Human Pheromones, Epigenetics, Physiology, and the Development of Animal Behavior

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In eusocial insects like the honeybee, diet and pheromones are epigenetic determinants of virtually all aspects of each organism's existence. The honeybee serves as a model organism for studying human immunity, disease resistance, allergic reactions, circadian rhythms, antibiotic resistance, development, mental health, longevity, and diseases of the X chromosome. Included among these different aspects of eusocial species survival are learning and memory as well as conditioned responses to sensory stimuli (1).

Mammalian conditioning paradigms suggest that androstenol experientially conditions hormonal effects in females, which may be unconsciously associated with behavioral affects of androsterone in women (2,3,4,5,6). Androsterone smells like fresh sweat. It is an individual human male-specific and somewhat primate-specific component of axillary secretions (7) that also contain androstenol, which influences levels of luteinizing hormone (LH) and mood in women (8,9). LH is a measure of diet-dependent sexual maturity and fertility, which is influenced by mammalian pheromones (10,11).

We evaluated individual video-taped fifteen-minute interactions of fourteen women with ovulatory phase levels of LH during a cooperative task. During the task, our male accomplice wore either a standardized androstenol / androsterone mixture diluted in propylene glycol (i.e., the vehicle), or just the vehicle -- with sandalwood odor added to keep him blind to his condition. When he was wearing the mixture compared to when he wore the vehicle, women were more likely to make eye contact with him ($t(12) = 3.43$, $p = .01$; IRR: $r = .964$, $p = .01$). They also laughed more during the interaction ($t(12) = 5.20$, $p < .01$; IRR: $r = .810$, $p = .01$) and they rated themselves as being more attracted to him ($t(12) = 2.786$, $p = .016$).

Our results combine the known effects of androstenol on LH and on mood in women with behavioral affects we attribute to androsterone. They also extend to human females the eusocial insect model for epigenetic effects of diet and pheromones on hormone-mediated gene expression during behavioral development.

Our disclosed mixture better characterizes species-specific human pheromones; their life-long effect on physiology, and their affect on behavior with no need to change the 1959 definition of pheromones (12) or to alter the concept of human pheromones first detailed in 1995 (13). Epigenetic effects of food odors and social odors dispel the psychological construct that the pheromones of any species from insects to mammals uniquely determine genetically predisposed social context-dependent endocrine responses or behavior in an invariant way (14).

Hypothesis: Adult females exposed to a male wearing the androstenol (A-nol) / androsterone (A-rone) mixture rather than the vehicle will experience an increase in mood, increase their flirtatious behavior, and rate the male as being better looking, having a better personality, and feel more attracted to him.

Measures

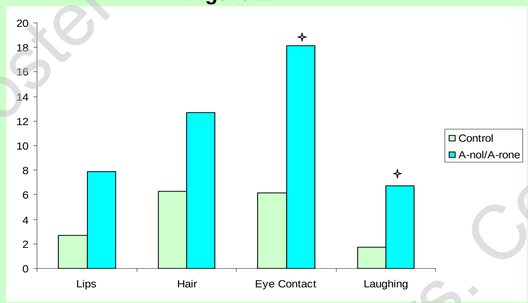
- Mood assessment questionnaire
- Post-Interaction ten-point Likert-scale questionnaire. Three categories of questions used to rate the confederate included:
  - •Personality- How intelligent was your task partner? How comfortable were you with your task partner? How funny was your task partner? If you had to do the task again, would you opt to have the same partner?
  - •Physical Appearance- How good-looking do you think your task partner was?
  - •Attraction- How attracted to your task partner were you?
- •Video Measure analyzed frequency of four flirting behaviors of subjects (15):
  - • Playing with hair/head toss- running fingers through hair, flipping hair, tossing head, etc.
  - • Eye contact with nodding- making eye contact with confederate while nodding at him
  - • Laughing- laughing/giggling at confederate's comments
  - • Drawing attention to lips or breasts- raising arms up, putting pen in mouth, etc.

Accomplice: A 21 year old Caucasian male wore either the A-nol / A-rone mixture dissolved either in propylene glycol or propylene glycol (the vehicle) alone. Sandalwood fragrance was added to the A-nol / A-rone mixture and to the vehicle.

Participants:
Subjects: Fourteen - female college students (mean age 20) who did not use hormonal birth control.

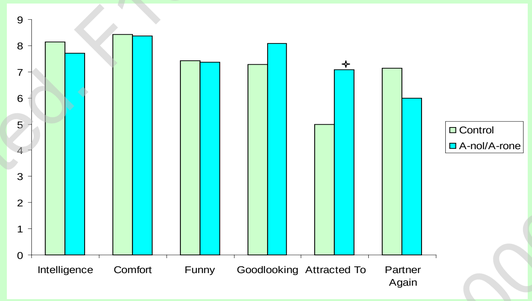
Procedure: The subjects participated on their day of ovulation. Our accomplice applied approximately 0.1 mL either of the vehicle or of the A-nol / A-rone mixture approximately 10-15 minutes before arriving at the test site. The subject and our accomplice were introduced and instructed to work together to answer as many puzzles from the *Mind Trap* game as possible in 15 minutes. Our accomplice was instructed to always read questions aloud, maintain close physical proximity to subject, correctly answer the majority of puzzles, and appear flirtatious and outgoing. Interaction was filmed for later evaluation.

Figure 1.



Results (Figure 1.): When our accomplice wore the A-nol / A-rone mixture containing sandalwood fragrance, the subjects were more likely, overall, to display non-verbal courtship behaviors. ($t(12) = 4.38$, $p < .01$; IRR: $r = .914$, $p = .01$). Specifically, they were more likely to make eye contact ($t(12) = 3.43$, $p = .01$; IRR: $r = .964$, $p = .01$) and laugh more during the interaction ($t(12) = 5.20$, $p < .01$; IRR: $r = .810$, $p = .01$) . The presence of the mixture did not have a significant effect on the subject's frequency of touching her lips or "hair flipping."

Figure 2.



Results (Figure 2.): When our accomplice wore the A-nol / A-rone mixture containing sandalwood fragrance, the subjects rated themselves as being more attracted to him. ($t(12) = 2.786$, $p = .016$). There was no significant effect of the mixture on the subject's rating of our accomplice as being more intelligent, more comfortable to be around, funnier, more "good-looking," or in having him as a task partner again.

Conclusions:

Mammalian olfactory/pheromonal conditioning paradigms play a role in women's altered perception of a man who is wearing an A-nol / A-rone mixture. This role of olfactory / pheromonal conditioning in mammals extends to a difference in behaviors associated with women's sexual interest in a man and in women's self-reported attraction to the man.

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