Clinical Aromatherapy and AIDS

Jane Buckle, PhD, MA, RN

Clinical aromatherapy is the use of essential oils for expected outcomes that are measurable and is a therapy that is used as part of nursing care in Switzerland, Germany, Australia, Canada, the United Kingdom, and, more recently, the United States. Essential oils are steam distillates obtained from aromatic plants. These volatile extracts have been used for many years by French hospitals against airborne bacteria and fungi. As antimicrobial agents, essential oils may be appropriate in HIV/AIDS for specific opportunistic infections. Aromatherapy can also alter perceptions of chronic pain, help maintain skin integrity, and is useful in stress management. Methods of application vary depending on the site of infection and the psychological profile of the patient and can include inhalation, compresses, baths, massage, and the "m" technique®. This article will explore the potential use of essential oils in HIV/AIDS focusing on four opportunistic infections: Cryptococcus neoformans, Candida albicans*, methicillin-resistant* Staphylococcus aureus*, and herpes simplex types I and II.*

Key words: *aromatherapy, AIDS, HIV, essential oils, opportunistic infections*

The prevalence of HIV/AIDS continues to rise in the United States and in many other parts of the world. In June 1999, the number of people living with HIV/AIDS in the United States was 950,000 (www.unaids). It is estimated that every minute, five people between the ages of 10 and 24 become infected with HIV somewhere in the world (Sowell, Moneyham, & Arnada-Naranjo, 1999). Because HIV does not have to be reported in many states, the estimate is conservative (Beal & Nield-Anderson, 2000). Approximately 50% of people with AIDS or HIV are using complementary and alternative modalities (CAMs) (Dwyer, Salvato-Schille, & Couston, 1995). Initially, HIV-positive or AIDS-infected people used CAM therapies that were thought to have immunostimulatory or antiviral properties (Elion & Cohen, 1997). However, as antiretroviral drugs became more successful, patients began choosing to add CAMs to their conventional regimes for specific symptom relief (Targ, 2000). Commonly used therapies include acupuncture for pain (Shlay et al., 1998), massage therapy (Ironson et al., 1996), and herbal supplements to boost immunity (Coss, McGrath, & Caggiano, 1998). Although aromatherapy is a lesser known complementary therapy, it has much to offer nursing care of HIV/AIDS in particular for the control of resistant infections, for altering perceptions of pain (Buckle 1999b), and for stress management.

Background

While the recognized definition states that "aromatherapy is the use of essential oils for therapeutic purposes" (Styles, 1997), the definition of clinical aromatherapy (as used in nursing) is more specific: "The use of essential oils for outcomes that are measurable" (Buckle, 2000). The definition of essential oils is also very specific: "Essential oils are the steam distillate of aromatic plants" (Tisserand & Balacs, 1995). Other kinds of extracts that are not obtained by steam distillation are not essential oils. Extracts may contain residues of allergenic solvents.

Possibly because aromatherapy is perceived by physicians to be useful mainly for stress, the antimicrobial properties of essential oils have not been acknowledged. There is, however, considerable published research available on the in vitro antibacterial,

Jane Buckle, PhD, MA, RN, is the director of RJ Buckle Associates LLC in Hunter, New York.

JOURNAL OF THE ASSOCIATION OF NURSES IN AIDS CARE, Vol. 13, No. 3, May/June 2002, 81-99

antifungal, and antiviral effects of a great number of essential oils. A search on Pubmed or Medline using the botanical name of the individual aromatic plant coupled with essential oil will produce between 20 and 100 articles per essential oil. Several databases dedicated to medicinal plants are available, such as Napralert (University of Chicago) and the Agricola Database, available via Silver Platter (www.silverplatter.com). There is also a privately owned Aromatherapy Database (Harris, 1997) that contains 700 printed abstracts on antimicrobial and other effects of essential oils. Copies can be purchased.

Searching for one essential oil such as lemongrass or eucalyptus will produce many in vitro studies relevant to nursing care. Lemongrass (*Cymbopogon citratus*) was found to be as effective in a 2.5% cream as four other commercial creams against ringworm and clinical isolates of four dermatophytes in vitro (Wannissorn, Jarikasen, & Soontorntanasart, 1996). Each of the commercial creams had clotrimazole, isoconazole nitrate, ketoconazole, benzoic acid, and salicylic acid as their main active ingredients. Onawunmi and Ogunlana (1986) found lemongrass effective against *Escherichia coli* and *Bacillus subtilis* in both broth dilution and agar diffusion tests (standard testing procedure). Lemongrass essential oil had an activity comparable to the standard antibiotic disks in the study, thus indicating that lemongrass is a viable option against certain pathogens. Eucalyptus was effective against all bacteria tested in vitro (Dellacassa, 1989; Hmamouch, Tantaoui-Elaraki, Es-Safi, & Agoumi, 1990). Benouda, Hassar, and Benjilali (1988) found eucalyptus to have an in vitro action comparable to orthodox antibiotics against pathogenic germs found in hospitals. Eucalyptus may also help the action of conventional antibiotics, as it enhanced the activity of streptomycin, isoniazid, and sulfonamides in in vitro tests (Kufferath & Mundualgo, 1954).

While skeptics may argue that the effective antimicrobial activity of an essential oil in vitro may not guarantee a similar action in humans, a recently published study in *BMC Surgery* indicates that essential oils can be effective in humans, and when nothing else works. Sherry, Boeck, and Warnke (2001) reported on a chronic case of MRSA (methicillin-resistant *Staphylococcus aureus*) osteomyelitis. A 49-year-old man had sustained an open fracture to his left tibia. He underwent debridement and insertion of an intramedullary nail. Two months later, he underwent a free-flap to the lower tibia, repositioning of the nail, and a femoral-popliteal bypass graft. Eight months later, he underwent debridement of the flap. Fifteen months later, he underwent debridement of an infective focus of the left tibia. He subsequently developed chronic MRSA osteomyelitis. Long-term antibiotic therapy (oral and intravenous) of 1 g of flucloxacillin and 1 g of dicloxacillin every 6 hours had been unsuccessful. Amputation was being considered.

In December 2000, via a 3-cm percutaneous incision, the lower tibia was drilled and washed out with 4000 mL of saline. Then it was packed with calcium sulfate pellets impregnated with lemongrass, eucalyptus, teatree, clove, and thyme in an ethanol base. A catheter was left in situ to allow delivery of further essential oils. One milliliter of antiseptic essential oil mixture was administrated daily. The dilution and ratio of the essential oils was not given. Three months later, the wound had healed and the culture was clear. The symptoms resolved, and a plain x-ray showed resolution of the infective process with incorporation of the bone graft. The authors commented that essential oils have a strong antimicrobial action, are inexpensive, are simple to use, and can be used topically.

Anderson and Fennessy (2000) reviewed the literature on teatree and concluded that there was compelling evidence of the effectiveness of teatree against MRSA. Caelli, Porteous, Carson, Heller, and Riley (2000) extrapolated the information from the in vitro studies and applied teatree to human subjects in a randomized, controlled pilot study (n = 30) using a 4% nasal ointment and a 5% body wash. The teatree combination was more effective than the control (3% mupirocin nasal ointment and triclosan body wash). All patients maintained intravenous vancomycin cover. This information is of particular interest to those in the field of infection, where pathogenic organisms are becoming resistant to antibiotics. Valnet (1980), a French physician, found that many essential oils also had gentle anti-inflammatory and analgesic properties, and as well as being good antimicrobials, were useful in other chronic diseases such as arthritis and bronchitis.

Since the September 11 terrorist attacks and subsequent concerns over anthrax as a biological weapon, two inexpensive, common, and safe-to-use essential oils have shown some effectiveness in vitro against the bacillus: basil (Ladariya & Rao, 1979) and palma rosa (Geda, 1995).

It is hardly surprising that there is confusion about aromatherapy. The term "aromatherapy" is used to sell anything from toothpaste to shampoo, and because of its marketability, the term "aromatherapy" is used even if the product itself has never been near an essential oil. There is a national fascination with aromatics and aromatherapy, hence the 18,000 web sites now dedicated to the subject. However, essential oils can be powerful, so there is a tremendous need for information to educate HIV/AIDS nurses on how clinical aromatherapy can be integrated into practice.

Synthetic Aromas

Aromatherapy does not include the environmental use of synthetic fragrances, which are man-made and are a recent development (Janowiak & Hawthorne, 1999). There is very little research on the effects of synthetics on humans, and the extended use of synthetics has been linked to an increase in asthma (Janowiak & Hawthorne, 1999). Unfortunately, synthetic fragrances are often confused with aromatherapy (Buckle, 1999b). However, unless the extract has been steam distilled from an aromatic plant, it cannot be classified as an essential oil (Williams, 1996). Coconut and raspberry odors, which are not essential oils, are not perceived to be aromatherapy.

Historical Overview

Aromatherapy is an ancient therapy that clearly has its roots in herbal medicine—the oldest medicine in the world. Eighty-five percent of the world's population relies on plant-based medicine (Fasihi, 1996). The fascination with plants is growing in the United States, and in 1998, $4 billion was spent on herbal medicines (Dossey, 2001). That same year, the translated German *Commission E Monographs* were published (Blumenthal, 1998). (The monographs had been used for many years by physicians in Germany as their reference point.) Journals and educational courses on botanical medicine are growing. Aromatherapy is perceived to be a modality in its own right and is not included in botanical medicine courses. This could be due to the fact that the process of steam distillation separates the volatile oil from the rest of the herb, resulting in the herb and the essential oil being used for different therapeutic actions. For example, chamomile herb is used for nausea and chamomile essential oil is not.

The renaissance of aromatherapy was undeniably clinical—the three people primarily responsible for its renaissance were a pharmacist, a nurse, and a physician. R. M. Gattefosse, a French chemist, was the first person to coin the word "aromatherapy" before World War II. He burnt both his hands in a laboratory explosion. The burns became infected with gas gangrene, and Gattefosse saved his hands from amputation (the treatment for gas gangrene at that time) by using essential oil of lavender. Gattefosse discussed the widespread use of essential oils on burns by French physicians dating back to 1915 in his classic book on aromatherapy, which was translated into English by Robert Tisserand and published as *Gattefosse's Aromatherapy* in 1993.

The second person in the renaissance of aromatherapy was Marguerite Maury (1989), an Austrian surgical assistant and nurse. She moved to France following the death of her first husband. Maury was interested in the impact of essential oils on skin conditions such as psoriasis and eczema. She discussed the use of essential oils as a skin preparation for surgery, to reduce scarring following surgery, to help skin grafts take, and for postradiation burns. Maury worked alongside physicians who, according to her book, appear positive about the effects of her treatment. Maury's book also contains suggestions about diets and a cornucopia of other suggestions for a healthy life. It makes fascinating reading and suggests that aromatherapy was being used in a clinical sense in the early 1940s in France.

The third person in the renaissance of aromatherapy was Jean Valnet (1980), a physician who used essential oils when the supply of antibiotics ran out during the Indo-China war (Buckle, 1997). Valnet found that essential oils were effective against both acute and chronic infections in humans. He also found that

concentrations that were insufficient to kill the pathogenic organism in a laboratory were effective in humans. The example given was an in vitro minimum inhibitory concentration (MIC) of 0.00025 g/mL as opposed to an in vivo concentration of 0.0000032 g/mL (Valnet, Duraffourd, Duraffourd, & Lapraz, 1978). However, this does not mean that aromatherapy is similar to homeopathy—quite the reverse. Essential oils are highly concentrated extracts—up to 100 times as powerful as the plant itself—usually only one to five drops are used at a time. The drops of essential oil are usually diluted for topical application in a cold-pressed vegetable oil such as sweet almond or inhaled undiluted with or without steam. While the ingestion of essential oils can be hazardous (undiluted or high-concentrated essentials such as cinnamon and clove can damage the mucous membrane), physicians in France have been prescribing essential oils by mouth since the early 1800s. And essential oils were not being used just for stress, nor were they just being inhaled.

Currently in France, essential oils are given orally or by injection alongside, or instead of, conventional antibiotics. However different countries perceive aromatics differently. In Germany, aromatherapy is accepted as part of phytotherapy (herbal medicine), and knowledge of herbs is a legal requirement in German medical training. In the United Kingdom, aromatherapy is often seen as an extension of massage therapy, although recently there have been moves to have aromatherapy accepted as part of herbal medicine (Burne, 1996).

Aromatherapy in the United States is in its infancy and only made its first appearance in the 1980s (Price & Price, 1995). Since that time, aromatherapy has moved rapidly to become part of the common language, appearing in comic strips, cartoons, and advertising campaigns. In the mid 1990s, the American Holistic Nurses Association (AHNA) endorsed a training program in clinical aromatherapy, and the program became popular among nurses. Articles began to appear in the nursing press, and hospitals began sponsoring training. Clinical aromatherapy was first accepted as a tool of holistic nursing by the state of Massachusetts (Lindberg, 1997). Other states such as Arizona, California, Maryland, Massachusetts, Nevada, New Mexico, New York, North Carolina, and Oregon followed suit (Buckle, 2001b).

An article published in the *Journal of Holistic Nursing* (Dossey, Frisch, Forker, & Lavin, 1998) listed aromatherapy as among the interventions "most frequently used in holistic nursing practice" and established aromatherapy as part of holistic nursing care. *AHNA Standards of Holistic Nursing Practice* (Frisch, Dossey, Guzzetta, & Quinn, 2000) is the accepted text for holistic nursing and established that certain interventions (including aromatherapy) were indeed part of nursing care. In March 2001, the AHNA published a broad position statement that gave clear guidance to other state boards of nursing that were trying to write their own position statements. In its statement, the AHNA wrote of its "support of the integration of CAM into conventional health care . . . that nurses represented the greatest number of health care professionals (more than 2.1 million) . . . that nurses were employed in more diverse clinical settings than any other health care professional . . . and that nurses were in a leadership role in the implementation of complementary and alternative therapies." No individual therapy was mentioned.

Research

In the past 10 years, there has been an escalation of botanical research targeting AIDS and HIV. Plotkin (2000) described some of this research in *Medicine Quest*. Kusumoto and Shimada (1992) searched specifically for herbs that could inhibit reverse transcriptase inhibitory activity and, thus, could inhibit replication of RNA tumor viruses; however, most research has focused on single plant extracts that can be patented.

Hypericin and pseudohypericin, components of *Hypericum perforatum* (St. John's wort), were found to be effective against HIV in vitro (Meruelo, Lavie, & Lavie, 1988). However, the 1999 phase 1 study of 30 HIV-infected people with CD4 counts lower than 350 cells/mm^3 found that 48% of the subjects could not tolerate the severe phototoxic side effects (Gulick et al., 1999). This could be due to the fact that the two chemical components (hypericin and pseudohypericin) had been isolated from the whole plant. In the case of

essential oils (and herbs in general), when a component is removed from the whole plant and used on its own, the results can be skewed. A clear example is lemongrass. Citral is an aldehyde that makes up 85% of lemongrass. When citral is removed from lemongrass and used at 50% dilution on the skin, it can cause erythema. However, if the whole essential oil is used, a 50% dilution will not result in erythema. This is because lemongrass also contains di-limonene, a terpene that has a "quenching effect," so no burning occurs (Tisserand & Balacs, 1995, p. 81).

There is no published research on the effects of the essential oil of *H. perforatum* on the AIDS/HIV virus, but the essential oil is being used for AIDS/HIV and for depression. However, the essential oil does not contain hypericin and pseudohypericin. It does contain quercetin, a pentahydroxyflavone (C. Wells, personal communication, 2001) that gives the essential oil its dark red color. Quercetin is quoted by Duke (1992) as having in vitro anti-HIV properties (inhibitory concentration = < 1 μg/mL), which indicates that the essential oil could be an interesting new avenue of antiretroviral research. The herb inhibits monoamine oxidase (www.natmedpro.com), and the essential oil may do the same. The essential oil is fairly easy to obtain, although expensive. *H. perforatum* is a common weed.

Another aromatic plant component that has HIV-inhibitory activity has been identified for preclinical development. Prostratin is an ester found in *Homalanthus nutans* (Cardellina & Boyd, 1995). A liquid extract from the bark of the *H. nutans* tree was given by the Samoan traditional healers to those with "sama sama"—viral hepatitis. A sample of the tree was sent to the National Cancer Institute in the mid 1980s by Paul Cox, a ethnobotanical researcher (who now heads the National Tropical Botanical Gardens), and in 1992 the National Cancer Institute (NCI) isolated a part of the plant that demonstrated powerful effects against HIV in laboratory settings. The active ingredient was named Prostratin and was immediately patented by the NCI. Prostratin appears to prevent HIV from infecting human cells and purges HIV from "viral reservoirs" in the body—places that HIV can hide from even the most powerful drugs approved to fight AIDS (www.mraa.org/charities_stories.html).

In the fall of 2001, the University of California, Los Angeles, received grant money ($72,000) from the National Institutes of Health to study the effects of Prostratin on animal models. This project will test the ability of Prostratin to activate latent HIV and study its effect on immune system organs that participate in the development of T cells (www.amfar.org/cgi-bin/iowa/grants/record). Esters are found in essential oils, although it is not clear which ester Prostratin is. *H. nutans* essential oil is not yet available commercially.

Opportunistic infections remain the most common cause of morbidity and death in people with HIV (Torres, 1993). This was verified by a phone call to the Centers for Disease Control and Prevention (B. Evans, personal communication, 2000). The major cause of death is pneumocystis carinii pneumonia in the United States and tuberculosis worldwide. A list of the essential oils that may either inhibit growth in vitro or relieve clinical symptoms of some opportunistic infections (Pratt, 1995) is shown in Table 1. *Candida albicans* and MRSA are also included, as both are common in immune-compromised patients.

Cryptococcus neoformans

Cryptococcus neoformans is a yeast infection that is spread from pigeon droppings and begins as a sporadic disease manifesting with lung infestation. From the lungs, yeast cells migrate to the central nervous system and brain via the blood. Standard treatment is fluconazole, itraconazole, or amphotericin B encapsulated in liposomes (Cordonnier, 1993). This treatment was verified as still ongoing (B. Evans, personal communication, 2000). However, clinical resistance occurs fairly quickly. Sixty percent of essential oils are known to possess antifungal properties (Deans, Svoboda, & Kennedy, 1989), and aromatherapy is particularly suitable for lung treatment, because when essential oils are inhaled they directly target the affected area and do not need to be digested as oral medication does. Essential oils such as pine and eucalyptus have a long history of inhaled use, and therefore it is extremely unlikely that essential oils damage the lungs. There has been some controversy over purported negative effects of inhaled pentamidine for pneumocystis (Kacmarek, 1990).

Table 1. Opportunistic Infections That Respond to Essential Oils

Opportunistic Infection	Common Name	Botanical Name	Research Work
Nontubercular opportunistic mycobacteria	Lavandin	*Lavandula x intermedia CT grosso*	Gabrielli et al. (1988)
Methicillin-resistant *Staphylococcus aureus*	Lavender	*Lavandula angustifolia*	Nelson (1997)
	Peppermint	*Mentha piperita*	Nelson (1997)
	Juniper	*Juniperus communis*	Nelson (1997)
	Teatree	*Melaleuca alternifolia*	Carson et al. (2000), Nelson (1997)
	Thyme	*Thymus vulgaris*	Nelson (1997)
Candida albicans	Teatree	*Melaleuca alternifolia*	Belaiche (1985), Pena (1962), Carson and Riley (1994)
	Peppermint	*Mentha piperita*	Pattnaik et al. (1996)
	Palma rosa	*Cymbopogon martini*	Pattnaik et al. (1996)
	Eucalyptus	*Eucalyptus globulus*	Pattnaik et al. (1996)
	Lemongrass	*Cymbopogon citratus*	Pattnaik et al. (1996)
	Geranium	*Pelargonium graveolens*	Chaumont and Bardy (1989)
	Bay	*Pimenta racemosa*	Voillon et al. (1993)
	Vetiver	*Vertiveria zizanoides*	Chaumont and Bardy (1989)
	Santolina	*Santolina chamaecyparisus*	Suresh et al. (1995)
	Melissa	*Melissa officinalis*	Suresh et al. (1995)
	Rosemary	*Rosmarinus officinalis*	Larrondo and Calvo (1991)
	Lippia	*Lippia alba*	Soliman et al. (1994)
	Oregano	*Origanum vulgare*	Fun and Svendsen (1990)
	Austrian pine	*Picea albies*	Stiles et al. (1995), Kartnig et al. (1991)
Cryptococcus neoformans	Rosemary	*Rosmarinus officinalis*	Soliman et al. (1994)
	Palma rosa	*Cymbopogon martini*	Viollon and Chaumont (1994)
	Thyme	*Thymus vulgaris*	Zollo et al. (1998)
	Geranium	*Pelargonium graveolens*	Viollon and Chaumont (1994)
	Marjoram	*Origanum majorana*	Viollon and Chaumont (1994)
	Sandalwood	*Santalum album*	Viollon and Chaumont (1994)
	Lemongrass	*Cymbopogon citratus*	Viollon and Chaumont (1994)
	Eucalyptus	*Eucalyptus globulus*	Viollon and Chaumont (1994)
	Patchouli	*Pogostemon cablin*	Viollon and Chaumont (1994)
	Basil	*Ocimum basilicum*	Viollon and Chaumont (1994)
	Peppermint	*Mentha piperita*	Zollo et al. (1998)
	Cypress lavender	*Santolina chamaecyparissus*	Suresh et al. (1995)
Herpes	Cubeb	*Piper cubeba*	May and Willuhn (1978)
	Blue gum	*Eucalyptus globulus*	May and Willuhn (1978)
	Juniper	*Juniperus communis*	May and Willuhn (1978)
	Melissa	*Melissa officinalis*	Wolbling and Leonhardt (1994)
	Teatree	*Melaleuca alternifolia*	Buckle (2001b)
	Palma rosa	*Cymbopogon martini*	Buckle (2001b)
	Rosemary	*Rosmarinus officinalis*	May and Willuhn (1978)
	Rose	*Rosa damascena*	Buckle (2001b)

Electrical or battery-operated diffusers and nebulizers are the most effective ways of getting essential oils into the lungs. Nebulizers are a very suitable method of treatment for lung infestations of yeast, fungi, or bacteria because they fill the air with an extremely fine mist of micromolecules of essential oil. Nebulizers can be programmed to go on and off at specific times. For recommended distributors of essential

Table 2. Resource Guide

Recommended Essential Oils Distributors	Nebulizers/Diffusers	Nationwide Training
Therapeutic Essentials 5 Michelle Court Edgewood, NM 98015 Phone: (505) 281-9547 E-mail: Ther1Ess1@aol.com	Leyden House 200 Brattleboro Road Leyden, MA 01337 Phone: (800) 754-0668 Fax: (413) 772-8858	American Holistic Nurses' Association P.O. Box 2130 Flagstaff, AZ 86004 Phone (800) 278-2462 URL: www.ahna.org
Florial France Ltd. 42 Chemin Des Aubepine, 06130 Grasse U.S. Contact: Kari Morford Phone: (206) 768-2562 URL: www.florial.com		RJ Buckle Associates LLC P.O. Box 868 Hunter, NY 12442 Phone: (518) 263-4402 URL: www.rjbuckle.com
Primavera 110 B Landing Court Novato, CA 94934 Phone: (415) 209-6688 URL: www.primaveralife.com		
Scents & Scentsibility Ltd. P.O. Box 8013 Bridgewater, NJ 08807 Phone: (980) 369-4537 Email: debbie@fastbreak.com URL: www.scentsibility.com		
Northwest Essence P.O. Box 428 Gig Harbor, WA 98335 Phone: (253) 858-0777 E-mail: northwestessence@earthlink.com		

oils and nebulizers, please see Table 2. The following studies are divided into whole essential oils and one isolated component from an essential oil.

Twenty-Five Effective Essential Oils

Viollon and Chaumont (1994) tested the susceptibility of a strain of *C. neoformans* isolated from the blood of a patient with AIDS to 25 essential oils and 17 separate chemical constituents found in essential oils. Antifungal activity was tested by dilution method on solid Sabouraud's dextrose agar with chloramphenicol 0.005%. (The presence of chloramphenicol ensured the inhibition of possible pollution by bacteria that could confound the results.) Ten microliters of *C. neoformans* from the patient's blood were spread on the culture. Cells were counted and the plates incubated at 37°C for 48 hours. Then, the MIC was measured.

Many of the essential oils used showed good fungistatic action. The best effects were from palma rosa, geranium, savory, sandalwood, thyme, marjoram, and lavender. These are all common, inexpensive essential oils. What was interesting about this study was that lavender and sweet marjoram, two essential oils that had previously been found to be ineffective against *C. neoformans* on fungal growth in vitro, were very effective when the fungus was isolated from infected human tissue. This appeared to agree with the findings of Valnet (1980) as discussed earlier in this article and could be related to the adaptogenic capacity of essential oils (and all plant medicines) to behave differently depending on the terrain they are in. Adaptogens constitute a novel class of metabolic

regulators that can have differing psychological and physiological effects depending on the requirement of the host (Panossian, Wikman, & Wagner, 1999).

Due to the high volatility of essential oils, Viollon and Chaumont (1994) hypothesized that they would be effective against pulmonary cryptococcosis because they could easily penetrate into the tissues (due to their low molecular weight) and would quickly reach the cerebral spinal fluid in meningitis. The researchers further hypothesized that essential oils would be less toxic than conventional drugs, as they have fewer side effects. It is disappointing that a literary search has not revealed any further published research by Viollon or Chaumont on the use of essential oils for cryptococcus.

Lemongrass, Eucalyptus, Palma Rosa, and Peppermint

Pattnaik, Subramanyam, and Kole (1996) reported that lemongrass, *Eucalyptus globulus*, palma rosa, and peppermint were the most effective essential oils tested against cryptococcus. Basil and thyme were not included in this study. (Lemongrass was effective not only against cryptococcus but against all 11 other fungi tested in low dilutions.) The MIC for each of the four essential oils against cryptococcus was 5 µL/mL. In another article, Pattnaik, Subramanyam, Bapaji, and Kole (1997) found that complete essential oils were more effective against cryptococcus than the isolated, active component. There was one exception, lemongrass, which was equal to the isolated parts of citral and geranial. Larrondo and Calvo (1991) compared the topical and inhaled action of citral to the systemic effects of clotrimazole. Although the actual way essential oils work as fungicides is not completely clear, it appears that metabolism and growth of the fungus are inhibited, often with a breakdown in the lipid part of the membrane, resulting in increased permeability and/or rupture (Larrondo, Agut, & Calvo-Torres, 1995).

Basil and Thyme

In another article, several essential oils obtained from the aromatic plants of central Africa were tested by Zollo et al. (1998) using two methods: microatmosphere and standardized broth dilution. In microatmosphere, the potency of the evaporated essential oil is measured. In standardized broth dilution, the essential oil is dissolved in a solvent and the potency is measured in increasing dilutions. In both methods of investigation, *Thymus vulgaris* (common thyme) and *Ocimum basilicum* (basil) demonstrated strong antifungal action against *C. neoformans*.

Pogostemon patchouli (Patchouli)

Patchouli was found to be effective against *Cryptococcus* and 16 other pathogenic fungi and commensal bacteria in a study by Yang, et al. (1996). In this in vitro study, essential oil of patchouli from three different countries—China, Indonesia, and India–was compared. Interestingly, only the Chinese patchouli was effective against *C. neoformans*. This was attributed to the higher content of patchouli alcohol (41%) as compared to the Indonesian and Indian (20%-23%) essential oils. These findings underline the importance of the chemistry of an essential oil and how it is directly related to where the plant was grown.

Rosemary

Soliman, El-Kashoury, Fathy, and Gonaid (1994) tested essential oil of rosemary (*Rosmarinus officinalis*). They investigated the essential oil distilled from two plants growing in different climatic conditions. They found that both rosemary essential oils were effective against *C. neoformans* in vitro and recommended that either essential oil could be an effective treatment in AIDS patients with cryptococcal meningitis and pneumonia. Although both types of rosemary were effective, the effectiveness could have been due to a different chemical component in each oil.

Eugenol

Eugenol is a phenolic component found in several essential oils and was reported to be effective in an in vitro study against 33 strains of *C. neoformans* using isolates from human patients (Boonchild & Flegel, 1982). The researchers concluded that eugenol would be effective against cutaneous mycoses, but toxicity

Table 3. Protocol for Vaginal Candida

1. Add two drops of teatree to one teaspoon (5 mL) of pure cold-pressed vegetable oil such as sweet almond oil.
2. Put mixture onto clean saucer.
3. Roll tampon in mixture.
4. Insert per vagina.
5. Use remainder of mixture around the outer labia. The sensation is pleasant and slightly tingly—like after cleaning your teeth.
6. Remove tampon after 4 hours and replace with new mixture.
7. Repeat as above four times a day (breakfast, lunch, tea, and dinner).
8. Leave in overnight.
9. Candida should be gone in 3 days and not return.

tests excluded the use of eugenol as a systemic agent. As a phenol, eugenol would not be suitable for extensive topical use, as phenols can be irritating to the skin. Phenols can also become hepatotoxic (Schnaubelt, 1999, p. 179). Eugenol is found in clove and savory—two essential oils that would need to be used with caution on the skin but could be used safely in a nebulizer.

C. albicans

Candida is normally present in the mouth, intestinal tract, and vagina, but when the pH of those areas becomes alkaline, overgrowth can occur, resulting in severe itching and the diagnostic creamy, curd-like deposits. Candida is the major fungal pathogen of immunocompromised patients (Kwon-Chung & Bennett, 1992) but is also common in diabetes, pregnancy, antibiotic therapy, postradiation therapy, and chemotherapy. Recently, candida has become resistant to many conventional drugs and metabolic inhibitors that have no commonality (Goldway, Teff, Schmidt, Oppenheim, & Koltin, 1995). Valnet (1980) used essential oils extensively with soldiers during the Korean War who had trench foot (a fungal infection). He later researched the effect of essential oils on candida and found that several essential oils were effective against it. Valnet et al. (1978) showed that essential oils in the human body (in vivo) were effective at much lower doses than in vitro, and the authors cited incidences in which the concentration had been as low as 0.0000032 g/mL.

Teatree

One of the most researched essential oils, teatree (*Melaleuca alternifolia*) has been shown to be effective (both in vitro and in vivo) against *C. albicans*. Nearly 40 years ago, Pena (1962) demonstrated the effectiveness of teatree for several vaginal infections including candida in 130 women. (This study was carried out before the era of randomized, controlled trials.) Treatment was of 2% teatree diluted in a cold-pressed vegetable oil and soaked into a tampon. Topical use of diluted teatree for the treatment of candidiasis produced fewer systemic side effects such as gastrointestinal upset and unpleasant taste, which are common side effects of conventional medication (Joesoef & Schmid, 1995). Today, over-the-counter, intravaginal teatree products are available in many countries, and self-treatment appears to be common among women with chronic vaginal symptoms (Nyirjesy, Weitz, Grody, & Lorber, 1997). The use of vaginally applied teatree for thrush is described and recommended by Northrupp (1995).

Between 1984 and 2000, the author recommended Pena's method of treatment to more than 300 women and had 100% success. The women were all self-diagnosed. The symptoms described were indicative of candida, but no swabs were taken. Five milliliters of 2% teatree diluted in grapeseed oil was applied to a tampon and applied vaginally. A fresh tampon and solution was applied every 4 hours. The tampon was left in situ overnight, and the treatment was continued for 3 days. All women received the same protocol (protocol can be found in Table 3). Relief of itching

occurred within 24 hours. Seventy-five percent of the women had experienced recurrent vaginal yeast infection for 10 years or more. Ninety-five percent had previously used conventional medical treatment but the candida had reoccurred. During the teatree treatment, no other conventional medication was used. What is particularly encouraging is that in every case, the candida had not returned up to 5 years later. In three cases, the vaginal wall was excoriated and sore. Prior to the treatree treatment, lavender douches or tampons (5 mL of 2% *Lavandula angustifolia* in grapeseed vegetable oil) were recommended every 4 hours until the mucosa had improved.

One particular case study stands out. This patient had had vaginal candida for 30 years. She had never sought medical help, as she felt too embarrassed and thought the condition was a direct result of having been abused as a child. A 5-mL bottle of teatree and some cold-pressed vegetable oil were given to her to use with a written protocol. She telephoned 3 days later crying with joy. She said, "For the first time in 30 years, I feel clean." This new feeling had a profound effect on her life—she went on to lose weight, had her teeth fixed, and, in her own words, "had the courage to put the past behind me and become a woman."

In another case, a teenager with recurring cystitis (3 years) had been on a cycle of antibiotics, thrush, and nystatin. Not only did teatree stop the thrush, the cystitis did not return. A further case was of a 14-month-old baby with candida. Two drops of teatree were sprinkled on the diaper, and the thrush was eliminated in 24 hours. In each of the three cases described, teatree was used without other antifungal medications such as clotrimazole.

Belaiche (1985a) reported on the positive effects of teatree pessaries (vaginal suppositories) on the vaginal candida of 28 patients. He found that teatree acted topically and was rapidly absorbed by the tributary veins and pelvic lymphatics. One patient discontinued treatment after 1 week due to irritation. Seventy-five percent were clinically and microbiologically clear of candida after 3 weeks, four showed moderate amelioration of discharge, and three were symptomless but candida was still present. Because Pena's treatment was for only 3 days and was successful, a 3-week requirement for partial success could be a reflection on the chemical constituents of the teatree involved or the ability of the pessary to be a good carrying medium for the essential oil. Belaiche (1985b) also studied the positive effects of teatree on skin irritation due to candida. The essential oil was applied directly to the skin, but the dilution was not stated.

Carson and Riley (1994) demonstrated that eight different samples of essential oil of teatree (obtained from different manufacturers) were effective against candida in a broth dilution. One year later, Carson and Riley (1995) showed that the major active constituents against candida were 1,8 cineol and 1-terpinen-4-ol. In 1997, a single case study was published in a British medical journal on the successful treatment of chronic mucocutaneous candidiasis with teatree (Rodger, 1997). The success of teatree in treating skin candida may be connected to the lipophilic nature of the essential oil and its ability to penetrate skin (Obata, Takayama, Machida, & Nagai, 1991).

Other Essential Oils

While teatree remains the first choice for the treatment of candida, there is research on other essential oils. Pattnaik et al. (1996) investigated the effects of peppermint, parmarosa, eucalyptus, and lemongrass on candida and found them to be effective in vitro. Chaumont and Bardy (1989) found geranium, bay, and vertiver to be effective in vitro against candida at 200 parts per million. However, Chaumont and Bardy compared these three essential oils to conventional medication clotrimazole, tolnaftate, and isoconazole and found that they were not as effective.

Suresh, Sriram, Dhanarj, Elango, and Chinnaswamy (1995) investigated the effects of cypress lavender (*Santolina chamaecyparissus*) essential oil and found it to be effective against candida in vitro and in vivo (animal). Cypress lavender is not related to true lavender (*L. angustifolia*). The in vivo studies were carried out on mice with induced vaginal and systemic candidiasis. A 4% solution of santolina removed the vaginal candida by the ninth day, which was comparable to the 2% clotrimazole solution that was used as a control. Santolina, diluted in olive oil at a dose of 25 mg/kg (milligrams of oil per kilograms of mouse) was as effective as the control, ketoconazole 25 mg/kg. Toxicological investigations did not show any significant changes to either biomedical or hematological parameters.

Larrondo and Calvo (1991) investigated the effect of true lavender (*L. angustifolia*), melissa, and rosemary essential oils left in a broth culture of candida for 8 hours and found that only melissa produced 100% inhibition of the fungus. Microscopy showed deformed, agglutinated yeast cells surrounded by expelled intracellular material. (Melissa is extremely expensive and frequently adulterated.) However, Soliman et al. (1994) later demonstrated that rosemary essential oil was effective against candida in a similar experiment. This different outcome could be due to the fact that a different chemotype of rosemary was used. A few essential oils, such as rosemary, can present very differing chemical profiles depending on where they were grown. These are then cloned and called chemotypes. This means a completely different chemical group is dominant, which may affect how it will be used clinically. Some chemotypes of rosemary that are high in 1,8 cineol (an oxide) could exacerbate an excoriated skin condition, so it might be safest to avoid rosemary if teatree is available.

Geranium, cinnamon, and peppermint were found by Viollon, Leger, and Chaumont (1993) to be effective in vitro against candida. Viollon's study was also aimed at returning the equilibrium of the vaginal flora. His study indicated that at chosen concentrations, essential oils inhibited vaginal pathogens without damaging the normal flora. This is good news, as many conventional medications remove the normal flora. Cinnamon is an aggressive essential oil high in phenols. Great care is needed when using it topically because it can cause dermal irritation and/or burns. It is not recommended for vaginal use. Peppermint should be used with care on grafted skin and excoriated areas. It is not recommended for vaginal use.

Stiles, Sparks, Ronzio, and Ronzio (1995) investigated the effectiveness of oregano (*Origanum vulgare*) on candida and found that it was effective at less than 0.1 µg/mL. The component thought to be effective was carvacrol. (Carvacrol is a phenol and as such would need to be used with caution on the skin and should be avoided on the mucous membrane.) Kartnig, Still, and Reinthaler (1991) completed an in vitro study and found *Picea abies*—sometimes called Norway spruce (Lawless, 1992) or Austrian pine (Guenther, 1972)—to be as effective as chloramphenicol and more effective than commercial "pine" oil against candida. *P. abies* is also called *Picea excelsa* and is not easily available commercially.

Essential Oil Components Effective Against Candida

Several specific compounds found in essential oils have been isolated and tested on their own against candida. More research is likely to be carried out on compounds isolated from essential oils than on whole essential oils. Plant extracts can be patented, but whole plants cannot. Therefore, research on parts of a plant is more attractive to funding than research on the whole plant.

Citral is the generic name for two different isomeric aldehydes (geranial and neral) that are found in many essential oils. Citral is thought to be the component most likely to be antifungal (Pattnaik et al., 1997). Onawunmi (1989) found citral to have antifungal properties in dilutions as low as 0.005% to 0.008%. Essential oils containing large amounts of citral are melissa, verbena, and lemongrass. Aldehydes are best avoided on a damaged mucous membrane, but they can be used diluted on the skin.

A component of essential oils found by Beylier and Givaudan (1979) to have anti-candida properties is citronellol. Citronellol is an alcohol and is the main constituent of *Eucalyptus citriadora* (60%-80%). Alcohol is safe to use on the skin and the mucous membrane.

Of all the above essential oils, teatree would still be the essential oil of choice, as it has the most published research.

Methicillin-Resistant *Staphylococcus aureus*

Thirty years ago, an article in the *Journal of the American Medical Association* reported an outbreak of methicillin-resistant *Staphylococcus aureus* (MRSA) (O'Toole, 1970). During the years that followed, many articles followed indicating that MRSA was not confined to one state but was prevalent across America (Storch, Radcliffe, Meyer, & Hinrichs, 1987). Since the arrival of MRSA, pathogens have become resistant to other antibiotics such as

vancomycin, penicillin, cephalosporin, aminoglycoside, and fluoroquinolone. The presence of antimicrobial-resistant pathogens led to hospital closures in the early 1990s (Kerr, Kerr, MacKintosh, & Marples, 1990) and to major concerns about long-term care (Naguib, Naguib, & Flournoy, 1993). The consequences of resistant pathogens remain serious for patients with poor functional status (Strausbaugh, Crossley, Nurse, & Thrupp, 1996).

MRSA was initially treated with mupirocin (Kauffman et al., 1993). When *S. aureus* became resistant to mupirocin, a serious threat to the containability of MRSA infection emerged (Riley et al., 1994), and the race was on to find a suitable alternative. Nitrofurazone, silver sulfadiazine, and azelaic acid were tried (in vitro) as topical antimicrobials (Maple, Hamilton-Miller, & Brumfit, 1992). In the late 1990s, the press became concerned and took up the story. A *New Scientist* article suggested that feeding cattle with low doses of chlortetracycline might have begun the cycle of drug resistance in humans (Bonner, 1997). Then, a feature appeared in *Discover* magazine titled "Last Days of the Wonder Drugs" (Radetsky, 1998), foretelling the death of antibiotics. The same year, the *New York Times* magazine ran a feature called "Superbugs" (Stolberg, 1998). The latter two articles were slightly alarmist. Both suggested that pathogen resistance was due to the overuse of antibiotics—either in medicine, as food additives, or as ingredients in household cleaning goods.

Barrett, Mummery, and Chattopadhyay (1999) argued that the fight against MRSA had been lost. But perhaps this is not so. Essential oils may have become forgotten in the new world of synthetic medicine, but until penicillin was discovered, essential oils were used more as medicines than as recreational additives to baths and candles. Sir Joseph Lister, a British surgeon (1827-1912), used carbolic spray and later thymol, a phenol found in essential oil of thyme, as antiseptics. Thymol is still used as an oral antiseptic, which is where Listerine gets its name. As reported earlier in this article, essential oils are still used, either with antibiotics or instead of them, in France (Belaiche, 1979; Valnet, 1980). The use of synthetic medicine is most acute in the "civilized world," where politics and pharmaceuticals appear to be inextricably linked (Buckle, 2001a). However, herbal medicine (which includes the use of aromatics) remains the main form of medicine for 85% of the world's population and the cornerstone of modern pharmacy (Dossey, 2001).

Teatree

Teatree has become ubiquitous in many "aromatherapy products" in the United States—for example in shampoo, skin care, and household cleaning products. The history of teatree goes back 75 years and begins in Australia, where Penfold and Grant (1925) first drew attention to teatree's remarkable antimicrobial properties. Since then, essential oil of teatree (an aromatic plant indigenous to New South Wales) has been found to be effective against many pathogens including *S. aureus* (Altman, 1988; Carson & Riley, 1998).

More recently, all 60 isolates of MRSA were found to be susceptible to teatree in an in vitro study by Carson, Cookson, Farrelly, and Riley (1995). The broth dilution method was used, which resulted in an MIC of 0.25% determined by broth microdilution.

A randomized, controlled study using teatree was carried out on 30 adult inpatients who were either infected or colonized with MRSA (Caelli et al., 2000). The study was carried out at John Hunter Hospital in Newcastle, New South Wales. Participants were randomly assigned to receive either 2% mupirocin nasal ointment and triclosan body wash (routine care [RC]) or a 4% teatree nasal ointment and a 5% teatree oil body wash (intervention care [IC]). Treatment lasted for a minimum of 3 days. Screening for MRSA was from the nostrils, the perianal region, and any site previously positive for MRSA. Swabs were taken 48 and 96 hours after cessation of the topical treatment. Treatment was carried out for a minimum of 3 days and a maximum of 34 days.

The most common site of isolation of MRSA was the skin, which accounted for 19 of the 30 patients (63%). The average age in the RC group was slightly older (74 years) compared to the IC group (58 years). Two patients in the RC group (13%) were cleared of MRSA compared to five patients in the teatree group (33%). Eight patients in the RC group (53%) remained chronically infected or colonized at the end of the treatment compared to three patients in the teatree group (20%). Teatree was shown to be more effective than mupirocin and triclosan, although the difference

Table 4. Protocol for Using Essential Oils in Herpes

Symptom	Topical Application	Frequency
Tingling	Undiluted essential oil	Every 4 hours
Redness and swelling	Undiluted essential oil	Every 4 hours
Pustule formation	Undiluted essential oil	Every 4 hours
Broken pustule, raw skin	25% diluted essential oil[a]	Every 4 hours
Raw skin	5% diluted essential oil[a]	Every 4 hours

a. Dilute in cold-pressed vegetable oils such as sweet almond. Do not use cooking oil.

was not statistically significant due to the small number of patients.

No adverse effects were reported from the mupirocin ointment or teatree body wash. One person complained of "burning" from the teatree nasal ointment, and one person complained of tightness from the triclosan body wash. No one complained of adverse effects from the teatree oil body wash.

Teatree, Peppermint, Lavender, Thyme and Juniper

Nelson (1997) investigated the effectiveness of four other essential oils against both MRSA and vancomycin-resistant *Enterococcus faecium* (VREF). The test organisms were isolated from inpatients of the West Glasgow Hospital Trust, Scotland, and included 15 nonreplicate strains of MRSA and 5 of VREF. All the VREF isolates were identified as *E. faecium*. Susceptibility was determined using the broth microdilution solution. The MIC was defined as the lowest concentration of each oil that inhibited visible growth after overnight incubation in the air at 37°C.

Nelson (1997) found that all essential oils tested were effective, with teatree slightly more potent at 0.25 to 2.0 µg/mL. Juniper was the least potent, with an MIC of just under 2%. The strains of VREF appeared to be four times as susceptible to the essential oils as MRSA. Nelson suggested that the MIC was very low, which boded well for topical application of dilute essential oils. This low dilution is of particular interest for teatree because many commercial preparations contain between 5% and 10% teatree. Because of the "greener image" and pleasant odor, Nelson suggested that essential oils might be more acceptable to patients than conventional antiseptics. However, he warned that the use of essential oils in cosmetics could undermine the potential efficacy of essential oils over time.

Nelson (1997) clearly demonstrated the potential for each of the five essential oils tested to be added to hand-wash preparations in hospitals to aid in the fight against MRSA.

Herpes Simplex

Herpes is a common infection in immune-compromised patients. Current treatment is nucleoside analogs such as idozuridine and acyclovir that facilitate an intracellular impediment to virus replication. Essential oils that may be effective against herpes in tissue are shown in Table 1. The table was compiled with reference to various research studies carried out on human tissue (in vitro) using extracts from plants (Cohen, Kucera, & Herrmann, 1964; Kucera & Herrmann, 1967; May & Willuhn, 1978). The most common essential oils have been listed from the 75 plants that were found to have virustatic activity. Despite the age of the articles that investigated the first four essential oils listed, the clinical efficacy of these four essential oils plus the other four essential oils listed has been found to be effective in 10 years of clinical experience by the author. Severity, duration, and frequency of herpes outbreaks have been decreased substantially. It is disappointing that there is no published research on teatree, palma rose, or rose and herpes, as the author's clinical experience suggests each of them would reduce the severity and frequency of herpes outbreaks in 5%-50% dilutions (see Table 4 for protocol).

A 1994 randomized, controlled multicentered study on 115 patients by Wolbling and Leonhardt (1994)

found extract of melissa to be effective. On the final day (fifth day of treatment), 24 patients in the melissa group were symptom free against 15 patients in the placebo control group. Scabbing and swelling were more reduced in the melissa group, indicating reduced cell damage. Method of treatment was a proprietary brand cream (Lomaherpan) that contains 1% melissa extract. The controls were treated with an identical cream base without melissa. The site of the herpes treated was (1) on the lips in 34 in the melissa group and 33 in the control group and (2) on the genitals in 4 in the melissa group and 6 in the control group. A subgroup of 67 patients tested herpes labialis. The decline of the lesion remained faster in the melissa group than the placebo group. A suggested protocol for application is shown in Table 4.

One percent melissa extract was tested for topical treatment of recurring herpes labialis (Koytchev, Alken, & Dundarov, 1999). This was a double-blind, placebo controlled, randomized trial on 66 patients who had a history of four episodes of herpes labialis per year. The melissa cream was applied four times a day. There was significant reduction in size of affected area and blisters at day 2 by the melissa group. Patients' pain was reduced and their healing period shortened.

Melissa is the most expensive of all essential oils and therefore is the most adulterated. Frequently it is mixed with synthetics or lemongrass or citronella. These contaminants may have a worsening effect on irritated or abraded lesions.

Nursing Implications

Historically, nursing has much in common with the philosophy of complementary therapies (Freeman & MacIntyre, 1999). Florence Nightingale rejected the germ theory, believing strongly in the need to prevent a hole in one's wholeness to avoid disease. Evidence-based medicine is clearly founded on the supremacy of the randomized, controlled trials over learned knowledge or the theory of holistic nursing (Fawcett et al., 2001). Even so, there would appear to be sufficient information in the form of randomized, controlled trials to suggest that essential oils could have an important role to play in the nursing care of AIDS/HIV.

This article has focused on the antimicrobial aspects of essential oils and suggested that essential oils can be used in a reductionist way. However, aromatherapy is more commonly known for stress management and for giving pleasure. These two important properties of aromatherapy need mentioning now because if aromatherapy can affect stress and can give pleasure, it can also produce profound changes in immune function. It is well documented that emotional stress can induce immune system suppression (Robinson, Mathews, & Witek-Janusek, 1999); therefore, anything that reduces stress can positively affect the immune system.

Nurses need to be able to evaluate the potential role of complementary therapies in nursing so they can choose those therapies that will benefit their patients based on the best evidence available. That evidence may be published articles, clinical experience, or the simple fact that the therapy may give pleasure and will not worsen the symptoms or the disease process.

Aromatherapy is accepted under the umbrella of holistic nursing care (Frisch et al., 2000). Essential oils are already in the public domain, and aromatherapy products are easily available. While these products may contain synthetics with no proven antimicrobial action, patients are familiar with the term aromatherapy. Given the widespread interest in aromatherapy by the public as well as the increasing popularity of this therapy among health care professionals, nurses should be aware of what this gentle therapy can offer an HHIV/AIDS patient. For example, essential oils have long been used to enhance conventional antibiotic treatment (Kufferath & Mundualgo, 1954). They can also lesson the side effects of drugs, and they usually smell pleasant. Essential oils are lipid soluble, and their influence can easily be traced on microbial membrane–catalyzed activities such as respiration (Knobloch, Pauli, Iberl, Weigand, & Weis, 1989).

Most of the studies cited in this article are in vitro. However, where there are human studies, the essential oils have appeared to be as successful as conventional medicine and often in extremely low doses. Many question the relevance of testing in animals because the only "animal model in which everything works just the same as a human being is the same human being" (Mansfield, 1996, p. 5). This article suggests that there is sufficient evidence to progress to human studies. Essential oils have been in the public domain for thousands of years and have caused very few deaths,

diseases, or injuries, unlike conventional medicines. Redux and Pondimin are suspected of killing 300 women, and Fenphen alone resulted in heart valve damage to 300,000 women in 5 years (Mundy, 2001). Essential oils are safe, inexpensive, easy to use, and smell good.

Resistance, Sensitivity, and Cautions

The primary effect of essential oils on bacteria and viruses appears to be on the cell membrane (Harris & Harris, 1995), where the essential oil appears to alter the osmotic regulatory function (Savino, Lollini, & Menghini, 1994). Because essential oils may be used for an extended period of time, the question of possible resistance is important.

Each essential oil is a very complicated chemical mixture containing up to 200 different chemical components. The amount of each component varies depending on where the plant was grown, the climatic conditions, and how the essential oil was extracted. This means that the chemistry of an essential oil is constantly changing ever so slightly, unlike the chemistry of an antibiotic, which remains constant. But these changes will make it more difficult for a pathogen to mutate to "fit" to an essential oil. So, it is easy to postulate that it would take a pathogen a long time to mutate sufficiently to accommodate a constantly changing compound. In aromatherapy, several essential oils are used together in a mixture. This means that even if the pathogen did succeed against one essential oil, by slightly altering the mixture by changing the ratio of the mix or adding a different essential oil, an entirely new challenge would be faced by the pathogen.

What makes essential oil research unattractive is that whole essential oils are not patentable. Therefore, this kind of research is unlikely to be funded by drug companies, especially if their own products are being used as controls.

Specific Precautions

Patch testing is recommended before using essential oils topically on patients who are on multiple drug regimes or who have a history of allergies. To carry out a patch test, put double the number of the percentage intended for clinical use on a Band-Aid and apply to the inner arm. Leave for 24 hours. If there is no irritation or redness, those essential oils can be used safely at half the percentage used. Take careful note of what aromas trigger discomfort in your patient and avoid them (e.g., German chamomile can sometimes produce sensitivity in people allergic to ragweed).

Extended use of undiluted or high-percentage essential oils that are high in phenols or aldehydes may result in skin irritation. Phenol- or aldehyde-rich essential oils should be used with caution when the skin is already broken or inflamed. Avoid use of undiluted phenol-rich essential oils on the skin, as they can cause burning. Always use essential oils from a reputable supplier who can supply

1. The correct botanical name (there are 60 different kinds of thyme!);
2. Where the plant was grown;
3. Which part of the plant was distilled;
4. Gas chromatograph for chemical analysis;
5. Material safety data sheet.

Essential oils should be stored in brown or blue glass bottles in a cool dark place. They have a limited shelf life—up to six years in an unopened bottle stored in a cool place. The bottles should have integral droppers. The label should have the botanical name clearly marked and the words "pure, undiluted essential oil." There are many unscrupulous suppliers, so be careful what brand you use. Some recommended suppliers are listed in the resource guide (Table 2).

As with all skills, it is strongly advised that nurses undertake clinical training before trying to incorporate that skill into their nursing practice. Aromatherapy is a complicated subject and cannot be learned in a few hours. Look for a clinical training specifically aimed at nurses that gives nursing continuing education units. For information, see the resource guide in Table 2.

In conclusion, aromatherapy is a safe therapy that can be a powerful tool in the nursing care of AIDS/HIV patients. It can empower nurses who wish for a more holistic and hands-on approach. Such an approach may also substantially improve their work environment and help put the hospitality back into hospitals.

References

Altman, P. (1988). Australian teatree oil. *Australian Journal of Pharmacy*, *69*, 276-278.

Anderson, J., & Fennessy, P. (2000). Can teatree (*Melaleuca alternifolia*) oil prevent MRSA? *Medical Journal of Australia*, *173*, 489.

Barrett, S., Mummery, R., & Chattopadhyay, B. (1999). Trying to control MRSA causes more problems than it solves. *Journal of Hospital Infection*, *39*, 85-93.

Beal, M., & Nield-Anderson, L. (2000). Acupuncture for symptom relief in HIV positive adults: Lessons learned from a pilot study. *Alternative Therapies in Health and Medicine*, *6*(5), 33-42.

Belaiche, P. (1979). *Traite de phytotherapie et d'aromatherapie* (Vol. 1). Paris: Maloine Editoire.

Belaiche, P. (1985a). Treatment of vaginal infections of *Candida albicans* with the essential oil of *Melaleuca alternifolia*. *Phytotherapie*, *15*, 13-14.

Belaiche, P. (1985b). Treatment of skin infections with the essential oil of *Melaleuca alternifolia*. *Phytotherapie*, *15*, 15-17.

Benouda, A., Hassar, M., & Benjilali, B. (1988). The antiseptic properties of essential oils in vitro, tested against pathogenic germs found in hospitals. *Fitoterapia*, *59*, 115-119.

Beylier, M., & Givaudan, S. (1979). Bacteriostatic activity of some Australian essential oils. *Perfume and Flavorist*, *4*, 23-25.

Blumenthal, M. (Ed.). (1998). *The complete Commission E monographs: Therapeutic guide to herbal medicine*. Austin, TX: American Botanical Council.

Bonner, J. (1997). Hooked on drugs. *New Scientist*, *153*(2065), 24-28.

Boonchild, C., & Flegel, T. (1982). In vitro activity of eugenol and vanillin against *Candida albicans* and *Cryptococcus neoformans*. *Canadian Journal of Microbiology*, *28*, 1235-1241.

Buckle, J. (1997). *Clinical aromatherapy in nursing*. London: Edward Arnold.

Buckle, J. (1999a). Aromatherapy in perianesthesia nursing. *Journal of Perianesthesia Nursing*, *14*, 336-345.

Buckle, J. (1999b). Use of aromatherapy as a complementary treatment for chronic pain. *Alternative Therapies in Health and Medicine*, *5*(5), 42-55.

Buckle, J. (2000). Lavender for chronic pain. *Holistic Nursing Update*, *1*(5), 36-39.

Buckle, J. (2001a). Plant v petrochemical medicine. *International Journal of Aromatherapy*, *119*(1), 8-18.

Buckle, J. (2001b). The role of aromatherapy in nursing care. *Nursing Clinics of North America*, *36*(1), 57-72.

Burne, J. (1996, January 30). A spoonful of oil makes the medicine unwanted. *The Independent Newspaper (London)*, Sec. 2, pp. 4-5.

Caelli, M., Porteous, J., Carson, C., Heller, R., & Riley, T. (2000). Teatree oil as an alternative agent decolonization for methicillin-resistant *Staphylococcus aureus*. *Journal of Hospital Infection*, *46*, 236-237.

Cardellina, J. H., & Boyd, M. R. (1995). Pursuits of new leads to antitumor and anti-HIV agents from plants. In *Proceedings of the Phytochemical Society of Europe* (pp. 81-93). Oxford, U.K.: Oxford Science.

Carson, C., Cookson, B., Farrelly, H., & Riley, T. (1995). Susceptibility of methicillin-resistant *Staphylococcus aureus* to the essential oil of *Melaleuca alternifolia*. *Journal of Antimicrobial Chemotherapeutics*, *35*, 421-424.

Carson, C., & Riley, T. (1994). The antimicrobial activity of teatree oil. *Medical Journal of Australia*, *160*, 236.

Carson, C., & Riley, T. (1995). Antimicrobial activity of the major components of the essential oil of *Melaleuca alternifolia*. *Journal of Applied Biology*, *78*, 264-269.

Carson, C., & Riley, T. (1998). *Antimicrobial activity of teatree oil*. Report for the Rural Industries Research and Development Corporation, AMA House, 42 Macquarie Street, Barton, ACT 2600, Australia.

Chaumont, J., & Bardy, I. (1989). The in-vitro antifungal activities of seven essential oils. *Fitoterapia*, *60*, 263-266.

Cohen, R., Kucera, L., & Herrmann, C. (1964). Antiviral activity of *Melissa officinalis*. *Proceedings From the Society for Experimental Biology and Medicine*, *117*, 431-434.

Cordonnier, C. (1993, November). *Les traitment preventifs et curatifs des mycoses en oncohematologie*. Paper presented at Euromedicine 1993: Monpelier-Le Corum: 9emes Rencontres Internationals de Recherches et de Technologies Medicales et Pharmaceutiques, Paris.

Coss, R., McGrath, P., & Caggiano, V. (1998). Alternative care: Patient choices for adjunct therapies within a cancer center. *Cancer Practice*, *6*, 176-181.

Deans, S., Svoboda, K., & Kennedy, A. (1989). Biological activity of plant volatile oils and their constituents. *Planta Medica*, *55*, 588.

Dellacassa, E. (1989). Antimicrobial activity of eucalyptus essential oil. *Fitoterapia*, *60*, 544-546.

Dossey, B., Frisch, N., Forker, J., & Lavin, J. (1998). Evolving a blueprint for certification: Inventory of professional activities and knowledge of a holistic nurse. *Journal of Holistic Nursing*, *16*(1), 33-56.

Dossey, L. (2001). Being green: On the relationship between people and plants. *Alternative Therapies in Health and Medicine*, *7*(3), 12-16, 132-140.

Duke, J. (1992). *Handbook of biologically active phytochemicals and their activities*. Boca Raton, FL: CRC Press.

Dwyer, J. T., Salvato-Schille, A. M., & Couston, A. (1995). The use of unconventional remedies among HIV positive men living in California. *Journal of the Association of Nurses in AIDS Care*, *6*(1), 17-28.

Elion, R., & Cohen, C. (1997). Complementary medicine and HIV infection. *Complementary and Alternative Therapies in Primary Care*, *24*, 905-919.

Fasihi, A. (1996). *Complementary medicine* (Vol. 2). London: Financial Times.

Fawcett, J., Watson, J., & Neuman, B., et al. (2001). On nursing theories and evidence. *Journal of Nursing Scholarship*, *33*, 115-119.

Freeman, A., & MacIntyre, R. (1999). Evaluating alternative treatments for HIV infections. *Nursing Clinics of North America*, *34*, 147-163.

Frisch, N., Dossey, B., Guzzetta, C., & Quinn, J. (2000). *AHNA standards of holistic nursing practice*. Gaithersburg, MD: Aspen.

Fun, C., & Svendsen, A. (1990). The essential oil of *Lippia alba* (mill) NEBr. *Journal of Essential Oil Research*, *2*, 265-267.

Gabrielli, G., Loggini, F., Cioni, P., et al. (1988). Activity of lavandino essential oil against non-tubercular opportunistic rapid growth mycobacteria. *Pharmacol Res Commun*, *20*(Suppl. 5), 37-40.

Gattefosse, R. M. (1993). *Gattefosse's aromatherapy* (Trans. by R. Tisserand). Saffron Walden, U.K.: C. W. Daniels.

Geda, A. (1995). Antibacterial activity of essential oils and their combinations. *Fat Sci Tech*, *97*, 458-460.

Goldway, G., Teff, D., Schmidt, R., Oppenheim, A., & Koltin, Y. (1995). Multidrug resistance in *Candida albicans*: Disruption of the BEN gene. *Antimicrobial Agents and Chemotherapy*, *39*, 422-426.

Guenther, E. (1972). *The essential oils* (Vol. 6). Malabar, FL: Krieger.

Gulick, R., McAuliffe, V., Holden-Wiltse, J., Crumpacker, C., Liebes, L., Stein, D., et al. (1999). Phase 1 studies of hypericin, the active compound in St. John's wort, as an antiretroviral agent in HIV-infected adults. *Annals of Internal Medicine*, *130*, 510-514.

Harris, B. (1997). *The aromatherapy database*. Available from Essential Oil Resource Consultants, Au Village, 83840 La Matre, Provence, France.

Harris, B., & Harris, R. (1995). Essential oils as antifungal agents. *Aromatherapy Quarterly*, *44*, 25-27.

Hmamouch, M., Tantaoui-Elaraki, A., Es-Safi, N., & Agoumi, A. (1990). Illustration of antibacterial and antifungal properties of eucalyptus essential oils. *Plantes Medicinales et Phytotherapie*, *24*, 278-289.

Ironson, G., Field, T., Scafadi, F., Hashimoto, M., Kumar, M., Kumar, A., et al. (1996). Massage therapy is associated with enhancement of the immune system's cytotoxic capacity. *International Journal of Neuroscience*, *84*, 205-217.

Janowiak, J., & Hawthorne, G. (1999). A comprehensive approach to controlling allergies and asthma. *Alternative and Complementary Therapies*, *5*, 254-265.

Joesoef, M., & Schmid, G. (1995). Bacterial vaginosis: Review of treatment options and potential clinical indications for therapy. *Clinical Infectious Disease*, *20*(Suppl. 1), S72-S79.

Kacmarek, R. M. (1990). Editorial—Ribovarin and pentamidine: Caregivers beware! *Respiratory Care*, *35*, 1034-1035.

Kartnig, T., Still, F., & Reinthaler, F. (1991). Antimicrobial activity of the essential oil of young pine shoots (*Picea albies*). *Journal of Ethnopharmacology*, *35*(92), 155-157.

Kauffman, C., Terpenning, M., Xiaogong, H., Zarins, L., Ramsey, M., & Jorgensen, K. (1993). Attempts to eradicate methicillin resistant *Staphylococcus aureus* from long term care facility with the use of mupirocin ointment. *American Journal of Medicine*, *94*, 371-378.

Kerr, S., Kerr, G., MacKintosh, C., & Marples, R. (1990). A survey of methicillin-resistant *Staphylococcus aureus* affecting patients in England and Wales. *Journal of Hospital Infection*, *16*, 16-48.

Knobloch, K., Pauli, A., Iberl, B., Weigand, H., & Weis, N. (1989). Antibacterial and antifungal properties of essential oil compounds. *Journal of Essential Oil Research*, *1*, 119-128.

Koytchev, R., Alken, R. G., & Dundarov, S. (1999). Balm mint extract (L0-701) for topical treatment of recurring herpes labialis. *Phytomedicine*, *6*, 225-230.

Kucera, L., & Herrmann, E. (1967). Antiviral substances in plants of the mint family (*Labiatae*) tannin of *Melissa officinalis*. *Proceedings From the Society for Experimental Biology and Medicine*, *124*, 865-869.

Kufferath, F., & Mundualgo, G. (1954). The activity of some preparations containing essential oils in TB. *Fitoterapia*, *25*, 483-485.

Kusumoto, I. T., & Shimada, I. (1992). Inhibitory effects of Indonesian plant extracts on reverse transcriptase of an RNA tumour virus. *Phytotherapy Research*, *6*, 241-244.

Kwon-Chung, K., & Bennett, J. (1992). *Medical mycology*. Philadelphia: Lea & Febgier.

Ladariya, A., & Rao, J. (1979). In vitro antimicrobial studies of the essential oils of *Cyperus scarisous* and *Ocimum basilicum*. *Indian Drugs*, *16*(7), 150-152.

Larrondo, J., Agut, M., & Calvo-Torres, M. (1995). Antimicrobial activity of essences from labiates. *Microbios*, *82*, 171-172.

Larrondo, J., & Calvo, M. (1991). Effect of essential oils on *Candida albicans*: A scanning electron microscope study. *Biomedical Letters*, *46*, 269-272.

Lawless, J. (1992). *The encyclopedia of essential oils*. Shaftesbury, U.K.: Element.

Lindberg, B. (1997). *Advisory ruling: Board of Registration in Nursing*. Boston: Commonwealth of Massachusetts Division of Registration.

Mansfield, P. (1996). Animal experiments are an obstacle to health. *Holistic Health*, *50*, 4-7.

Maple, P., Hamilton-Miller, J., & Brumfit, W. (1992). Comparison of the in-vitro activities of the topical antimicrobials azelaic acid, nitrofurzone, silver sulphadiazine and mupirocin against methicillin-resistant *Staphylococcus aureus*. *Journal of Antimicrobial Chemotherapeutics*, *29*, 661-668.

Maury, M. (1989). *Marguerite Maury's guide to aromatherapy*. Saffron Walden, U.K.: C. W. Daniels.

May, V. G., & Willuhn, G. (1978). Antivirale Wirkung waBriger Pflanzenextrakte in Gewebekulturen. *Arzneim-Forsch/Drug Research*, *28*(1), 1-7.

Meruelo, D., Lavie, G., & Lavie, D. (1988). Therapeutic agents with dramatic antiretroviral activity and little toxicity at effective doses: Aromatic polycyclic diones hypericin and pseudohypericin. *Proceedings of the National Academy of Sciences*, *85*, 5230-5234.

Mundy, A. (2001). *Dispensing with the truth*. New York: St. Martin's Press.

Naguib, M. H., Naguib, M. T., & Flournoy, D. (1993). Mupiricon resistance in methicillin resistant *Staphylococcus aureus* from a veterans hospital. *Chemotherapeutics*, *39*, 400-404.

Nelson, R. (1997). In vitro activities of five plant essential oils against methicillin-resistant *Staphylococcus aureus* and

vancomycin resistant *Enterococcus faecium*. *Journal of Antimicrobial Chemotherapy*, *40*, 305-306.

Northrupp, C. (1995). *Women's bodies, women's wisdom*. London: Piatkus.

Nyirjesy, P., Weitz, M., Grody, M., & Lorber, B. (1997). Over-the-counter and alternative medicines in the treatment of chronic vaginal symptoms. *Obstetrics and Gynecology*, *90*, 50-53.

Obata, Y., Takayama, K., Machida, Y., & Nagai, T. (1991). Combined effect of cyclic monoterpenes and ethanol on percutaneous absorption of diclofenac sodium. *Drug Design and Delivery*, *1*(8), 137-144.

Onawunmi, G. (1989). Evaluation of the antimicrobial activity of citral. *Letters of Applied Microbiology*, *9*, 105-108.

Onawunmi, G., & Ogunlana, E. (1986). A study of the antibacterial activity of the essential oil of lemongrass. *Int J Crude Drug Res*, *24*(2), 64-68.

O'Toole, R., Drew, W., Dahlgren, B., & Beaty, H. (1970). An outbreak of methicillin-resistant *Staphylococcus aureus* infection: Observations in hospital and nursing home. *Journal of the American Medical Association*, *213*, 237-263.

Panossian, A., Wikman, G., & Wagner, H. (1999). Plant adaptogens 111: Earlier and more recent aspects and concepts on their mode of action. *Phytomedicine*, *6*, 287-300.

Pattnaik, S., Subramanyam, V., Bapaji, M., & Kole, C. (1997). Antibacterial and antifungal activity of aromatic constituents of essential oils. *Microbios*, *89*, 39-46.

Pattnaik, S., Subramanyam, V., & Kole, C. (1996). Antibacterial and antifungal activity of essential oils in vitro. *Microbios*, *86*, 237-246.

Pena, E. (1962). Meleleuca alternifolia oil: Its use for trichomonal vaginitis and other vaginal infections. *Obstetrics and Gynecology*, *19*, 793-795.

Penfold, A., & Grant, R. (1925). The germicidal values of some Australian essential oils and their pure constituents. *Journal of the Proceedings of the Royal Society*, *60*, 167-170.

Plotkin, M. (2000). *Medicine quest*. New York: Viking.

Pratt, R. (1995). *HIV and AIDS: A strategy for nursing care*. London: Edward Arnold.

Price, S., & Price, L. (1995). *Aromatherapy for health professionals*. London: Churchill Livingstone.

Radetsky, P. (1998). Last days of the wonder drugs. *Discover*, *19*(11), 76-88.

Riley, T., Carson, C., Bowman, R., Mulgrave, L., Golledge, C., Pearman, J., & Grubb, W. (1994). Mupirocin-resistant, methicillin-resistant *Staphylococcus aureus* in Western Australia. *Medical Journal of Australia*, *161*, 397-398.

Robinson, P., Mathews, H., & Witek-Janusek, L. (1999). Stress and HIV disease progression: Psychoneuroimmunological framework. Journal of the Association of Nurses in AIDS Care, *10*(1), 21-31.

Rodger, E. (1997). Chronic mucocutaneous candidiasis—A case study. *Journal of British Podiatric Medicine*, *52*, 9-10.

Savino, A., Lollini, M., & Menghini, A. (1994). Antimicrobial activity of the essential oil of *Pneumus boldus* (boldo): Aromatogram and electron microscopy observations. *Bollettino di Microbiologia e Indagini Laboratorio*, *14*(1), 5-12.

Schnaubelt, K. (1999). *Medical aromatherapy.* Berkeley, CA: Frog Ltd.

Sherry, E., Boeck, H., & Warnke, P. (2001). Percutaneous treatment of chronic MRSA osteomyelitis with a novel plant-derived antiseptic. *BMC Surgery*. Available at www.biomedcentral.com/1471/2482/1/1.

Shlay, J. C., Chaloner, K., Max, M. B., et al. (1998). Acupuncture and amitriptyline for pain due to HIV-related peripheral neuropathy. *Journal of the American Medical Association*, *280*, 1590-1595.

Soliman, F., El-Kashoury, E., Fathy, M., & Gonaid, M. (1994). Analysis and biological activity of the essential oil of *Rosmarinus officinalis L* from Egypt. *Flavour and Fragrance Journal*, *9*, 29-33.

Sowell, R., Moneyham, L., & Arnada-Naranjo, B. (1999). The care of women with AIDS. *Nursing Clinics of North America*, *34*, 179-198.

Stiles, J., Sparks, M., Ronzio, B., & Ronzio, R. (1995). The inhibition of *Candida albicans* by oregano. *Journal of Applied Nutrition*, *47*(4), 96-102.

Stolberg, S. (1998, August 2). Superbugs. *The New York Times Magazine*, pp. 42-48.

Storch, G., Radcliffe, J., Meyer, P., & Hinrichs, J. (1987). Methicillin resistant *Staphylococcus aureus* in a nursing home. *Infection Control*, *34*, 2193-2199.

Strausbaugh, L., Crossley, K., Nurse, B., & Thrupp, L. (1996). Antimicrobial resistance in long-term care facilities. *Infection Control and Hospital Epidemiology*, *17*, 129-140.

Styles, J. (1997). The use of aromatherapy in hospitalized children with HIV disease. *Complementary Therapies in Nursing and Midwifery*, *3*, 16-21.

Suresh, B., Sriram, S., Dhanarj, S., Elango, K., Chinnaswamy, K. (1995). Anticandidal activity of *Santolina chamaecyparisus* volatile oil. *Journal of Ethnopharmacology*, *55*, 151-159.

Targ, E. (2000). CAM and HIV/AIDS: The importance of complementarity. *Alternative Therapies in Health and Medicine*, *6*(5), 30-31.

Tisserand, R., & Balacs, T. (1995). *Essential oil safety.* London: Churchill Livingstone.

Torres, G. (1993). Treatment issues. *The Gay Men's Health Crisis Newsletter of Experimental AIDS Therapies*, *7*(8), 1.

Valnet, J. (1980). *The practice of aromatherapy.* Saffron Waldon, U.K.: C. W. Daniel.

Valnet, J., Duraffourd, C., Duraffourd, P., & Lapraz, J. (1978). New results and interpretations of 268 clinical tests using an aromatogram. *Plantes Medicinales et Phytotherapie*, *12*(10), 43-52.

Viollon, C., & Chaumont, J. (1994). Antifungal properties of essential oil components against *Cryptococcus neoformans*. *Mycopathologia*, *128*, 151-153.

Viollon, C., Leger, D., & Chaumont, J. (1993). The antagonistic properties in vitro, of specified natural volatile compounds with respect to the germs of the vaginal flora. *Plantes Medicinales et Phytotherapie*, *26*(1), 17-22.

Wannissorn, B., Jarikasen, S., & Soontorntanasart, T. (1996). Antifungal activity of lemongrass oils and lemongrass oil cream. *Physiotherapy Research*, *10*, 551-554.

Williams, D. (1996). *The chemistry of essential oils*. Weymouth, U.K.: Micelle Press.

Wolbling, R., & Leonhardt, K. (1994). Local therapy of herpes simplex with dried extract from *Melissa officinalis*. *Phytomedicine*, *1*, 25-31.

Yang, D., Michel, D., Mandin, D., Andriamboavonjy, H., Poitry, P., & Chaumont, J. (1996). Antifungal and antibacterial properties in vitro of three patchouli essential oils of different origins. *Acta Botanica Gallica*, *143*(1), 29-35.

Zollo, P. A., Biyiti, L., Tchoumbougnang, F., et al. (1998). Aromatic plants of tropical central Africa: Part 32. Chemical composition and antifungal activity of thirteen essential oils from aromatic plants of Cameroon. *Flavour and Fragrance Journal*, *13*, 107-114.