hence, no assumptions can be made at this stage. In summary, each retrovirus may have evolved to take advantage of unique host proteins at the particular sites on the membrane where they assemble — just as they have evolved to use different receptors on the cell surface for entering host cells.

Laurence Garnier, John W. Wills*
Department of Microbiology and Immunology
Michael F. Verderame
Department of Medicine and Division of Endocrinology, Diabetes and Metabolism, Pennsylvania State University College of Medicine,
500 University Drive, PO Box 850, Hershey, Pennsylvania 17033, USA
Marius Sudol
Department of Biochemistry
The Mount Sinai School of Medicine
One Gustave L. Levy Place
New York, New York 10029, USA
* jwills@cor-mail. biochem. hmc. psu. edu

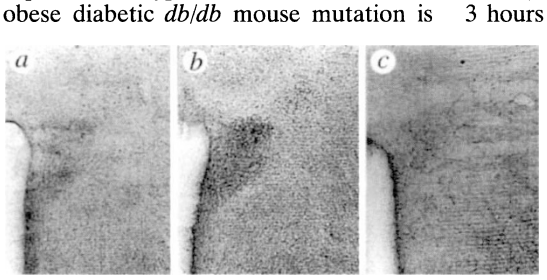
Leptin activation in hypothalamus

SIR — The excessive fat deposition and other genetic disorders seen in the obese *ob/ob* mouse has been shown to be due to a mutation (premature stop codon) in the *ob* gene[1]. Normally, the *ob* gene is expressed in adipose tissue, with the secreted circulating gene product, leptin, being thought to act as a hormonal feedback signal to regulate fat cell size via hypothalamic mechanisms controlling food intake and metabolic rate. Thus, treatment of *ob/ob* mice with leptin restores this signal and corrects most, if not all, of the mutant's metabolic and endocrine defects[2–5].

The leptin receptor (Ob-R) gene has at least six splice variants, but the observation that the Ob-Rb variant is highly expressed in hypothalamus, and that the obese diabetic *db/db* mouse mutation is found in the Ob-Rb variant[6], strongly suggests that leptin normally exerts its effects on this hypothalamic receptor. How this large (M_r 16,000) leptin protein crosses the blood–brain barrier to activate the Ob-Rb receptor is not known, and it is possible that the hypothalamic leptin receptor is in an area where there is a weak or non-existent blood–brain barrier. To obtain a more precise idea of the hypothalamic areas involved in mediating the effects of leptin, we used Fos protein immunoreactivity to localize expression of the immediate early gene c-*fos* as a marker of neuronal activation[7].

The only hypothalamic area to show obvious, dense Fos protein immunoreactivity is the paraventricular nucleus in *ob/ob* mice treated 3 hours previously with leptin (see figure). There is no Fos protein staining in the paraventricular nucleus of lean mice receiving leptin, nor in *ob/ob* mice receiving vehicle (control group). In the *ob/ob* mice receiving leptin, there is little Fos protein immunoreactivity elsewhere in the hypothalamus (data not shown), other than some staining in the zona incerta and arcuate nucleus and a few scantily stained neurons in the ventromedial hypothalamus; we saw no staining in any hypothalamic area 24 hours after leptin injection.

The hypothalamic areas mentioned above are important in the neuroendocrine control of energy homeostasis, with the paraventricular nucleus being particularly prominent as a focus for the action of neuropeptide Y, corticotrophin-releasing factor and the monoamine neurotransmitters affecting ingestive behaviour and autonomic control of metabolism. The ventromedial hypothalamus is another important area controlling energy intake and expenditure, and we were surprised to find little or no evidence of c-*fos* expression (neuronal activation). However, it is possible that greater activation of this area (and others) might be seen at a later stage (after 3 hours but before 24 hours) after leptin injection, or with repeated leptin injections.



Fos protein immunoreactivity in the paraventricular nucleus of a lean mouse treated with leptin (*a*), an *ob/ob* mouse treated with leptin (*b*) and an *ob/ob* mouse treated with vehicle (*c*). Female *ob/ob* obese and lean (+/?) mice were injected with 1 mg kg^{-1} recombinant murine leptin (Amgen) or vehicle, and 3 h later were overdosed with sodium pentobarbitone and immediately transfused transcardially with ice-cold saline, followed by 4% paraformaldehyde. The brains were sliced in 100-μm-thick coronal sections through the hypothalamus and incubated in primary Fos antiserum (OA11-824; Cambridge Research Biochemicals). We used an avidin–biotin–horseradish peroxidase procedure, with diaminobenzidine as a chromogen[8], to visualize Fos protein immunoreactivity.

We believe that the failure of leptin to induce Fos protein immunoreactivity in the paraventricular nucleus of lean mice is because lean mice, unlike *ob/ob* mice, produce mature leptin and are therefore less sensitive to doses of exogenous leptin. However, a single injection at a tenfold higher dose (10 mg per kg) still fails to activate the paraventricular nucleus in lean mice, suggesting that even higher, and/or repeated, doses may be required.

In conclusion, it seems that the most rapid and strongest hypothalamic response to leptin in *ob/ob* mice occurs in the paraventricular nucleus, which suggests that this is where the Ob-Rb receptor is most likely to be located, although one cannot exclude a more distant location with projections to this hypothalamic area.

Anthony J. Woods
Michael J. Stock
Department of Physiology,
St George's Hospital Medical School,
University of London,
London SW17 0RE, UK

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Flashing males win mate success

SIR — The spectacular bioluminescent displays of male fireflies (Coleoptera: Lampyridae) are widely regarded as advertisement signals under sexual selection pressures[1]. However, despite extensive work on species identity[2], mimicry[3] and synchrony[4] in bioluminescent signalling systems, potential influences of intra- and intersexual selection on the evolution of flash characters have never been demonstrated in any species. Here, we report the first evidence for intersexual selection on a bioluminescent signal character. Using a novel photic playback experiment, we determined that females of the Nearctic firefly species *Photinus consimilis* prefer flash rates that exceed the mean rate in the male population but prefer flash lengths that approximate the mean. This combination of directional and stabilizing selection indicates that females do not simply choose signals containing high photic power.

The *P. consimilis* signalling system includes elements typical of many Lampyridae[5]. Males signal while slowly flying 1–3 m above the ground. A stationary female on the ground which detects a male's signal may reply with a dimmer signal after a characteristic delay; this often attracts the male to her vicinity. A signalling dialogue may ensue and culminate in courtship and mating.

Male signals are 0.7–3.1-s flash 'trains' given at 2.5–4.0 trains per min. The males fly 3–6 m between producing successive flash trains, but usually hover while flashing. Each flash in a train is approximately 70 ms long (F). Radiant intensity during a flash rises gradually to a plateau, then slowly decays. Flash period (T) and interflash interval (T–F) within a train are influenced by temperature and may be predicted by least-squares linear models; the average male flash rate ($\bar{T}^{-1}$) at