parable to those observed in ovariectomized females (*23*). In the present study, this quantitative difference appears to have been abolished by prolonged exposure to low estrogen concentrations.

Our observations lead to the conclusion that in the rhesus monkey, in striking contrast to the rat, the control system which initiates the secretion of the LH surge is equally competent in both sexes. Since the males studied were exposed to the normal circulating patterns of androgens from the time of conception to adulthood, the foregoing findings and considerations suggest that the schema for the sexual differentiation of the central nervous system of rodents, as it relates to the control of gonadotropin secretion, may not be applicable to primates, including man.

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References and Notes

1. G. W. Harris, *Endocrinology* **75**, 627 (1964).
2. C. A. Barraclough, *Recent Progr. Horm. Res.* **22**, 503 (1966); R. A. Gorski, in *Frontiers in Neuroendocrinology*, L. Martini and W. F. Ganong, Eds. (Oxford Univ. Press, New York, 1971), pp. 237–290.
3. N. B. Schwartz, *Recent Progr. Horm. Res.* **25**, 1 (1969).
4. ——— and P. Waltz, *Fed. Proc.* **29**, 1907 (1970).
5. L. Caligaris, J. J. Astrada, S. Taleisnik, *Endocrinology* **88**, 810 (1971).
6. J. D. Neill, *ibid.* **90**, 1154 (1972).
7. E. Terasawa, M. Kawakami, C. H. Sawyer, *Proc. Soc. Exp. Biol. Med.* **132**, 497 (1969); J. W. Everett, J. W. Holsinger, G. H. Zielmaker, W. C. Redmond, D. L. Quinn, *Neuroendocrinology* **6**, 98 (1970); D. L. Quinn, *Nature* **209**, 891 (1966).
8. C. A. Barraclough and J. H. Leathem, *Proc. Soc. Exp. Biol. Med.* **85**, 673 (1954); C. A. Barraclough, *Amer. J. Anat.* **97**, 493 (1955).
9. H. H. Swanson, *J. Reprod. Fert.* **21**, 183 (1970); F. R. Alleva, J. J. Alleva, E. J. Umberger, *Endocrinology* **85**, 312 (1969).
10. K. Brown-Grant and M. R. Sherwood, *J. Endocrinol.* **49**, 277 (1971).
11. O. L. Treloar, R. C. Wolf, R. K. Meyer, *Endocrinology* **90**, 281 (1972).
12. L. J. Wells and G. van Wagenen, *Contrib. Embryol. Carnegie Inst. Washington* **35**, 93 (1954); W. C. Young, R. W. Goy, C. H. Phoenix, *Science* **143**, 212 (1964); R. W. Goy, *Phil. Trans. Roy. Soc. London Ser. B* **259**, 149 (1970); ——— and J. Resko, *Recent Progr. Horm. Res.* **28**, 707 (1972).
13. L. Wilkins, *The Diagnosis and Treatment of Endocrine Disorders in Childhood and Adolescence* (Thomas, Springfield, Ill., ed. 3, 1965).
14. E. Knobil, D. J. Dierschke, T. Yamaji, F. J. Karsch, J. Hotchkiss, R. F. Weick, in *Gonadotropins*, B. B. Saxena, C. G. Beling, H. M. Gandy, Eds. (Wiley, New York, 1972), pp. 72–86.
15. S. E. Monroe, R. B. Jaffe, A. R. Midgley, *J. Clin. Endocrinol. Metab.* **34**, 342 (1972); S. S. C. Yen and C. C. Tsai, *ibid.*, p. 298; G. Leyendecker, S. Wardlaw, W. Nocke, in *Gonadotropins*, B. B. Saxena, C. G. Beling, H. M. Gandy, Eds. (Wiley, New York, 1972), pp. 720–729.
16. T. Yamaji, D. J. Dierschke, J. Hotchkiss, A. N. Bhattacharya, A. H. Surve, E. Knobil, *Endocrinology* **89**, 1034 (1971).
17. F. J. Karsch, D. J. Dierschke, R. F. Weick, T. Yamaji, J. Hotchkiss, E. Knobil, *ibid.*, in press.
18. S. E. Monroe, W. D. Peckham, J. D. Neill, E. Knobil, *ibid.* **86**, 1012 (1970).
19. J. Hotchkiss, L. E. Atkinson, E. Knobil, *ibid.* **89**, 177 (1971).
20. L. E. Atkinson, A. N. Bhattacharya, S. E. Monroe, D. J. Dierschke, E. Knobil, *ibid.* **87**, 847 (1970).
21. S. E. Monroe, L. E. Atkinson, E. Knobil, *ibid.*, p. 453.
22. D. L. Klawon, S. Sorrentino, Jr., D. S. Schalch, *ibid.* **88**, 1131 (1971).
23. T. Yamaji, D. J. Dierschke, F. J. Karsch, R. F. Weick, E. Knobil, unpublished data.
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Plant Taxonomy: Ultraviolet Patterns of Flowers Visible as Fluorescent Patterns in Pressed Herbarium Specimens

Abstract. *Pressed flowers, in herbarium specimens, show visible fluorescent patterns matching the invisible ultraviolet patterns that the flowers show in life. The technique is taxonomically applicable since it makes an important but usually neglected floral character readily demonstrable.*

We recently described a simple technique, ultraviolet video-viewing (*1*), whereby the ultraviolet patterns of flowers, ordinarily visible to insects only, can be observed by man. In essence, the technique consists of illuminating flowers with an ultraviolet light (300 to 400 nm), and viewing them with a television camera equipped with an appropriate ultraviolet-transmitting lens and filter. The ultraviolet pattern on the petals shows up in sharp black-and-white contrast on the video monitor.

While video-viewing herbarium specimens, in order to check on the persistence of ultraviolet patterns after death and desiccation, we noted that the patterns are indeed often preserved in pressed flowers, albeit with some attenuation, but, more interestingly, we found that in such flowers the patterns

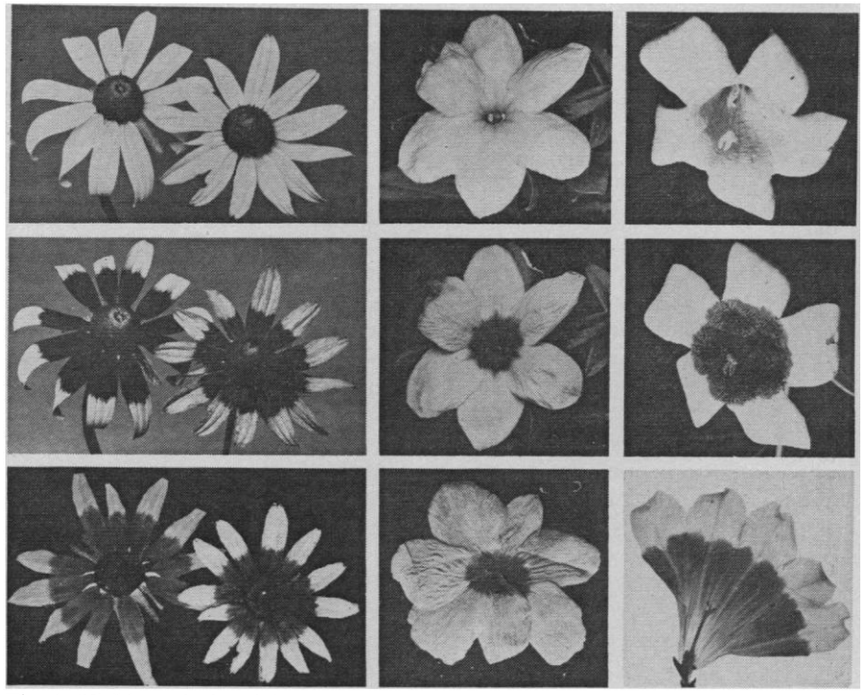

Fig. 1. Visible and ultraviolet patterns of fresh flowers, contrasted with the fluorescent patterns demonstrable after pressing. Horizontal rows: (top) visible patterns of fresh flowers, photographed on conventional film; (middle) invisible ultraviolet patterns of fresh flowers, photographed on ultraviolet-sensitive film; (bottom) visible fluorescent patterns of pressed flowers, induced by ultraviolet illumination, photographed on conventional film. Vertical rows: (left) *Rudbeckia hirta*; (center) *Jasminium mesnyi*; (right) *Gelsenium sempervirens* (corolla spread open in pressed specimen).

reveal themselves directly, as visible fluorescent images induced by the ultraviolet illumination, so that the transduction to a video image is really not required. We found the phenomenon to hold consistently for a diversity of pressed flowers known to have ultraviolet patterns in life, including members of the Compositae (*Rudbeckia, Heliopsis, Helianthus, Viguiera, Bidens*), Ranunculaceae (*Caltha*), Rosaceae (*Potentilla*), Oleaceae (*Jasminium*), Oxalidaceae (*Oxalis*), Loganiaceae (*Gelsenium*), and Guttiferae (*Hypericum, Ascyrum*). Invariably, the fluorescent patterns matched the ultraviolet patterns, in both contour and approximate contrast, leaving no doubt that the former are visible concomitants of the latter. Regions of petals that are ultraviolet-reflecting in life appear reflectant (yellowish-green to blue-green) in the fluorescent image, and ultraviolet-absorbing portions (such as "nectar guides") remain dark in the fluorescent patterns (Fig. 1). In the living flower, the fluorescence is at most only faintly discernible, but it becomes clearly, and sometimes brilliantly, apparent within hours after pressing, as soon as the flowers are dried or nearly dried. Aside from implications relevant to floral chemistry and coloration, the fluorescent phenomenon is of obvious use to botanists, who could, by the simple employ of a conventional ultraviolet "black light" (*2*), render visible an otherwise invisible floral character of considerable taxonomic value. As a rule, the fluorescence is most intense in relatively fresh herbarium material, but even flowers more than 10 to 30 years old commonly show the pattern. A distinct fluorescent pattern, typical for the species, was clearly apparent in the oldest herbarium flower examined by us, a cultivated specimen of *Rudbeckia hirta* from the collections of John Stuart, third Earl of Bute, who died—following a fall incurred while trying to reach a rare flower on a cliff—in 1792 (*3*).

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References and Notes

1. T. Eisner, R. E. Silberglied, D. Aneshansley, J. E. Carrel, H. C. Howland, *Science* **166**, 1172 (1969).
2. Any of a number of commercially available ultraviolet long-wave (about 3660-A) lamps, such as are commonly used for visualization of fluorescent spots on chromatographic plates, can be employed.
3. W. T. Thistleton-Dyer, *Kew Bull.* **60**, 279 (1891).
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Pheromone Concentration as a Mechanism for Reproductive Isolation between Two Lepidopterous Species

Abstract. *Pheromone-releasing females of the closely related noctuid moths* Trichoplusia ni *and* Autographa californica *attract mainly males of their own species. Sex-pheromone-concentration specificity appears to be an important reproductive isolating mechanism for these two species. Apparently, both species utilize the same pheromone,* cis*-7-dodecenyl acetate, for mating communication, but* T. ni *utilizes a higher level than does* A. californica. *Traps releasing amounts of* cis*-7-dodecenyl acetate that are highly attractive for males of one of the species catch very few males of the other species.*

Factors such as differing seasonal cycles, geographic distributions, host plant specificities, and times of mating are frequently cited as species-isolating mechanisms (*1*). *Trichoplusia ni*, the cabbage looper, and *Autographa californica*, the alfalfa looper, frequent many of the same host plants and overlap considerably in their geographic distributions and seasonal cycles (*2*). Although there is some variation in the timing of their mating rhythms (*3*), this does not appear sufficient to cause efficient isolation between the species.

Another mechanism for isolation that has recently received considerable attention is sex-pheromone specificity (*4*). Such a mechanism would appear to be extremely important, because reproductive isolation between closely related species would be most efficiently achieved by mechanisms operating at the sensory and behavioral levels, preventing the two sexes of related species from approaching each other for mating.

The most obvious way in which sex-pheromone specificity between two or more species can be achieved is through each species utilizing a behaviorally and chemically distinct pheromone. Here we report a situation in which two closely related noctuid moth species apparently achieve reproductive isolation by utilizing behaviorally distinct levels of the same sex pheromone in mating communication.

The sex pheromone of *T. ni* is *cis*-7-dodecenyl acetate (*5*). Based on gas-liquid chromotography, bioassay, and electroantennogram analysis, it appears that *A. californica* also utilizes this compound as a sex pheromone (*6*). However, when caged virgin 3- to 4-day-old females of *T. ni* and *A. californica* were used as bait in separate traps (*7*) in the same field on 30 consecutive nights, they attracted mainly males of their own species (Table 1).

Extracts of pheromone glands from *T. ni* females evoked a higher response from both *T. ni* and *A. californica* males in laboratory bioassays than equivalent extracts from *A. californica* females (*8*). When extracts of pheromone glands from females of both species were subjected to gas-liquid chromatography followed by bioassay analysis, quantitative determinations indicated the presence of approximately 0.5 μg and 0.01 μg of pheromone per female for *T. ni* and *A. californica*, respectively. Based on these data, we suggest that females of *A. californica* utilize a smaller quantity of *cis*-7-do-

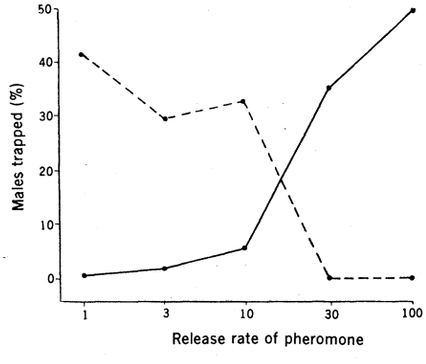

Fig. 1. Percentages of *T. ni* males (solid line; $N = 962$) and *A. californica* males (dashed line; $N = 81$) captured in traps baited with *cis*-7-dodecenyl acetate released at various relative rates.