe & Gill, 2000; Parrott, Sisk & Turner, 2000) indicate the need for cautionary advice beyond that regarding secondary side-effects (e.g., dehydration). Serotonergic neurotoxicity may result from prolonged and frequent use, a pattern contrary to the sporadic use in traditional societies. Physiological risks may be exaggerated, however, as reports linking hallucinogen use to organic damage and dysfunction lack controls for confounding factors such as co-morbidity and polydrug abuse, rendering their conclusion suspect (Halpern & Pope, 1999). There are clear contra-indications for use of psychointegrators (particularly monoamine oxidase inhibitors) with serotonin re-uptake inhibitors (Callaway & Grob, 1998). Serious psychiatric impairments probably should be considered a contra-indication.

Clients who use these substances, or have needs that may be served by their use, can benefit from the therapist as educator. Therapists need to be aware that their own attitudes will affect the experiences induced. Clients need to be advised of the need for qualified guidance and appropriate set, setting, goals and support. Traditional patterns of use in non-Western societies provide the richest database for guiding therapeutic use (see Metzner, 1998 for summarization). These traditional approaches have been adapted for the guidance of contemporary people (e.g., see Leary, 1997). Traditional use involved administration by shamanistic healers in periodic sessions, often involving the entire community. This use involved a significantly different worldview and focus than psycholytic and psychedelic therapies (Metzner, 1998).

Information about these substances and their uses and specific effects are widely available (cf., Ott, 1993, 1994; Shulgin & Shulgin, 1991; websites at psychedeliclibrary.org, maps.org, geocities.com/psychedelics101, drugtext.org, and csp.org). The pre-prohibition research and limited subsequent clinical studies, particularly in Europe (Passie, 1997), also provide indications of potential applications. The psycholytic approach has usefulness at the beginning of therapy to reduce fear-induced inhibitions and repressions, facilitate communication, and accelerate the formation of therapeutic alliances (Riedlinger & Riedlinger, 1994). Psycholytic therapy has greatest applicability for those with: psychic rigidity and rigid defenses; sexual and severe character neuroses; anxiety, depression, and chronic compulsions; and alcoholism. The ability to overcome strong defensive structures may provide success for those with whom classic psychoanalysis was unsuccessful (Kurland, 1985; Metzner, 1998; Passie, 1997; Zanger, 1989). Users may find benefits through assistance in placing fears and emotional traumas in a more realistic perspective (Greer & Tolbert, 1998). Riedlinger and Riedlinger's (1994) examination of the relationship of serotonergic disorders and depression suggests that the success of psychointegrators reflects effects upon serotonergic mechanisms similar to those of other 5-HT uptake inhibitors used in treating mood disorders, anxiety, aggression, panic and obsessive compulsive disorders (OCD). This may parallel traditional antidepressants' "down-regulation" of serotonin receptors and the normalization of serotonin transmission (Ribeiro, 1991). The usefulness of psychointegrators in treatment of OCD is well enough indicated to warrant clinical trials (Delgado & Moreno, 1998). Earlier work with oncology patients indicates further use is warranted.

Treatment of alcoholism and other forms of drug dependence is a promising area for use of psychointegrators, which often are integrated in non-Western ethnomedical treatments of substance dependence (Heggenhougen, 1997; Jilek, 1994). The incredulity that this suggestion might raise is unsubstantiated since these substances in general appear to be non-addictive (McKim, 1991). Psychointegrators' effectiveness is exemplified in the widespread consensus among Native American rehabilitation counselors that the NAC is the only effective tool against alcoholism in Indian country. Bill Wilson considered his LSD experiences to have had an importance equal to the conversion experience that led to his co-founding of Alcoholics Anonymous (AA) (Smith, 2000). His efforts to have AA endorse LSD as a source of the spiritual experiences for treating alcoholism were, however, rejected by the board. The role of LSD in treating alcoholism and other drug dependence (Abramson, 1967; Kurland, 1985) indicates the use of the psychedelic approach and its large doses for inducing transcendent peak or mystical experiences. Treatment of substance dependence with the psychedelic approach remains inadequately examined in clinical populations (Mangini, 1998), but evidence for its effectiveness continues to accumulate (e.g., see ; Alper, Lotsof, Frenken, Luciano & Bastiaans, 1999; Mabit, Giove & Vega, 1996; Sanchez-Ramos & Mash, 1996).

There is widespread recognition that psychointegrators enhance self-healing effects by allowing a purge of negative affects and memories and activating inherent capacities for psychological integration. There may also be immune system enhancement (Roberts, 1999, 2000). Contemporary applications of psychointegrators typically combine psycholytic and psychedelic approaches, using large doses to induce transformative experiences and a series of low doses in psycholytic sessions for processing psychodynamic material (Passie, 1997).

Research Applications

Psychointegrators induce experiences that facilitate study of the general principles of the brain and consciousness. Grof's clinical research with LSD (1975, 1980, 1992) provided new models of the nature of human consciousness. Psychointegrators elicit experiences in what Grof labels the transbiological realms, the perinatal and transpersonal domains of experience. The transpersonal domain includes the archetypal and mystical structures, dimensions of human consciousness and identity beyond egoic identity. Grof has shown that these substances help elucidate the operations of the brain and mind. They accentuate certain processes (e.g., emotional harmony, connection and integration with nature and humanity, joy and euphoria, alternate identities and sense of self), revealing natural cognitive domains and symbol systems (Shannon, 2000). Naranjo (1996) suggested psychointegrators activate "Kundalini phenomena" (high levels of organismic self-regulation) as a consequence of ego suspension and the activation of latent mental structures. These substances have also been considered a source of veridical mystical and spiritual experiences, as attested to in the recent book by the acclaimed expert on world religions, Huston Smith (2000).

CONCLUSIONS

The roles of psychointegrators in many cultures point to their important functions in meeting human needs. Although Western societies have held negative views of these substances and most ASC, they represent responses to innate drives (Siegel, 1990). The innate basis of the drive to seek ASC raises questions about the consequences for a society that views such behavior as aberrant and pathological and attempts to repress it. The recurrent societal "discovery" of ASC (e.g., "ecstasy" and its use at group parties known as raves) illustrates the persistent need to address these issues, as ignoring and prohibiting them has not led to their demise. The numerous biological and chemical sources of these substances with powerful psychological effects suggest that their use will continue. Societies need to take informed approaches to their managed use rather than excluding them to a counter-culture producing ethos. Failure of societies to provide legitimate avenues of access, and instead outlawing these experiences, increases the likelihood that their utilization will contribute to antisocial tendencies.

Typical cross-cultural patterns of psychointegrator use involve management of developmental change or crises-induced problems. Psychointegrators integrate conscious, pre-conscious and unconscious processes into a new gestalt or understanding. Their institutionalized use involves healing and spiritual integration, a "wholing" of the individual. This integrative stimulation is a rationale for the term "psychointegrator" to refer to their functions and effects, reflecting the coupling of the soul or spirit with the mind and emotions. This conjunction of healing with the spiritual reflects an integration

of psychophysiological and psychocultural dynamics, a fundamental adaptation found in all human societies in shamanistic healing practices. The use of psychointegrator substances as a means of achieving this psychobiological and psychosocial adaptation reflects the need to reorient psychocultural dynamics to changes in social and cosmological relations. Humanity has many millenniums of use of these substances, and legal prohibitions have not stopped this human drive to experience therapeutic alterations of consciousness. They are, however, powerful and potentially dangerous; only adequate education can help prevent abuse and destructive effects.

NOTE

[1]Many different plants are loosely classified as hallucinogens because they produce hallucinations through toxic effects upon the body. The plants of the family Solanaceae such as mandrake (*Mandragora officinarum*), deadly nightshade (*Atropa belladonna*), henbane (*Hyoscyamus niger*), and the genus *Datura* (e.g., jimson weed) may be inappropriately classified as hallucinogens. Anticholinergics such as atropine, hyoscyamine, and scopolamine (hyoscine), block acetylcholine's muscarinic receptor sites (McKim, 1991) and can cause cardiac arrhythmia, arrest and death through a reduction in heart rate and contractions, blocking of neurotransmission, and interference with the parasympathetic nervous system (Kruk & Pycock, 1991). This produces delirium, clouded consciousness, interference with basic life-support functions, and possible death, conditions not typically associated with the indoleamine compounds. Deaths due to use of these substances are reported every year in the U.S., but shamanistic traditions have apparently found ritual ways to use these plants safely (Jacobs, 1996).

REFERENCES

Aberle, D. (1966). *The Peyote religion among the Navaho.* Chicago: Aldine.

Abramson, H. (Ed.). (1967). *The use of LSD in psychotherapy and alcoholism.* Indianapolis, IN: Bobbs-Merrill.

Aghajanian, G. (1981). The modulatory role of serotonin at multiple receptors in brain. In B. Jacobs & A. Gelperin (Eds.), *Serotonin neurotransmission and behavior.* Cambridge, MA: MIT Press.

Aghajanian, G. (1982). Neurophysiologic properties of psychotomimetics. In F. Hoffmeister and G. Stille (Eds.), *Psychotropic agents III* (pp. 89-109). New York: Springer Verlag.

Aghajanian, G. (1984). LSD and serotonergic dorsal raphe neurons: Intracellular studies in vivo and in vitro. In B. Jacobs (Ed.), *Hallucinogens: Neurochemical, behavioral and clinical perspectives* (pp. 137-141). New York: Raven Press.

Aghajanian, G. (1994). Serotonin and the action of LSD in the brain. *Psychiatric Annals, 2463,* 137-141.

Alper, K., Lotsof, H., Frenken, G., Luciano, D., & Bastiaans, J. (1999). Treatment of acute opioid withdrawal with ibogaine. *American Journal on Addictions, 8*(3), 234-242.

Andritzky, W. (1989). Sociopsychotherapeutic functions of ayahuasca healing in Amazonia. *Journal of Psychoactive Drugs, 21*(1), 77-89.

Beck, J. (2000). MDMA in the USA: An epidemiological overview. In C. Ratsh & J. Baker (Eds.), *Yearbook for Ethnomedicine and the Study of Consciousness,* 6/7, 127-136.

Bliss, K. (1988). LSD and psychotherapy. *Contemporary Drug Problems,* 519-563.

Bravo, G. & Grob, C. (1989). Shamans, sacraments and psychiatrists. *Journal of Psychoactive Drugs, 21*(1), 123-128.

Burgess, C., O'Donohoe, A. & Gill, M. (2000). Agony and ecstasy: A review of MDMA effects and toxicity. *European Psychiatry, 15*(5), 287-94.

Calabrese, J. (1997). Spiritual healing and human development in the Native American Church: Toward a cultural psychiatry of peyote. *Psychoanalytic Review, 84*(2), 237-255.

Callaway, J. & Grob, C. (1998). Ayahuasca preparations and serotonin reuptake inhibitors: A potential combination for severe adverse interactions. *Journal of Psychoactive Drugs, 30*(4), 367-369.

Carlsson, A., Waters, N. & Carlsson, M. (1999). Neurotransmitter interactions in schizophrenia-therapeutic implications. *European Archives of Psychiatry, 249*(4), 37-43.

Cohen, S. (1971). Theories on the effects of psychomimetics. In L. Madow & L. Snow (Eds.), *The psychodynamic implications of physiological studies of psychomimetic drugs* (pp. 3-10). Springfield, IL: Charles Thomas.

Davis, W. (1985). *The serpent and the rainbow.* New York: Simon & Schuster.

Delgado, P. & Moreno, F. (1998). Hallucinogens, serotonin and obsessive-compulsive disorder. *Journal of Psychoactive Drugs, 30*(4), 359-366.

Dobkin de Rios, M. (1984). *Hallucinogens: Cross-cultural perspectives.* Albuquerque, NM: University of New Mexico.

Dobkin de Rios, M. & Smith, D. (1977). Drug use and abuse in cross-cultural perspective. *Human Organization, 36*(1), 14-21.

Fink, M. (1978). Psychoactive drugs and the waking EEG 1966-1976. In M. Lipton, A. Dimascio, & K. Killam (Eds.), *Psychopharmacology* (pp. 691-698). New York: Raven Press.

Fischbach, G. (1992, September). Mind and brain. *Scientific American, Special Issue, Mind and Brain,* 48-57.

Freedman, D. (1984). LSD: The bridge from human to animal. In B. Jacobs (Ed.), *Hallucinogens: Neurochemical, behavioral, and clinical perspectives* (pp. 203-226). New York: Raven Press.

Furst, P. (Ed.). (1972). *Flesh of the gods.* New York: Praeger.

Furst, P. (Ed.). (1976). *Hallucinogens and culture.* San Francisco, CA: Chandler and Sharp.

Glennon, R. (1990). Serotonin receptors: Clinical implications. *Neuroscience and Biobehavioral Reviews, 14,* 35-47.

Gold, M. (Ed.). (1994a). The new psychedelic subculture. *Psychiatric Annals, 24*(3).

Gold, M. (1994b). The epidemiology, attitudes and pharmacology of LSD use in the 1990. *Psychiatric Annals, 24*(3), 124-126.

Greer, G., & Tolbert, R. (1998). A method of conducting therapeutic sessions with MDMA. *Journal of Psychoactive Drugs, 30*(4), 371-379.

Grob, C., & Dobkin de Rios, M. (1992). Adolescent drug use in cross-cultural perspective. *Journal of Drug Issues, 22*(1), 121-138.

Grof, S. (1975). *Realms of the unconscious: Observations from LSD Research.* New York: Viking Press.

Grof, S. (1980). *LSD psychotherapy.* Pomona, CA: Hunter House.

Grof, S. (1992) *The holotropic mind.* San Francisco: Harper Collins.

Halpern, J. & Pope, H. (1999). Do hallucinogens cause residual neuropsychological toxicity? *Drug & Alcohol Dependence, 53*(3), 247-256.

Hamon M. (1984). Common neurochemical correlates to the action of hallucinogens. In B. Jacobs (Ed.), *Hallucinogens: Neurochemical, behavioral and clinical perspectives* (pp. 143-170). New York: Raven Press.

Harner, M. (Ed.). (1973). *Hallucinogens and shamanism*. New York: Oxford University Press.

Heggenhougen, C. (1997). *Reaching new highs: Alternative therapies for drug addicts*. Northvale, NJ: Jason Aronson.

Hoffmeister, F. & Stille, G. (Eds.). (1982). *Psychotropic agents III*. New York: Springer Verlag.

Hollister, L. (1984). Effects of hallucinogens in humans. In B. Jacobs (Ed.), *Hallucinogens: Neurochemical, behavioral and clinical perspectives* (pp. 203-226). New York: Raven Press.

Jacobs, B. (1984a). (Ed.). *Hallucinogens: Neurochemical, behavioral, and clinical perspectives*. New York: Raven Press.

Jacobs, B. (1984b). Postsynaptic serotonergic action of hallucinogens. In B. Jacobs (Ed.), *Hallucinogens: Neurochemical, behavioral, and clinical perspectives,* (pp. 183-202). New York: Raven Press.

Jacobs, B., & Gelperin, A. (Eds.). (1981). *Serotonin neurotransmission and behavior*. Cambridge, MA: MIT Press.

Jacobs, B. & Trulson, M. (1981). The role of serotonin in the action of hallucinogenic drugs. In B. Jacobs & A. Gelperin (Eds.), *Serotonin neurotransmission and behavior*. Cambridge, MA: MIT Press.

Jacobs, D. (1996). The use of Datura in rites of transition. In M. Winkelman & W. Andritsky (Eds.), *Sacred plants, consciousness and healing* (pp. 341-351). *Yearbook of cross-cultural medicine and psychotherapy, 5*. Berlin: VWB.

Jilek, W. (1994). Traditional healing and the prevention and treatment of alcohol and drug abuse. *Transcultural Psychiatric Research Review, 31,* 219-258.

Kruk, Z. & Pycock, C. (1991). *Neurotransmitters and drugs*. London: Chapman and Hall.

Kurland, A. (1985). LSD in the supportive care of the terminally ill cancer patient. *Journal of Psychoactive Drugs, 17* (4), 279-290.

La Barre, W. (1970). Old and New World narcotics: A statistical question. *Economic Botany, 24,* 368-373.

La Barre, W. (1972). Hallucinogens and the shamanic origins of religion. In P. Furst (Ed.), *Flesh of the gods* (pp. 261-278). New York: Praeger.

Laughlin, C., McManus, J. & d'Aquili, E. (1992). *Brain, symbol and experience toward a neurophenomenology of consciousness*. New York: Columbia University Press.

Leary, T. (1997). *Psychedelic prayers and other meditations*. Berkeley, CA: Ronin Publishing Co.

Lukoff, D., Zanger, R. & Lu, F. (1990). Transpersonal psychology research review: Psychoactive substances and transpersonal states. *Journal of Transpersonal Psychology, 22*(2), 107-147.

Mabit, J., Giove R. & Vega J. (1996). Takiwasi: The use of Amazonian shamanism to rehabilitate drug addicts. In M. Winkelman & W. Andritzky (Eds.), Sacred plants, consciousness and healing. *Yearbook of Cross-Cultural Medicine and Psychotherapy, 5* (pp. 257-85). Berlin: VWB.

MacLean, P. (1990). *The triune brain in evolution*. New York: Plenum.

Mandell, A. (1980). Toward a psychobiology of transcendence: God in the brain. In D. Davidson and R. Davidson (Eds.), *The psychobiology of consciousness* (pp. 379-464). New York: Plenum.

Mandell, A. (1985). Interhemispheric fusion. *Journal of Psychoactive Drugs, 17*(4), 257-266.

Mangini, M. (1998). Treatment of alcoholism using psychedelic drugs: A review of the program of research. *Journal of Psychoactive Drugs, 30*(4), 381-418.

Mathias, R. (1993). NIDA research takes a new look at LSD and other hallucinogens. *NIDA Notes, 8*(l), 6-11.

McKim, W. (1991). *Drugs and behavior: An introduction to behavioral pharmacology*. Englewood Cliffs, NJ: Prentice-Hall.

Metzner, R. (1998). Hallucinogenic drugs and plants in psychotherapy and shamanism. *Journal of Psychoactive Drugs, 30* (4), 333-431.

Miller, N. & Gold, M. (1993). LSD and ecstasy: Pharmacology, phenomenology and treatment. *Psychiatric Annals, 24*(3), 131-134.

Naranjo, C. (1996). The interpretation of psychedelic experience in light of the psychology of meditation. In M. Winkelman & W. Andritsky (Eds.), *Sacred plants, consciousness and healing* (pp. 75-90). *Yearbook of Cross-Cultural Medicine and Psychotherapy, 5*. Berlin: VWB.

Ott, J. (1993). *Pharmacotheon*. Kennewick, WA: Natural Products.

Ott, J. (1994). *Ayahuasca analogues*. Kennewick, WA: Natural Products.

Parent, A. (1981). The anatomy of serotonin-containing neurons across the phylogeny. In B. Jacobs & A. Gelperin (Eds.), *Serotonin neurotransmission and behavior*. Cambridge, MA: MIT Press.

Parrott, A., Sisk, E., & Turner, J. (2000). Psychobiological problems in heavy "ecstasy" (MDMA) polydrug users. *Drug & Alcohol Dependence, 60*(1), 105-110.

Passie, T. (1997). *Psycholytic and psychedelic therapy research, 1931-1995: A complete international bibliography*. Hannover, Germany: Laurentius Publishers.

Praag, H. (1991). The present and future of serotonergic drugs. *Human Psychopharmacology, 6*, 513-519.

Rätsch, C. (Ed.). (1989). *Gateway to inner space, sacred plants, mysticism and psychotherapy*. Bridgeport, Dorset: Prisim Press.

Ribeiro, C. (1991). Pharmacology of serotonin neuronal systems. *Human Psychopharacology, 6*, 37-51.

Riedlinger, T. & Riedlinger, J. (1994). Psychedelic and entactogenic drugs in the treatment of depression. *Journal of Psychoactive Drugs, 26*(l), 41-55.

Roberts, T. (1999). Do entheogen-induced mystical experiences boost the immune system? Psychedelics, peak experiences, and wellness. *Advances in Mind-Body Medicine, 15,* 139-147.

Roberts, T. (Ed.). (2000). *Psychoactive sacraments*. San Francisco: Council on Spiritual Practices.

Role, L., & J. Kelly. (1991). The brain stem: Cranial nerve nuclei and the monoaminergic systems. In E. Kandal, J. Schwartz & T. Jessell (Eds.), *Principles of neural science,* (pp. 683-699). New York: Elsevier.

Ryall, R. (1989). *Mechanisms of drug action on the nervous system*. Cambridge, UK: Cambridge University Press.

Sanchez-Ramos, J., & Mash, D. (1996). Pharmacotherapy of drug dependence with ibogain. In M. Winkelman & W. Andritzky (Eds.), *Sacred plants, consciousness and healing. Yearbook of Cross-Cultural Medicine and Psychotherapy, 5*, 353-367. Berlin: VWB.

Schmidt, A., & Peroutka, S. (1989). S-Hydroxytryptamine Receptor "Families." *Neuropsychopharmacology, 3,* 2242-2249.

Schultes, R. (1972). An overview of hallucinogens in the western hemisphere. In P. Furst (Ed.), *Flesh of the gods,* (pp. 3-54). New York: Praeger.

Schultes, R., & Hofmann, A. (1979). *Plants of the gods origins of hallucinogenic use.* New York: McGraw Hill. (Reprinted 1992 by Healing Arts Press, Rochester, Vermont)

Schultes, R., & Winkelman, M. (1996). The principal American hallucinogenic plants and their bioactive and therapeutic properties. In M. Winkelman & W. Andritsky (Eds.), *Sacred plants, consciousness and healing* (pp. 205-239). *Yearbook of Cross-Cultural Medicine and Psychotherapy, 5.* Berlin: VWB.

Schuster, P., Lieb, R. Lamertz, C. & Wittchen, H. (1998). Is the use of ecstasy and hallucinogens increasing? Results from a community study. *European Addiction Research, 4*(1-2),75-82.

Shannon, B. (2000). Cognitive psychology and the study of Ayahuasca, In C. Ratsch & J. Baker (Eds.), *Yearbook for Ethnomedicine and the Study of Consciousness,* 6/7, 77-94.

Shulgin, A., & Shulgin, A. (1995). *Phikal.* Berkeley, CA: Transform Press.

Siegel, R. (1984). The natural history of hallucinogens. In B. Jacobs (Ed.), *Hallucinogens: Neurochemical, behavioral and clinical perspectives* (pp. 1-18). Raven Press: New York.

Siegel, R. (1990). *Intoxication: Life in pursuit of artificial paradise.* New York: Dutton.

Smith, D., & Seymour, R. (1994). LSD: History and toxicity. *Psychiatric Annals, 24*(3), 145-147.

Smith, H. (2000). *Cleansing the doors of perception: The religious significance of enthenogenic plants and chemicals.* New York: J. P. Tarcher.

Stafford, P. (1992). *Psychedelics encyclopedia.* Berkeley, CA: Ronin Press.

Wasson, R., Kramrisch, S., Ott, J. & Ruck, C. (1986). Persephone's quest: Ethnogens and the origins of religion. New Haven, CT: Yale University Press.

Wasson, R. (1980). *The wondrous mushroom: Mycolatry in Mesoamerica.* New York: McGraw Hill.

Werner M. (1993) Hallucinogens. *Pediatrics in Review, 14*(12), 466-472.

Winkelman, M. (1986a). Trance states: A theoretical model and cross-cultural analysis. *Ethos, 14*(2), 174-203.

Winkelman, M. (1986b). Magico-religious practitioner types and socioeconomic conditions. *Behavior Science Research, 20,* 17-46.

Winkelman, M. (1990). Shaman and other "magico-religious" healers: A cross-cultural study of their origins, nature, and social transformations. *Ethos, 18,* 308-352.

Winkelman, M. (1991). Physiological, social and functional aspects of drug and non-drug altered states of consciousness. In W. Andritzky (Ed.), *Yearbook of cross-cultural medicine and psychotherapy, 1990* (pp. 183-198). Berlin: VWB-Verlag.

Winkelman, M. (1992). *Shamans, priests and witches. A cross-cultural study of magico-religious practitioners* (Anthropological Research Papers #44). Arizona State University.

Winkelman, M. (1996). Psychointegrator plants: Their roles in human culture and health. In M. Winkelman & W. Andritzky (Eds.), *Sacred plants, consciousness and healing. Yearbook of cross-cultural medicine and psychotherapy, 5* (pp. 9-53). Berlin: VWB.

Winkelman, M. (2000). *Shamanism: The neural ecology of consciousness and healing*. Westport, CT: Bergin & Garvey.

Winkelman, M., & Andritzky, W. (Eds.). (1996). *Sacred plants, consciousness and healing. Yearbook of cross-cultural medicine and psychotherapy*, 5. Berlin: VWB.

Yensen, R. (1985). LSD and psychotherapy. *Journal of Psychoactive Drugs, 17*(4), 267-277.

Yensen, R. (1996). From shamans and mystics to scientists and psychotherapists. In M. Winkelman & W. Andritzky (Eds.), *Sacred plants, consciousness and healing. Yearbook of cross-cultural medicine and psychotherapy* (Vol. 5, pp. 109-128). Berlin: VWB.

Zanger, R. (1989). Psycholytic therapy in Europe. *Newsletter: The Albert Hoffman Foundation, 1*(2).

Zoccolillo, M., Vitaro, F., & Tremblay, R. (1999). Problem drug and alcohol use in a community sample of adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry, 38*(7), 900-907.

Biographical Data. Michael Winkelman, PhD, is a Senior Lecturer in the Department of Anthropology at Arizona State University, where he is Director of the Ethnographic Field School, Baja California, Mexico. His research interests are in shamanism, shamanistic healing, altered states of consciousness and ethnomedicine; and in cross-cultural adaptation and inter-ethnic relations. He is the author of *Shamanism: The Neural Ecology of Consciousness and Healing* (Westport, CT: Bergin and Garvey, 2000), *Shamans, Priests and Witches: A Cross-cultural Study of Magico-religious Practitioners* (Anthropological Research Papers #44. Tempe, AZ: Arizona State, 1992), *Ethnic Sensitivity in Social Work* and *Ethnic Relations in the US: A Sociohistorical Cultural Systems Approach* (1999, 1998, Eddie Bowers Publishing, Dubuque: Iowa). He is also the co-editor of *Sacred Plants, Consciousness and Healing,* and *Divination and Healing* (*Yearbook of Cross-cultural Medicine and Psychotherapy, Volumes 6 & 9,* Berlin: Springer Verlag).

Offprints. Requests for offprints should be directed to Michael Winkelman, PhD, Anthropology Dept., Arizona State University, Box 872402, Tempe, AZ 85287-2402.