OLFAC TORY PREFERENCES IN HUMAN FEMALES

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By

Judy L. Stange, B.A.
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The purpose of this study was to determine if a relationship existed between olfactory preferences and sexual orientation in Heterosexual, Entire Life lesbian, and Adopted Lifestyle lesbian women.

Research in the area of olfaction and sexual behavior was reviewed and, on the basis of the literature, it was hypothesized that Heterosexual women would prefer male odors, Entire Life lesbian women would prefer female odors, and Adopted Lifestyle lesbian women would prefer male odors more than Entire Life lesbians.

The design involved having female subjects sniff male and female odors and indicate a preference for either the male or female odor. The odor samples were human apocrine gland secretions obtained by having odor donors wear gauze pads in their armpits. The odor collected on the pads was then stabilized through applications of alcohol and subsequent freezing.

Chi square analyses were performed on the data, and contingency coefficients were computed for between-group comparisons. It was found that there does appear to be a relationship between sexual orientation and olfactory preferences. In regard to Hypothesis 1, Heterosexual
women did appear to prefer the male odor at a level significantly greater than would be expected by chance. Hypothesis 2, that Entire Life lesbians would prefer female odors, was not supported, as the distribution obtained may have resulted by chance. Hypothesis 3 was not tested because insufficient subjects to fill the minimum expected cell frequencies for the data analysis fell into the Adopted Lifestyle group.

These results are discussed in relationship to previous theories of olfaction and sexuality, and limitations of the study and suggestions for future research are presented.
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The role of olfaction in chemical communication in insects and animals has been well researched, particularly in such areas as communication of sexual status, territorial marking, and aggression. Due to a variety of cognitive factors as well as input from other sense modalities, the role of olfaction has been less understood with humans. The sexual attraction of one individual to another as a result of scent has been reported in the literature, and a variety of research in human olfactory communication has recently been conducted, particularly in such areas as sexual behavior and menstrual synchrony. Comfort (1971) felt strongly that human sexual pheromones existed and felt that humans received sex signals that could be found to emanate from underarm odors.

The research that has been conducted with humans has dealt with heterosexual behavior and has been focused primarily on a search for a pheromone which stimulated coital activity between heterosexual couple. However, should olfaction play a role in heterosexual attraction, then it seemed plausible that it might also be involved in attraction between homosexual individuals. This study sought to explore this question by focusing not on actual sexual activity, but on the subjective preferences of
heterosexual and homosexual women to determine if hetero-
sexual women were more likely to prefer male odors and
homosexual women to prefer female odors.

Before continuing with a discussion of the role of
olfaction in human sexuality, some attention has been
given to the evolution of the term "pheromone" and to the
animal research on which many of the studies on olfaction
and human sexuality have been based.

Rogel (1978) noted that the existence of chemical
"messengers" which act through an olfactory mode was
originally established through research with insects. The
female silkworm moth was discovered to release a substance
which was extremely potent in eliciting immediate male
sexual behavior and in fact would induce a male moth to
fly long distances in search of the female who had emitted
the substance. Bethe (1932; cited in Wilson, 1975)
originally called these substances "ecto—hormones" or
"external hormones". However, Karlson and Luscher (1959)
felt that this term was somewhat inappropriate and renamed
these external chemical messengers "pheromones", from the
Greek pherein, "to transfer" and hormon, "to excite".

Karlson and Luscher (p. 55) stated that "pheromones
are defined as substances which are secreted to the outside
by one individual and received by a second individual of
the same species, in which they release a specific reaction,
for example, a definite behavior or a developmental process."
Wilson and Bossert (1963) expanded on the term "pheromone"
and felt that there were two basic types of pheromones,
each of which resulted in a different effect. Pheromones
that produced an immediate fixed behavioral response, such
as in the case of the moths mentioned above, were called
"releaser" or "signalling" pheromones by Wilson and Bossert.
They referred to those substances which produced a delayed,
often developmental response as "primer pheromones." Rogel
(1978) cited as an example of a primer pheromone the case
of honey bees, where the queen bee secreted a substance
which when ingested by the worker bees inhibited ovarian
growth and ability to lay eggs.

Animal Studies. Pheromone research with vertebrates
has established that pheromones seemed to communicate
several types of information, including sexual status
(Keverne & Michael, 1971); territoriality (Hediger, 1955;
Marsden & Holler, 1964; Mykytowycz, 1965); and individual
The pheromone itself may be emitted through several different
modalities, including in feces, urine, and through scent
glands on the body.

Bruce (1960) found that urine from an unfamiliar male
mouse could block the pregnancy of a female mouse that had
been recently inseminated by a familiar male mouse. However,
recently mated females rendered anosmic through ablation of the olfactory bulbs did not experience this effect (Bruce & Parrot, 1960). Lee and Boot (1955) found an increased occurrence of pseudopregnancy in four female mice grouped together as opposed to singly housed females (Lee-Boot effect). In a more complex series of experiments, Dewar (1959) showed that the incidence of pseudopregnancy was related to the grouping of the mice, and that the effect was temporary and normal cycles and estrus occurred when the mice were later isolated. Interestingly, housing of females in large groups of thirty resulted in highly significant incidences of anestrus (Whitten, 1959). But when a male was introduced into the large group, the females' cycles "synchronized" and on the third night after such introduction a significantly greater number of matings occurred than on any other night (Whitten effect), thus indicating a higher-than-chance frequency of estrus at that time. Interestingly, when male feces were introduced into the group, but not the male himself, the effect was seen (Whitten, 1958), thus suggesting the presence of a male pheromone found in feces. Further support for an olfactorily-acting pheromone was provided by Whitten (1956), who found that the effect did not occur among anosmic females.

In a study using golden hamsters, Murphy and Schneider (1969) found that removing the olfactory bulbs of sexually
naive and sexually experienced male hamsters resulted in a total elimination of their mating behavior. In blinded, unilaterally bulbectomized, and sham-operated controls, mating behavior remained essentially normal, again pointing to the operation of an olfactorily-acting pheromone in animals.

Gordon and Bernstein (1973) examined seasonal variations in mounting behavior in primates. They housed a group of female rhesus monkeys with a group of male monkeys. Another group of males only was housed so that they had no physical contact with the female/male group, but did have visual, auditory, and olfactory contact. Another group of males was housed in isolation so that they had no visual or olfactory contact with the females, but were within auditory range. When the females came into season, the males housed with them exhibited increased incidences of mounting and ejaculation. The second group of males, who were in visual and olfactory contact, also showed increased sexual activity, including mounting and ejaculatory behavior among themselves. The males who were completely isolated except for auditory contact showed no changes in sexual behavior. Gordon and Bernstein attributed these results to a seasonal change in female status that affected the males, either through a visual or an olfactory mode.

Vandenbergh (1969) noted that free-ranging rhesus monkeys breed with a distinct seasonal rhythm. However, it
was found that when female rhesus monkeys were prematurely brought into estrus through the administration of estradiol benzoate, male sexual behavior could be induced in the non-mating season. More support for an olfactory mode of communication was provided by the work of Michael and his associates. Michael and Keverne (1968) trained male rhesus monkeys to bar press to gain access to a female. Each male was paired with three ovarectomized females on different days, and one of the females (the control) received subcutaneous injections of estradiol throughout the experiment. The other two (experimental) females received no treatment at this point. The males regularly bar pressed and obtained access to the estrogenized female during a 22 day test period, but did so only occasionally for the untreated females. The males were then rendered anosmic by the use of nasal plugs, and at the same time the two previously untreated females began receiving estradiol. While the males continued to bar press for access to the control female who had been receiving estradiol throughout (although at a much lower rate than previously), they did not bar press for access to the experimental females. Control males who were not rendered anosmic, however, did respond to the experimental females at this time. After a two week test period, the experimental males' nasal passages were unblocked and upon reversal of the anosmia these males
began to bar press for access to the experimental females to whom they had not previously responded. This study seemed to provide support for olfactory communication of sexual status in female monkeys, although the fact that the males continued to respond to the control female even when rendered anosmic indicated that some other factors besides olfaction may be involved in primate sexual behavior. However, Michael and his colleagues believed that estrogen-izing females resulted in chemical changes and production of a substance (which they called Copulin) that stimulated male sexual behavior.

Keverne and Michael (1971) found that vaginal secretions collected from ovarectomized, estrogen-treated females that were then applied to the sex skin of ovarectomized, untreated females stimulated sexual behaviors in males. Further, the males were not sexually stimulated by those females when a control substance was applied.

Michael, Keverne, and Bonsall (1971) collected and analyzed samples of ovarectomized rhesus vaginal secretions following estrogen administration. Using gas chromatography, they were able to identify six types of acids that were active in vaginal secretions. They then synthesized these short-chain aliphatic acids. A test of their effectiveness found that the synthetic substance, or pheromone, when applied to an ovaractomized female, was successful in stimulating male sexual behavior.
Short-chain aliphatic acids can also be found in human vaginal secretions (Morris & Udry, 1978). Interestingly, Michael (1972) found that smearing human vaginal secretions on the sex skin of ovariectomized female rhesus monkeys also stimulated male rhesus sexual behavior. While this may provide some evidence of a possible human female pheromone, it might also reflect simply the effects of a novel stimulus on male rhesus sexual behavior.

In evaluating the research that had been aimed at isolating a sexual pheromone in non-human primates, it appeared that the evidence was mixed. A lengthy series of experiments seemed to substantiate that male rhesus sexual behavior may be stimulated by female vaginal secretions. Further, the effectiveness of these secretions appeared to be related to the presence of estrogen in the female, as ovariectomized, non-estrogenized females' secretions did not appear to stimulate male sexual activity. Also, some work had been successful in chemically synthesizing a substance (short-chain aliphatic acids) that appeared to stimulate male rhesus sexual behavior, thus providing further support for a pheromonal hypothesis. However, the evidence was not totally conclusive, and caution in evaluating this type of research is needed, particularly since some of the work of Michael and his colleagues has been criticized on the basis of small sample size and
selection of sexually responsive subjects (Goldfoot, Goy, Kravatz, & Freeman, 1976). While research has shown that olfactory cues may play some role in rhesus sexual behavior, these olfactory stimuli could not at the time be considered to be powerful releaser pheromones. Rather, it was likely that other factors, such as novelty of the stimulus or visual or auditory cues, may also have been involved in stimulating rhesus sexual activity.

Human Studies. Research in the area of pheromones and human sexual behavior has been conducted less frequently than rhesus research and has been less conclusive, due in part to difficulties in methodology and data collection. Further, because human sexual behavior appeared to be related to a variety of cognitive, emotional, and situational factors, it appeared unlikely that a releaser pheromone—a substance that stimulated immediate sexual behavior—would be found in humans.

However, studies of olfaction have provided some evidence that interrelated the olfactory processes and sexual behavior (Heath, 1972; Pribram, 1969; Pribram & Krugar, 1954). Pribram and Krugar found that olfactory input in humans was relayed via the nasal olfactory receptacles to the primary receptor sites of the prepyriform complex, the olfactory tubercle, and parts of the amygdaloid complex. Olfactory input was then sent from
these sites to secondary reception sites in the limbic system, particularly the hippocampus, the septum, and other parts of the amygdaloid nucleus.

Sexual behavior in humans also appeared to be associated with many of the sites to which olfactory input was channeled. Heath (1972) found that physiological signs of sexual arousal could be produced by stimulation of the amygdala and septal regions. He also reported that pleasurable feelings associated with sexual arousal could be elicited by stimulating hypothalamic pathways. Pribram (1969) found that penile erection and mounting could be effected in male animals by stimulating the septal region of the brain.

Clinical studies of human sexual behavior and olfaction have drawn largely on the work conducted with rhesus monkeys, and has sought a female vaginal source for a human pheromone. Since cyclicity in rhesus sexual behavior appears to be seasonal and related to estrogen levels of females, as noted by Vandenburgh (1969), and thus to differing odors of vaginal secretions, the search for pheromones in humans began with studies of cyclicity in sexual behavior. McCance, Luff, and Widdowsan (1937) and James (1971) reported that in humans coital activity was at a low level during menses, peaked in the follicular phase, and was again low in the luteal phase. In a 1968
study, Udry and Morris gathered daily reports of sexual behavior from two different population samples. The first group consisted of 40 premenopausal, married, working, non-white females, most of whom were of low educational level and held low status jobs. The second group consisted of 48 middle-class, mostly college educated married women. None of the women used oral contraceptives. In both samples, frequency of intercourse showed a sharp rise toward the middle of the menstrual cycle, a strong drop after the middle, and a second smaller rise toward the end of the cycle, although the absolute frequency of intercourse was different between the two groups. Udry and Morris concluded that cyclic variations in human sexual behavior were related to the menstrual cycle, and that sexual activity increased with increasing presence of estrogen in the body, around the time of ovulation. In another study, these same researchers found that women exhibited this cyclic fluctuation in sexual activity when they were not receiving contraceptive pills, but did not show a cyclic pattern when they were receiving pills (Udry & Morris, 1970). These results were attributed to the observation that contraceptive pills block ovulation and the estrogen-related changes in vaginal secretions which might influence sexual behavior do not then occur.

The search for a human pheromone has concentrated on chemically isolating a pheromone in human vaginal secretions.
A number of researchers (Michael, 1972; Michael, Bousall, & Warner, 1974; Huggins & Preti, 1976) found short-chain aliphatic acids in human vaginal secretions, with greater numbers of these acids present around the time of ovulation. These acid chains were of the same basic type as those found in rhesus females (Morris & Udry, 1978) and research has shown that these human aliphatic acids can stimulate sexual behavior in rhesus males (Michael, 1972). Presumably, these short-chain aliphatic acids may have been responsible for the cyclic changes seen in frequency of intercourse among humans, as the acids and frequency of copulation appeared to peak at the same time (around ovulation) in humans. In an attempt to further clarify the role of these acids in human sexual activity, Morris and Udry (1978) created a synthetic substance (presumably, they hoped, the active pheromone substance) which they used in a study of frequency of sexual intercourse. The substance was created to correspond to the acid peaks that Michael (1971) had found in a gas chromatography analysis of human vaginal secretions. Morris and Udry selected a number of married couples, all of whom used some form of contraception, but none of whom used contraceptive pills or the rhythm method. Sixty-two couples completed the study, which ran for three menstrual months. The couples were asked to file daily reports of occurrence of sexual intercourse, non-coital
sexual activity, menstruation, and periods of illness or time spent apart. Wives also measured their basal body temperature each morning. Four substances were used in the study: the "pheromone," alcohol alone, perfume in alcohol, and water. The couples received a set of coded treatments, each packaged in one-dose containers that were consecutively numbered for each day of the study, and randomized so that each of the four treatments appeared twice in eight days. Each wife was asked to apply the contents of one container to the skin of her chest each night before bed. No effect was found for any of the treatments on any of the dependent variables. However, Morris and Udry noted that the sample did not as a whole show the same cyclicity in frequency of intercourse as they had found in their earlier studies. They then broke down the group and looked at individual couples' patterns of sexual behavior. This yielded 12 couples who appeared to be cyclic in their sexual activity. In looking at the results of the study for these 12 couples only, they found a significant effect for the "pheromone" treatment on frequency of intercourse. This may provide some evidence that couples who were cyclic in their sexual behavior were more susceptible to the influence of vaginal acid odor. However, there were a number of methodological flaws that Morris and Udry note, including problems in determining the necessary or appropriate quantity and
proportions of each acid in the synthetic "pheromone," and the overall concentration of the "pheromone" as a whole. Further, they noted that their sample was very well-educated relative to the general population, and pointed out that based on previous studies (Udry & Morris, 1968; Morris & Udry, 1971) more educated individuals show less cyclicity in their sexual behavior than less educated couples. They concluded, finally, that they had not at this time isolated a synthetic human pheromone.

It was interesting to note the biases that have appeared in research on human pheromones. Rogel (1978) noted several of these biases, and questioned the assumptions of the predominantly male researchers in this field. She felt that several biases could be found in the research. She cited past research that had focused on finding a pheromone that emanated from the female. This assumption was questioned because in some animal species, a pheromone that emanated from the male had been shown to be necessary for sexual activity to occur. Hopson (1979) noted that in boars, the male had to emit a substance called "boar taint" which the female must have smelled before she assumed a sexually receptive position.

Rogel also noted that some lines of research had suggested that females were more sensitive to "biologically significant" odors than males. For example, in a 1950
study, Le Magnen (cited in Kalogerakis, 1963) tested a group of men and women to determine their sensitivity to exaltolide, a musk-like substance. He reported that 50-60% of the men were anosmic to exaltolide, while most of the others displayed a sensitivity of roughly 1:11 million. All women tested who had not undergone ovarectomy were sensitive to dilutions on the order of 1:1 billion. Also, variations in sensitivity during the course of the menstrual cycle were noted, and sensitivity increased at the time of ovulation to a value 100-100,000 times that present during menstruation. Le Magnen also found that six ovarectomized females were 100-1000 times less sensitive to the odor than non-ovarectomized women. Four of the ovarectomized women regained normal sensitivity when treated with estrogen. Other researchers, (e.g., Le Magnen, 1952; Schneider & Wolf, 1955; Koelega & Koster, 1974) using a variety of substances, had also found that females were more sensitive than males to what Le Magnen called "biologically significant" substances; and still other researchers had found that female sensitivity to various odors changed through the menstrual cycle, and greater olfactory detection ability occurred about the time of ovulation (Le Magnen, 1952; Vierling & Rock, 1967). Studies of this type suggested that future studies might well be directed toward a search for a male pheromone and its' role as well as for a female
pheromone, given the apparently greater female sensitivity to "biologically significant" odors.

Another criticism of Rogel's is that past studies of cyclicity in human sexual behavior had attempted to isolate a female pheromone of vaginal origin, and suggested that a search for a pheromone that was emitted from a different area of the body might be more fruitful. Morris and Udry (1978) attempted to isolate a female pheromone of vaginal origin, but it is of interest that they had their female subjects apply the substance to their chests, rather than to the vaginal area. Morris and Udry indicated that this was done because in most social or sexual interactions, humans were more likely to first come into contact with the upper body than with the genital area. Arguments of this sort, presented both by Rogel (1978) and Morris and Udry (1978), provided the rationale for using underarm apocrine gland secretions in the present study. However, it should be noted that genital secretions or odors may be important in sexual attraction between individuals.

Other arguments for the use of apocrine gland secretions collected from the underarm area were provided by Kuno (1956) and Shelley and Hurley (1953). Kuno (1956) felt that apocrine gland odor may be related to reproductive activity. He reported that apocrine secretions appeared to vary with the menstrual cycle, and that increased activity was seen during the premenstrual and menstrual phase. Also, Shelley and
Hurley (1953) noted that the apocrine gland began functioning at puberty and declined in activity in old age.

Moncrief (1966) reported that apocrine glands were found in a number of different body areas, including the axilla, the eyelids, the circumananal region, the mons pubis, the aureola and the nipple of the breast, the labia minora of the female, and the scrotum of the male, and that the heaviest concentration of apocrine glands was found in the axilla. Each of these glands produced upon stimulation, an odorless substance which took on its characteristic sweaty odor from bacterial action once it reached the surface of the body.

Several studies examined olfactory communications via apocrine gland secretions, although none of these focused on actual sexual behavior. Russell (1976) asked college students to wear T-shirts for 24 hours. The shirts were then collected and sealed in plastic bags. For the tests, shirts were placed in wax buckets which had a hole cut in them for sniffing. In the first test, subjects sniffed buckets containing their own shirt, an unfamiliar male's shirt, and an unfamiliar female's shirt, and were asked to identify their own shirt. Subjects were able to do so at a level significantly above chance. In the second test, subjects sniffed shirts belonging to the same unfamiliar male and female as in the first test, and were asked to identify which of the two shirts belonged to a male. Again subjects were able to do so. In another study of individual discrimination of humans by odor, Wallace (1977) found that
both male and female subjects were able to discriminate between two men, two women, and a man and a woman, on the basis of olfactory cues from the hand. These studies appeared to indicate that olfaction may play some role in recognition of individual humans and in recognition of gender by odor alone.

Probably the best case for olfactory communication between humans came from research in the area of menstrual synchrony and suppression. McClintock (1971) became interested in a study by Collet, Wertenberger, and Fiske (1954), who reported a higher percentage of anovulatory cycles for college age women than for older women. Although Collet et al., attributed this to a maturational factor, McClintock felt that it might be similar to the Lee-Boot effect in mice, in which female mice grouped together became pseudopregnant or anestrous. McClintock felt that groups of women living together were more likely to be anestrous than other women, and felt that this was due to an interpersonal factor as well as a maturational factor. Subjects were 135 females, aged 17-22 years, who lived in the same college dormitory. These women were separated into four groups: a) roommates; b) closest friends; c) close friend groups; and d) living groups (housed in close proximity to each other, but not roommates). Subjects were asked to provide data on dates their menstrual cycles began, duration of menstruation, and presence of dysmenorrhea. Subjects also indicated how often
each week they were in the presence of males, and how often they spent time with various female friends. These data were gathered from late September to early April. McClintock found that women who saw males less than three times per week experienced significantly longer cycles than the women who saw males with greater frequency. Additionally, McClintock looked at synchronization of menstrual cycles among the various groups. Synchronization referred to a reduction in the difference between menstrual onset dates between women. She found a significant increase in synchronization in the test period among roommates, closest friends, and roommates and closest friends combined, but not among the close friend groups or living groups. She was able to rule out effects of diet and light-dark cycles, and concluded that spending time together seemed to be the determining factor in synchrony occurring.

In another study, Russell, Switz, and Thompson (1976) found that spending time together was not necessary for synchrony to occur. They found a woman who reported a history of "driving" other women's cycles—by "driving," they meant that other females' menstrual onset dates frequently began to synchronize with those of the stimulus female. The experimenters had the stimulus woman wear gauze pads in her armpits to collect apocrine gland secretions. These pads were then extracted in alcohol, creating
an alcohol solution scented with the apocrine odors. Two groups of females participated in the study. One group had the apocrine/alcohol solution painted on their upper lips three times a week throughout the course of the study. The control group received alcohol only. Russell et al., found a significant increase in synchronization with the donor female among the experimental group, but not among the control group. This occurred even though the women in the study had no contact with the donor female, other than olfactory contact with her apocrine secretions.

These studies seemed to provide some support for eventually isolating a human pheromone that was present in apocrine gland secretions, and that appeared to have some effect on reproductive behaviors, specifically on female menstrual activity.

In considering the work that has been done on human olfactory communication and sexual activity, it seemed highly unlikely that a "releaser" pheromone would be found; that is, it was doubtful that a substance would be found in either vaginal secretions or in apocrine gland secretions that would have the effect of triggering immediate sexual behavior in humans. However, work by such researchers as McClintock (1971) and Russell et al., (1976) did seem to provide some evidence that human olfactory communication may be mediated through the action of primer pheromones.
These were pheromones which, rather than triggering an immediate behavioral response, initiated a delayed response or developmental process (Wilson & Bossert, 1963). This type of process seemed far more likely in light of the variety of cognitive, emotional, and situational factors which appeared to be involved in human sexual attraction and behavior.

Theories of Olfaction and Sexuality. A number of psychiatric accounts of the relationship between olfaction and human sexuality focused on symbolic relationships between the nose and the penis, and went on to describe nasal problems that were alleviated by treatment of an underlying sexual problem (e.g., Schneider, 1971; Hollender, 1972; Brady, 1975).

Beginning from psychiatric accounts such as these, several theorists went on to posit a developmental function for olfaction in the development of human sexuality. In one study, Stein, Ottenberg, and Roulet (1958) found that children ages 3-4 found the odors of feces, sweat and amyl acetate pleasant, but that around age 5 there was a sharp decrease in the number of "like" responses, postulated to the associated with the Oedipal period. They stated that the response changes seen may have been due to the "panrepression of erotic drives that is initiated by the Oedipal conflict." Based on studies such as this, as well
as upon a number of anecdotal accounts and case histories, Bieber (1959) developed a theory of olfaction and sexuality. Bieber felt that at some point in human development, which he believed to be during the Oedipal phase, heterosexual reactivity sets in. He felt that heterosexual reactivity (the capacity to react with sexual excitation to a heterosexual object) was an inevitable physiological potential and stated that observations, particularly upon homosexuals, had convinced him that there was an early sexual responsivity to heterosexual objects and that this reaction was biologically inevitable if (1) heterosexual objects were present in the environment and (2) if nutrition was adequate. Bieber went on to explain his assumptions that heterosexual reactivity was mediated through either one sensory modality or a combination of sensory modalities. Specifically, he felt that some alteration in the physiology of one or more sensory modalities accounted for the development of heterosexual reactivity. Bieber felt that the sensory modality involved was that of olfaction, and cited evidence supporting changes in olfactory physiology in relation to sexual functioning. Bieber also asserted that there were no comparable physiological changes in any of the other sensory modalities that were related to sexual functioning.

Bieber conceptualized that somewhere between the ages of 2 and 5, "development of the gonads and central nervous
system reaches a state of organization wherein the individual reacts with excitation to sexual odors (and that) this reactivity is evidence of a change in the physiology of the gonads, the central nervous system, and the physiology of olfaction (p. 856)." Once an individual was able to identify sexually exciting odors, Bieber felt that the other sensory modalities then came into play, and sexual excitation could then be elicited by the other sensory modalities. Thus, Bieber maintained that while olfaction may be the primary modality in early heterosexual reactivity, it does not necessarily remain the dominant modality in adult heterosexual reactivity, as vision, touch, and hearing become involved.

Other theorists have also maintained that olfaction plays a primary role in sexual development, such as Kalogerakis (1963), who presented a number of reports of patients who related dreams connecting olfactory content and sexual themes, often related to incestuous fears. He also cited case materials describing one young boy's reactions to the odors of his parents. Kalogerakis suggested "a possibly biological basis for the establishment of sexual identity, in which olfaction would play a crucial role. Specifically, this would involve attraction to the body odors of the heterosexual parent, and concomitantly, repulsion from the odors emitted by the parents of the same
sex . . . (p. 430). These reactions would not be expected to determine the child's overall attitude to each of his parents but would form a basic biological substratum for the development of his sexual identity and sexual relatedness to the adult male and female (p. 431)."

Both Kalogerakis and Bieber asserted that sexual identity was established at an early age, with olfaction playing a primary role in its development. While they cited numerous case histories and observations of correlated physiological changes of olfactory mechanisms and sexual mechanisms, they unfortunately provided little data to support their theories. However, in view of the research which has been conducted on chemical communication among animals, it may be that their theories are viable. Further, research by such individuals as McClintock (1971) and Russell et al., (1976) on menstrual synchrony and suppression also suggested that chemical communication and reproductive processes were linked in humans.

Kalogerakis and Bieber addressed their theories to the development of heterosexual identity, and felt that children acquired, or were biologically predisposed to learn, a preference for the odor of opposite-sexed individuals, and that the other sensory modalities were then brought into line to correspond to the preference. Bieber explicitly stated that this was an inevitable occurrence, and felt
that heterosexual reactivity was virtually inevitable for all individuals. Indeed, he stated that some of the interviews on which his theory was based were conducted on homosexuals. Unfortunately, he did not elaborate on this point, nor did he include histories of either his homosexual or heterosexual respondents.

Bieber’s and Kalogerakis’ theories that olfaction played a role in the development of heterosexual reactivity were intriguing. However, while both theorists cited various cases in which olfaction and sexuality were related, no empirical studies had been conducted which examined odor preferences of heterosexual or homosexual individuals. Bieber and Kalogerakis both felt that heterosexual reactivity developed at an early age as a result of an olfactory process, and Bieber specifically stated that all individuals developed an initial heterosexual reactivity. Their theories proposed a developmental role for olfaction in the development of sexual reactivity, and a number of different studies could be designed to address this issue. However, the initial step in the process of research seemed to be simply to determine whether heterosexual and homosexual individuals preferred the odors of opposite-sex individuals or whether there were differences, where heterosexual individuals preferred the odors of opposite-sex individuals and homosexual individuals preferred the odor of same-sex
individuals. This writer has accumulated a considerable amount of anecdotal information which suggested there may be differences in the odor preferences of women who reported being homosexual their entire lives and those who indicated that they adopted a homosexual lifestyle later in life, after an earlier period of heterosexual reactivity. Specifically, "entire life" homosexual women had indicated that they were very aware of and responsive to the odors of other women, while "adopted lifestyle" homosexual women indicated that they were aware of odors from men, but not from other women.

The purpose of this study was to investigate the role of olfaction in human sexuality; specifically, to determine whether there were differences in preference for same-sex versus opposite-sex odors among three different groups of women who reported themselves to be a) heterosexual; b) "entire life" homosexuals; or c) "adopted lifestyle" homosexuals. For the purposes of this study, heterosexuals were considered to be those women who indicated that they practiced heterosexual behavior by their response on the Kinsey scale of homosexual behavior (Kinsey, Pomeroy, Martin, & Gebhard, 1953), and reported heterosexual feelings on the Bell and Weinberg (1978) adaptation of Kinsey's scale. "Entire life" homosexuals were those women who reported lifelong histories of homosexual behavior and feelings on
the Kinsey and the Bell and Weinberg scales. Herman (1947) noted that there appeared to be two different types of homosexuality, one of which began in childhood and the other which appeared later in life. The "Entire Life" group as defined above reflects the first type of homosexuality described by Herman, and the "Adopted Lifestyle" group then reflects the second type of homosexuality, which appears later in life. Thus, the "Adopted Lifestyle" group was composed of women who indicated on the Kinsey and Bell and Weinberg scales that they currently practiced homosexuality but had undergone a substantial period of heterosexual activity earlier in their lives.

In the remainder of this study, the terms "Heterosexuals," "Entire Life" homosexuals, and "Adopted Lifestyle" homosexuals will be referred to without the use of quotation marks in order to provide ease in reading. However, the reader is reminded that these were groups which carried special definitions as outlined above. The term "Combined Lesbians" group was used in those situations where the data from the Entire Life lesbian and Adopted Lifestyle lesbians groups were combined.

The specific questions to be investigated in this study were as follows.

1. Do women who are deemed heterosexual prefer the odor of aroused opposite-sex individuals as opposed to having no preference or preferring the odors of aroused same-sex individuals?
2. Do women deemed entire life homosexual prefer the odor of aroused same-sex individuals as opposed to having no preference or preferring the odors of aroused opposite-sex individuals?

In order to address these questions, it is hypothesized, on the basis of the literature, that:

1. Persons who indicated that they were practicing heterosexuals would prefer the odor of aroused opposite-sex individuals as opposed to having no preference or preferring the odors of aroused same-sex individuals.

2. Persons who indicated that they were entire life homosexuals would prefer the odor of aroused same-sex individuals as opposed to having no preference or preferring the odors of aroused opposite-sex individuals.

Method

The purpose of this study was to investigate the role of olfaction in human sexuality and to determine if same-sex odors or opposite-sex odors were selected as their preference by women reporting different sexual orientations.

Subjects

Data for this study was obtained from 55 females ranging in age from 18 to 36. These women were selected by requesting volunteers from college classes and from student organizations within a college community.

Materials

A questionnaire was utilized which asked subjects to provide demographic information as well as to respond to
a variety of questions regarding their sexual feelings and behavior. Two questions were taken from the scale of sexual behavior developed by Kinsey and his associates which asks subjects to rate themselves on a scale of sexual behavior ranging in value from one to seven. A value of one indicated exclusively heterosexual behavior while a value of seven indicated exclusively homosexual behavior, with the points 2–6 inclusively being various combinations of heterosexual and homosexual behavior (Kinsey, Pomeroy, Martin, & Gebhard, 1953).

Bell and Weinberg (1978) adapted the Kinsey scale to include ratings of heterosexual or homosexual feelings using a similar seven-point scale, and these questions were also included in the questionnaire.

A number of items adopted from Van Buskirk (1979) were included in the questionnaire for the purpose of providing additional data for developing future research in this area.

Materials used to gather and preserve odors from scent donors included 3 x 3 cotton gauze pads, isopropyl alcohol, amber-colored glass laboratory bottles, and glass eyedroppers. Also utilized were four foam ice chests and a sufficient amount of dry ice to fill each chest half way.

The materials for the olfactory acuity screening test consisted of five pairs of two ounce amber colored
glass bottles. One bottle in each pair was filled with distilled water. The other bottle in each of the five pairs was filled with distilled white vinegar and water solution of varying concentrations. The concentrations ranged from 1 part vinegar to one part water up to a concentration of one part vinegar to 16 parts water. The intermediate concentrations were 1 part vinegar to 2 parts water, 1 part vinegar to 4 parts water, and 1 part vinegar to 8 parts water.

**Procedure**

**Odor Collection.** Odor donors consisted of two white males and two white females. Each donor was recruited by the author, who described the study to them, and participation was voluntary. Donors were asked to bathe only with Ivory soap and refrain from using deodorants or perfumes for a period of 24 hours before the actual odor collection. Female donors were also requested to report on the onset dates of the last two menstrual cycles. These dates were then used to calculate expected onset of the next cycle. Using this information, reverse cycle days were calculated so that odor collection occurred during the expected follicular phase (reverse days 15-17 were used). Females using birth control pills were excluded as possible odor donors, due to possible hormonal changes associated with contraceptive pill use.
Kuno (1956) noted that physiological changes accompanying sexual arousal may affect scent gland secretions. Thus, for the actual odor collection, donors were asked to tape the 3 x 3 gauze pads to their armpits for a period of two hours and then, still wearing the pads, to masturbate to orgasm. Donors were then asked to place each gauze pad in a separate glass laboratory bottle within 15 minutes after attaining orgasm and to apply five drops of alcohol to each pad using the eyedropper in order to stabilize and retain the odor (Owen, 1981). Donors then sealed the bottles and placed them in an ice chest containing dry ice. The odor samples were collected from each donor the following day, and were placed in a freezer where they remained until they were needed. All odor samples were collected within 48 hours of the date on which the experiment was conducted. Thirty minutes prior to testing subjects, the bottles were removed from the freezer and allowed to come to room temperature but remained sealed.

**Odor Evaluations.** Subjects who volunteered for the experiment were instructed not to smoke for one hour prior to the experiment, and not to use deodorant, cough drops, breath mints, or sprays. Subjects arriving for the experiment were seated in a waiting area. Subjects were informed about the study and told that the research involved sniffing a number of different scents and their
indicating a preference, as well as their responding to a questionnaire about sexual attraction and behavior. Subjects were not told the source of the scents. Informed consent forms were distributed and explained to the subjects, and questions were answered.

Two rooms were prepared for conducting the odor evaluations. In each room were two partitioned areas and room temperature was equated at 68° Fahrenheit in each room. In each area were two bottles, one containing a male scent and the other a female scent. Each bottle was labelled with a letter identifying it to the experimenter. Male-female scent sample pairs were randomly formed by the toss of a die, and all subjects were thus exposed to the same pairs of samples. The order of presentation of the samples was counterbalanced.

Upon entering the room, the subject was seated at the table holding the first pair of samples. Subjects were told that each bottle contained a different scent suspended in an alcohol solution. She was then instructed to remove the stopper from each bottle in turn, sniff each scent for no more than 15 seconds, without touching her nose to the bottle, and indicate a preference for one or the other by circling a letter on the answer sheet. Each subject, after a two minute recuperation period, moved to the next area and completed the same procedure for the other pair of scents.
Subjects were then administered an olfactory acuity test developed by Hopson (1979). The test consisted of having subjects sniff pairs of bottles containing either pure distilled water or a vinegar and water solution. Each subject was first exposed to the pair containing a solution of one part vinegar to 16 parts water. If she could correctly identify the bottle containing the vinegar solution, she was considered to have passed the screening test. If not, the other pairs were administered in sequence from weakest (1:8 concentration) to strongest (1:1 concentration). To pass the olfactory screening test, the subject had to correctly identify the bottle containing the vinegar solution at either the 1:16 concentration level or the 1:8 concentration level.

Subjects were then taken to another room where they were asked to complete the Behavioral History Questionnaire. Upon completing the questionnaire, subjects were debriefed and dismissed.

Group Assignment. Subjects were assigned to the Heterosexual, Entire Life lesbian, or Adopted Lifestyle lesbian groups on the basis of their responses to questions 4-8 on the Behavioral History Questionnaire. Each subject was asked to respond to these questions about sexual feelings or behavior by circling a response number that could range in value from one to seven. The values of the
responses to these questions were then summed to yield a total score which became the basis for group assignment. Total scores of 5—10 placed a subject in the Heterosexual group, a total of 26—30 placed her in the Adopted Lifestyle group, and a score of 31—35 in the Entire Life group. For example, a woman who circled answer number one (exclusively heterosexual) to each of the five questions would obtain a total score of 5 and would be placed in the Heterosexual group. A woman who chose answer 7 (exclusively homosexual) for her response to each item would achieve a total score of 35, placing her in the Entire Life group.

Of the 55 subjects who participated in the study, 23 were classified by this method as Heterosexual, 15 as Entire Life lesbians, and 13 as Adopted Lifestyle lesbians. Two women were bisexual and their responses did not meet the criteria for inclusion in any group and their data were not included in the results. Two women did not pass the olfactory acuity screening test and their data were also omitted.

**Results**

Preferences of subjects were defined so that if a subject indicated a preference for the male scent on each of the two odor evaluations, she was considered to have demonstrated a preference for male odors. Selecting the female scent on both of the odor evaluations was considered to
demonstrate a preference for female odors. Selecting a male scent on one trial and a female scent on the other was considered to reflect no preference. Frequencies of these occurrences are summarized in Table 1.

Table 1

Preferences of Heterosexual, Entire Life Lesbian and Adopted Lifestyle Lesbian Women for Male or Female Scents

<table>
<thead>
<tr>
<th>Group</th>
<th>Preferred Male Scents</th>
<th>No Preference</th>
<th>Preferred Female Scents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Frequency</td>
<td>Frequency</td>
</tr>
<tr>
<td>Heterosexual</td>
<td>14</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Entire Life Lesbians</td>
<td>6</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Adopted Lifestyle Lesbians</td>
<td>5</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

Between-Group Analyses

For further comparisons, the data of the Adopted Lifestyle group was combined with that of the Entire Life lesbian group, and this was referred to as the Combined Lesbian group. Table 2 summarizes the responses of the Heterosexual group and the Combined Lesbian group. For purposes of the analysis, the categories of "no preference" and "preferred female odors" were collapsed into one category. The chi square did not reach significance (\( \chi^2 = 2.3558, p < .20, df = 1 \)).
Table 2

Chi Square Analysis of Preferences of Heterosexual and Combined Lesbian Groups for Odors of Aroused Males or Aroused Females

<table>
<thead>
<tr>
<th>Group</th>
<th>Preferred Male Odors</th>
<th>No Preference or Preferred Female Odors</th>
<th>Chi Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>Frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterosexual</td>
<td>14</td>
<td>9</td>
<td>2.3558</td>
</tr>
<tr>
<td>Combined Lesbian</td>
<td>11</td>
<td>17</td>
<td></td>
</tr>
</tbody>
</table>

Table 3 presents the chi square of the Heterosexual and the Entire Life lesbian groups on preferences for odors of aroused males or aroused females. The chi square did not reach significance ($\chi^2 = 1.589, p < .30, df = 1$).

Table 3

Chi Square Analysis of Preferences of Heterosexual and Entire Life Lesbian Women for Odors of Aroused Males or Aroused Females

<table>
<thead>
<tr>
<th>Group</th>
<th>Preferred Male Odors</th>
<th>No Preference or Preferred Female Odors</th>
<th>Chi Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>Frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterosexual</td>
<td>14</td>
<td>9</td>
<td>1.589</td>
</tr>
<tr>
<td>Entire Life Lesbian</td>
<td>6</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

The results from the chi square analyses presented in Table 2 and Table 3 suggest that sexual orientation, as defined
by the Heterosexual, Entire Life lesbian and Combined Lesbian groups, does not appear to be related to preference for odors of aroused males or aroused females at a level significantly above chance.

Within-Group Analyses

Using the frequencies reported in Table 1, a 1 X 2 (group X odors) chi square analysis was performed for the Heterosexual group. The chi square was significant ($\chi^2 = 9.5763, \ p < .01, \ df = 2$), with more women preferring the male scents than would have been expected by chance.

The chi square for the Entire Life group did not reach significance ($\chi^2 = 5.2, \ p < .10, \ df = 2$), and the chi square for the Combined Lesbian group also did not attain significance ($\chi^2 = 4.8031, \ p < .10, \ df = 2$).

Discussion

The results of the present study appear to provide support for Hypothesis 1, that Heterosexual women would prefer the odors of aroused males to those of aroused females. The obtained frequencies depart significantly from those that would have been expected by chance, and the pattern of the obtained frequencies indicates that this departure is attributable to a preference for male odors by Heterosexual women or to a tendency to avoid the female odors, and thus choose the male odors instead. Such a finding was expected on the basis of Bieber's (1959) and Kalogerakis' (1963) assertions that an initial olfactory reactivity may be formed
during childhood which may be reflected by preferences for male odors in adulthood, thus leading to the contention that heterosexual women may exhibit a preference for male odors due to a learning factor or to a biological predisposition. One may postulate that due to gender identification in sexual experiences, heterosexual women may have learned to associate male odors with pleasurable or desirable experiences and this learning may be reflected in their preferences.

Hypothesis 2 was not supported in the present study. The frequencies of preferences obtained from the Entire Life lesbian group did not attain statistical significance, thus suggesting that the observed differences in odor preference may have resulted by chance. For this group, then, the results obtained may have been due to chance rather than to a differential preference of Entire Life lesbian women for odors of aroused males or aroused females. While not reaching statistical significance, observation of the attained frequencies suggests that Entire life lesbian women may tend to exhibit no clear preference for male or female odors. This might suggest that in Entire Life lesbians an initial reactivity to male scents may have been established during childhood, but that in some of these women this reactivity has been modified by post-pubertal experiences. If this was the case, the assertions of Bieber (1959) and Kalogerakis (1963) that heterosexual reactivity was established through an olfactory mode during childhood might be accurate, but
their belief that this preference maintains throughout the lifetime might be open to question.

The chi square for the Combined Lesbian group did not reach significance. However, it is interesting to note that for this combined group, the trend appeared to be toward these women preferring the aroused male odor or expressing no preference, rather than preferring the odors of aroused females. One explanation for this might be that women, as Bieber (1959) and Kalogerakis (1963) would suggest, through biological predisposition or early learning, form an initial reactivity to male scents and that this reactivity is reflected in the present study through these women's tendency to prefer odors of aroused males. However, it may be that the frequencies obtained reflect the preferences of two groups, Entire Life lesbians and Adopted Lifestyle lesbians, who may be different in terms of their olfactory preferences.

If women who report homosexual feelings and behavior throughout their lifetimes are different from those women who report early heterosexual histories followed by later homosexual activity, as Herman (1974) would suggest, then these women may have different olfactory preferences. Specifically, women who have been homosexual throughout their lifetimes may have learned, or been biologically predisposed to acquire, a preference for the odors of same-sex individuals. Women who were heterosexual in adolescence and early adulthood, and who later became homosexual, may
have acquired, or been predisposed to acquire, a preference for odors of the opposite sex. If this were the case, combining these two lesbian groups might mask these preferences.

In this study, the frequencies of preferences obtained for the Entire Life group suggests that these women might not prefer the odor of same-sex individuals, as noted above, and this group's preferences may not differ significantly from Heterosexuals or from Adopted Lifestyle lesbians. However, failure to obtain significant differences among these groups may be related to difficulty in assigning women to the groups. This difficulty may have stemmed from the use of a self-report questionnaire for assigning subjects to groups. This did not appear to impact greatly on the Heterosexual group which seemed to be homogeneous in that none of these women reported sexual experiences with other women. However, the questionnaire format may have presented some problems in assigning women to the Adopted Lifestyle lesbian group or to the Entire Life lesbian group. For example, what one woman might consider "substantial" heterosexual behavior might be reported by another as "slight" heterosexual activity and even though the quantity and degree of heterosexual behavior engaged in by two different women might be the same, differences in interpretation might have resulted in differential responding to items. This could have resulted in some women who had actually had very little heterosexual behavior being placed in the
Entire Life group as a function of differences in their interpretation of and response to the questionnaire items.

Another factor that must be considered is that of age of the subjects. While the age range of women in the study was 18-36, the vast majority of these women were between the ages of 18 and 22. Bell and Weinberg (1978) noted that over 50% of the women who report being homosexual do not adopt such a lifestyle until the age of 23 or older. The relatively young sample reflected in this study may differ somewhat from women who adopted a lesbian lifestyle at a later age, and these young women might in some ways be more similar to Entire Life lesbians than would women who adopted a lesbian lifestyle at a later age, and thus presumably after a relatively longer period of heterosexual activity.

Another issue raised in the present study is that the preferences of these subjects may be preferences for the odors of individual donors who were sexually aroused through masturbating to orgasm. Preferences of subjects may or may not be the same if odor donors did not masturbate to orgasm. An interesting variation of this study would be to achieve sexual arousal in donors through another mode, such as the use of erotic movies or literature, rather than through the mechanical means of masturbation, as the qualitative differences in arousal achieved through different modalities might affect scent gland secretions and hence preferences of subjects.
Another variation might be to use odors of donors who wore gauze pads while going about their daily business, and who were not sexually aroused, to determine if sexual arousal of donors resulted in differences in olfactory preferences.

Additionally, both heterosexual and homosexual odor donors might be utilized, to determine if differences existed among heterosexual and homosexual individuals in preferences for odors of other heterosexual or homosexual individuals. For example, it might be found that homosexual women showed strong preferences for odors of other homosexual women, but not for the odors of heterosexual women, and might suggest possible differences in the odors emitted by individuals of different sexual orientations, as well as in preferences of subjects who were homosexual or heterosexual.

Another possible problem in the present research was that the odors obtained from scent donors may have been masked by the use of alcohol in preserving the odors. It was interesting that none of the subjects were able to identify the source of the scents. In future research, scents might be collected on the day of the study and presented to subjects without alcohol being used to preserve the scents. Of course, pilot studies would need to be conducted to determine how long odors remained on the pads without the use of alcohol, in order to insure that subjects were exposed to consistent concentrations of the odors.
In other variations of this research, a discrimination test might be developed to eliminate subjects who could not discriminate the test odors from a neutral stimulus. For example, such a test might consist of having subjects sniff a male odor, a female odor, and a neutral substance such as distilled water. Subjects who could not correctly identify the human scents from the neutral substance over a number of trials would be eliminated from the study. Another type of study might involve having subjects evaluate and rank-order scents from a number of different donors, in order to minimize effects of individual differences in odors obtained from donors.

Ideally, a longitudinal study designed to assess olfactory preferences throughout childhood and early adulthood, in conjunction with periodic reports of an individual's sexual experiences, might also be designed to help clarify issues associated with the relationship between olfaction and sexuality. Future research might also include the utilization of male subjects for comparative purposes. Additionally, different dependent measures, such as physiological measures of sexual response to male and female odors, might be added.

In closing, it must be emphasized that causality cannot be assumed when considering these results. It is of interest that heterosexual women in this study appeared to prefer the odors of sexually aroused opposite-sex individuals. However, the results obtained in this study are not sufficient data upon which to base any statements of etiology or causality.
for either homosexual or heterosexual behavior. Neither do these results confirm or disconfirm any theory of olfactory factors in the development of sexual reactivity. What this study does, however, is to provide a base for further research in this area and provide suggestions for continuing this line of study.
Appendix A
FORM 2
USE OF HUMAN SUBJECTS
INFORMED CONSENT

NAME OF SUBJECT:

1. I hereby give consent to Judy Stange to perform or supervise the following investigational procedure or treatment:
   - administration of scent preference test involving sniffing and indicating a preference for various odors;
   - administration of a questionnaire covering sexual attitudes and/or behavior

2. I have (seen, heard) a clear explanation and understand the nature and purpose of the procedure or treatment; possible appropriate alternative procedures that would be advantageous to me (him, her); and the attendant discomforts or risks involved and the possibility of complications which might arise. I have (seen, heard) a clear explanation and understand the benefits to be expected. I understand that the procedure or treatment to be performed is investigational and that I may withdraw my consent for my (his, her) status. With my understanding of this, having received this information and satisfactory answers to the questions I have asked, I voluntarily consent to the procedure or treatment designated in Paragraph 1 above.

   Date

   SIGNED: ___________________   SIGNED: ___________________
   WITNESS                  SUBJECT
   or

   SIGNED: ___________________   SIGNED: ___________________
   WITNESS                  PERSON RESPONSIBLE
   Relationship
Instructions to persons authorized to sign:

If the subject is not competent, the person responsible shall be the legal appointed guardian or legally authorized representative.

If the subject is a minor under 18 years or age, the person responsible is the mother or father or legally appointed guardian.

If the subject is unable to write his name, the following is legally acceptable: John H. (His X Mark) Doe and two (2) witnesses.
Appendix B

Subject #
Code

You will shortly be asked to sniff several pairs of scents and indicate a preference for one of each pair. These scents are in an alcohol base. Each sample does contain a scent, though some may be very faint and some rather stronger. You will be allowed a minimum of 15 seconds to sniff each sample of the pair, and will have a 2 minute rest between pairs.

Please circle the letter corresponding to the scent you prefer.

Sample 1:
- I prefer Scent A  Scent B

Sample 2:
- I prefer Scent A  Scent B

Can you identify the scents that were used? If so, please list what you think they might have been.

Sample 1
- Scent A
- Scent B

Sample 2
- Scent A
- Scent B
Appendix C

BEHAVIORAL HISTORY QUESTIONNAIRE

The following items ask you to respond to some questions about yourself and about your sexual feelings and behavior. Remember that your answers to these questions will be kept strictly confidential and you will be identified only by a number.

Instructions: Read each question and select the one best answer. Mark your answers by circling the number of your response. Work as quickly as you can in answering these questions.

1. Age:
   1. 17-19
   2. 20-22
   3. 23-25
   4. 26-30
   5. 31-40
   6. 41-50
   7. 51 and over

2. Education:
   1. grade school
   2. some high school
   3. high school graduate
   4. some college
   5. college degree
   6. some graduate work
   7. graduate degree

3. How did you hear about this study?
   1. through friends
   2. in class
   3. newspaper ads

4. Rate yourself as you see yourself now, at this point in time, in terms of your actual sexual behavior.
   1. exclusively heterosexual behavior
   2. mainly heterosexual with a slight degree of homosexual behavior
   3. mainly heterosexual with a substantial degree of homosexual behavior
   4. as much heterosexual as homosexual behavior
   5. mainly homosexual with a substantial degree of heterosexual behavior
   6. mainly homosexual with a slight degree of heterosexual behavior
   7. exclusively homosexual behavior
Appendix C—Continued

5. Rate yourself as you see yourself now, at this point in time, in terms of your feelings. Think about how you actually feel, rather than considering whether or not you act on those feelings.
   1. exclusively heterosexual feelings
   2. mainly heterosexual with a slight degree of homosexual feelings
   3. mainly heterosexual with a substantial degree of homosexual feelings
   4. as much heterosexual as homosexual feelings
   5. mainly homosexual with a substantial degree of heterosexual feelings
   6. mainly homosexual with a slight degree of heterosexual feelings
   7. exclusively homosexual feelings

6. Thinking back on your entire life, rate yourself in terms of your sexual behavior throughout your lifetime.
   1. exclusively heterosexual behavior
   2. mainly heterosexual with a slight degree of homosexual behavior
   3. mainly heterosexual with a substantial degree of homosexual behavior
   4. as much heterosexual as homosexual behavior
   5. mainly homosexual with a substantial degree of heterosexual behavior
   6. mainly homosexual with a slight degree of heterosexual behavior
   7. exclusively homosexual behavior

7. Again thinking back on your entire life, rate yourself in terms of your feelings throughout your lifetime.
   1. exclusively heterosexual feelings
   2. mainly heterosexual with a slight degree of homosexual feelings
   3. mainly heterosexual with a substantial degree of homosexual feelings
   4. as much heterosexual as homosexual feelings
   5. mainly homosexual with a substantial degree of homosexual feelings
   6. mainly homosexual with a slight degree of homosexual feelings
   7. exclusively homosexual feelings

8. Thinking back on your entire life, which of these descriptions best fits you?
   1. exclusively heterosexual throughout my life
   2. exclusively heterosexual but with incidental sexual relationships with one or two women
   3. heterosexual now but had a substantial period of homosexual behavior during adolescence or early adulthood
4. bisexual—can and do enjoy sexual and emotional relationships with both men and women
5. homosexual now but had a substantial period of heterosexual behavior during adolescence or early adulthood
6. exclusively homosexual but with incidental sexual relationships with one or two men
7. exclusively homosexual throughout my life

9. Do you find that smells or scents are important to you in your sexual attractions and/or relationships?
   1. yes
   2. no
   3. not sure

10. How sensitive would you say your sense of smell is?
    1. exceptionally sensitive
    2. quite sensitive
    3. fairly sensitive
    4. fairly insensitive
    5. quite insensitive
    6. exceptionally sensitive

11. At what age did you first start dating (heterosexual)?
    1. before age 14
    2. 14-16
    3. 17-19
    4. 20 or older
    5. never

12. At what age did you first have sexual intercourse with a male?
    1. before age 14
    2. 14-16
    3. 17-19
    4. 20 or older
    5. never

13. How often do you have an orgasm during sexual intercourse with a male?
    1. almost always
    2. occasionally
    3. never
    4. never had sexual intercourse with a male
    5. don't know

14. With how many different males have you had sexual intercourse?
    1. 15 or more
    2. 8-14
    3. 3-7
    4. 2
    5. 1
    6. none
15. With how many different sexual partners (male) have you had intercourse in the past year?
   1. 10 or more
   2. 6-9
   3. 3-5
   4. 2
   5. 1
   6. none

16. I am currently involved in a sexual relationship with a male which includes intercourse.
   1. yes
   2. no

17. I would rate the degree of sexual satisfaction I have had with men as being
   1. poor
   2. satisfactory
   3. good
   4. excellent
   5. not applicable

18. I would rate the amount of emotional satisfaction I have had with men (with whom I've had sex) as being
   1. none
   2. some
   3. well satisfied
   4. almost totally satisfied
   5. never had a sexual relationship with a man

19. What is your present legal marital status?
   1. single
   2. married
   3. separated
   4. divorced
   5. widowed

20. If you are not married, are you
   1. involved with a sexual relationship with one man
   2. involved in a sexual relationship with one woman
   3. not currently involved in a relationship
   4. I am married

21. At what age did you first start dating women?
   1. before age 14
   2. 14-16
   3. 17-19
   4. 20 or older
   5. never
22. At what age did you first have full sexual relations with a woman?
   1. before age 14
   2. 14-16
   3. 17-19
   4. 20 or older
   5. never

23. How often do you have an orgasm during sexual relations with a female?
   1. almost always
   2. occasionally
   3. never
   4. never had sexual relations with a female
   5. don't know

24. With how many different females have you had sexual relations?
   1. 15 or more
   2. 8-14
   3. 3-7
   4. 2
   5. 1
   6. none

25. With how many different female sexual partners have you had sexual relations in the last year?
   1. 10 or more
   2. 6-9
   3. 3-5
   4. 2
   5. 1
   6. none

26. I am currently involved in a sexual relationship with a female.
   1. yes
   2. no

27. I would rate the degree of sexual satisfaction I have had with women as being
   1. poor
   2. satisfactory
   3. good
   4. excellent
   5. not applicable

28. I would rate the degree of emotional satisfaction with women with whom I've had sex as being
   1. none
   2. some
3. well satisfied
4. almost totally satisfied
5. never had a sexual relationship with a woman

29. In terms of sexual satisfaction I would prefer having a sexual relationship with a
1. female
2. male
3. no preference

30. At the present time, I am sexually attracted to
1. females only
2. males only
3. both males and females
4. no one

31. If the opportunity arose, I would engage in a homosexual relationship or experience.
1. yes, I have and I liked it
2. might, given the right conditions
3. I have, but I didn't like it
4. definitely would like to try it
5. never under any conditions
6. I don't know

32. I feel I was able to answer these questions openly and honestly.
1. yes
2. no

33. Please list the date of onset of your most recent menstrual period. __________________

34. Please list the expected date of onset of your next menstrual period. __________________
References


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Mykytowycz, R. Further observations on the territorial function and histology of the submandibular cutaneous (chin) glands in the rabbit (*Oryctolagus Cuniculus*). *Animal Behavior*, 1965, 13, 400-412.


