

Do Animals "Know" They Need Vitamin D? Evidence for Vitamin D-Seeking Behavior Across the Animal Kingdom

Yes, but so far only lizards have been shown to do it: panther chameleons and brown anoles fed low vitamin D3 diets expose themselves to more UVB, and fed high-D3 diets they expose themselves to less. That is the only published case of a behavior that tracks vitamin D status in a feedback loop. In birds, mammals and invertebrates the "vitamin D-seeking" idea is either untested or contradicted, with one exception. Recent mouse work suggests UV-triggered β -endorphin reward, which vitamin D deficiency makes stronger, could be a mammalian version of the same mechanism.

TL;DR

- **Strongest evidence (lizards):** In Ferguson et al. (2003) and Karsten et al. (2009), panther chameleons on low-D3 diets sought out more UVB, and those on high-D3 diets sought less, both under lamps and in natural sunlight. Ferguson et al. (2013) found the same pattern in the brown anole *Anolis sagrei*, but not in its shade-dwelling relative *A. lineatopus*.
- **Weak or contradicted (birds, cats, dogs, most mammals):** There is little support for the idea that birds sunbathe to photoactivate preen oil and then eat it, and no experiment has linked sunning to vitamin D status. Cats and dogs sunbathe even though their skin makes almost no vitamin D, so their basking cannot be vitamin D seeking. Animals do show real specific appetites for calcium and phosphorus (Richter's parathyroidectomized rats, laying hens, bone-chewing cattle), but these track minerals, not vitamin D. Many are learned rather than innate.
- **Plausible but unproven (humans and mice):** UV raises skin β -endorphin and produces addiction-like behavior in mice (Fell et al., Cell 2014). Frequent human tanners prefer UV beds over identical-looking non-UV beds. Kemény et al. (Sci Adv 2021) found vitamin D deficiency makes UV and opioid reward stronger in mice and proposed an evolved "seek sun until vitamin D is replete" feedback loop. This is an interesting hypothesis, not established human biology.

Key Findings

The evidence falls into three tiers. **Tier 1 (experimental, vitamin D status manipulated, behavior measured):** panther chameleons, Jamaican brown anoles, and, in a mechanistic rather than natural-behavior sense, vitamin D receptor knockout and diet-deficient mice in UV place-preference tests. **Tier 2 (behavior regulates UV, but vitamin D status not manipulated):** eastern fence lizards and ornate tree lizards, which regulate UV exposure separately from temperature. **Tier 3 (plausible physiology, no behavioral test):** bird preen-oil ingestion, fur-grooming in rodents and cattle, primate sunbathing, and insect vitamin D synthesis. Mineral appetites for calcium and phosphorus, including osteophagy, are well documented. They are related to vitamin D but are a different phenomenon.

Across all of this work, no study shows an animal detecting vitamin D itself in food and preferentially choosing it. Where animals regulate vitamin D, the lever seems to be light exposure, and in lizards they appear to respond to visible light more than to UVB as such.

Details

1. Reptiles: the core evidence for vitamin D "photoregulation"

Panther chameleons (*Furcifer pardalis*). The founding paper is Ferguson, Gehrmann, Karsten, Hammack, McRae, Chen, Lung and Holick, "Do Panther Chameleons Bask to Regulate Endogenous Vitamin D3 Production?" (Physiological and Biochemical Zoology 76:52-59, 2003) [[Ferguson 2003](#)]. In laboratory light gradients the chameleons moved toward brighter visible, UVA and UVB light, and at equal high irradiances their response to UVB was significantly greater than to UVA. Skin patches exposed in vitro to high UVB made more vitamin D3. Females that chose higher-UVB positions had much higher circulating 25(OH)D3 (604 vs. 92 ng/mL). The key result: chameleons on low-D3 diets (1-3 IU/g) spent significantly more time under UV-producing light than those on high-D3 diets (9-129 IU/g). The authors concluded that "vitamin D3 photoregulation seems to be an important additional component of the function of basking." Note that the user's prompt says *Chamaeleo calcaratus*; the animals studied were panther chameleons, *Furcifer* (formerly *Chamaeleo*) *pardalis*. An earlier conference chapter, Jones, Ferguson, Gehrmann, Holick, Chen and Lu, "Vitamin D nutritional status influences voluntary behavioral photoregulation in a lizard" (in *Biologic Effects of Light 1995*, de Gruyter, 1996), reported the phenomenon first [[Springer chapter](#)].

Karsten, Ferguson, Chen and Holick, "Panther Chameleons, *Furcifer pardalis*, Behaviorally Regulate Optimal Exposure to UV Depending on Dietary Vitamin D3 Status" (Physiological and Biochemical Zoology 82:218-225, 2009) [[Karsten 2009](#)], moved the test outdoors into natural sunlight. Low-D3 chameleons significantly increased their UV exposure compared with high-D3 chameleons. All low-D3 animals kept their exposure within the UV range previously linked to best reproductive success, and they did so with "extreme effectiveness" relative to the UV available. A secondary summary reports an effectiveness score of 1.00 and an optimal reproductive window of about 3.66-7.01% photoproduct formation; I could not check these figures against the full text. The study also noted that basking continued when air temperatures (about 32.7 °C at peak UV) were already above the lizards' preferred temperature, which argues against a purely thermal explanation.

Anoles. Ferguson et al. (2005, Physiological and Biochemical Zoology 78:193-200) [[Ferguson 2005](#)] compared the sun-loving *Anolis sagrei* with the shade-dwelling *A. lineatopus merope* in Jamaica. The shade species received less UVB and less dietary D3, but its skin converted provitamin D to photoproducts more efficiently. So one species compensates with behavior and the other with skin physiology. The behavioral test came later in "Ultraviolet Light Exposure and Response to Dietary Vitamin D3 in Two Jamaican Anoles" (Journal of Herpetology 47(4), 2013) [[Ferguson 2013](#)]. *A. sagrei* on a low-D3 diet for six weeks exposed itself more often to visible and UVB light, and took higher UVB doses, than in a following six weeks on high-D3. When switched back to low-D3, exposure stayed lower, suggesting a slow return to relying on skin synthesis. *A. lineatopus* showed no such adjustment. The authors also found that *A. sagrei* responded about as much to visible light without UVB as with it: "the anoles appeared to be responding primarily to visible light." This is an important mechanistic caveat. The lizards do not appear to sense UVB directly. More plausibly, internal vitamin D status changes their attraction to bright microhabitats, which in nature carry UVB.

Fence and tree lizards: UV regulation separate from temperature. Conley and Lattanzio, "Active regulation of ultraviolet light exposure overrides thermal preference behaviour in eastern fence lizards" (Functional Ecology 36:2240-2250, 2022) [[Conley & Lattanzio 2022 data](#)],

gave *Sceloporus undulatus* a gradient where temperature and UV ran in opposite directions. The lizards "prioritize UV over temperature, favouring body temperatures much higher than preferred values to sustain preferred UV exposure," while "temperature had no reciprocal impact on UV regulation behavior." Lattanzio's follow-up field study, "Beyond thermoregulation: Active behavioural regulation of ultraviolet light exposure by a free-ranging lizard" (Journal of Animal Ecology, online 18 July 2026) [[Lattanzio 2026](#)], used custom UV data loggers on wild ornate tree lizards (*Urosaurus ornatus*). It found active UV regulation, but in the direction of preferring *low* UV exposures despite large environmental variation. Together these studies show lizards treat UV as something to regulate, sometimes seeking it and sometimes avoiding it, consistent with balancing vitamin D against UV damage. Neither study manipulated vitamin D status, so they show UV regulation, not vitamin D-driven regulation.

Field context. Wild chameleons are not sun-worshippers. Two Madagascan *Calumma* species had a median UV Index exposure of only 0.3 and rarely exceeded UVI 3.0 (Zoo Biology [[Madagascar chameleons](#)]). Ferguson's "UV zones" for 15 lizard and snake species range from a median UVI of 0.35 in zone 1 to 3.1 in zone 4. This supports the idea that the behavior is about hitting a target, not maximizing exposure. The nocturnal leopard gecko also makes vitamin D3 from brief UVB (Oonincx et al. 2020, Comparative Biochemistry and Physiology B) [[Leopard gecko](#)], which shows the capacity exists even in species that rarely bask.

Bearded dragons, turtles and tortoises. Bearded dragons (*Pogona vitticeps*) clearly make vitamin D3 under UVB (Oonincx et al. 2010), but I found no published experiment testing whether their basking changes with D3 status. The same gap applies to chelonians. Chessman's "The conundrum of turtle and tortoise basking: A critical review" (Journal of Zoology 323:263-283, 2024) [[Chessman 2024](#)] concludes that "the primary function of most nominal chelonian basking is thermoregulatory warming." Skin and shell conditioning has substantial support. Vitamin D synthesis is among the functions with only "some supporting evidence for particular species and environments." Pritchard and Greenhood (1968) proposed vitamin D synthesis as the main function of turtle basking, but that hypothesis has not been confirmed by status-manipulation experiments. Physiologically, UVB clearly raises 25(OH)D3 in red-eared sliders (Acierno et al. 2006, American Journal of Veterinary Research), and Geisler et al. (2023) described seasonal and sunlight effects on vitamin D3 in *Testudo hermanni* and *Trachemys scripta*. Pet-keeping advice that a turtle "knows better than you do what her UV and vitamin needs are" goes beyond the evidence.

2. Birds: preen oil, sunbathing, and a theory that never quite held

The preen-oil hypothesis holds that 7-dehydrocholesterol (7-DHC) in uropygial gland secretion is spread over the feathers, converted by UVB, and swallowed during preening. The primary data are mixed. An early ScienceDirect paper, "The site and nature of provitamin D in birds" [[Provitamin D in birds](#)], examined the preen glands of ducks, geese and chickens and found "no evidence for the occurrence of the provitamin." It concluded that "the theory that birds obtain their vitamin D through preening no longer can be supported" and found provitamin D concentrated instead in the skin of the feet. Later, Uva, Mandich and Vallarino (1983) [[Uva 1983](#)] reported that in domestic fowl, 7-DHC is "synthesized and stored mainly in the uropygial gland" with some vitamin D3 there and in leg skin, and that photolysis "may occur also on the dorsal feathers." A 2020 review of vitamin D in veterinary species [[Vet species review 2020](#)] calls the evidence limited: "there is currently limited research into whether this vitamin D intake occurs in chickens." Avian veterinary and pet-bird sources often state the preening route as fact, but that confidence is not supported by the primary literature.

More importantly for Henry's question, no study I found has shown that birds sunbathe more when vitamin D deficient. The competing explanations have better experimental support. A 2020 Animal Microbiome study of vulture plumage [[Vulture plumage](#)] notes that "sunning is often performed at thermoneutral temperatures in tropical and temperate latitudes" and that "birds may voluntarily sunbathe to the brink of hyperthermia," which points to non-thermal functions. The ectoparasite hypothesis has direct experimental evidence. In Blem and Blem's swallow experiment (Condor 95:728, 1993), "fumigated birds sunned less than controls, suggesting that the motivation to sun decreases when ectoparasites are not present." In Moyer and Wagenbach's test with model wings made from black noddy feathers (Auk 112:1073-1077, 1995), about 10 minutes of sun heated the wings to 140-160 °F, and the louse died in six of 12 trials, including six of seven trials where feather temperature passed 140 °F, while lice in shade survived. On the other hand, a controlled mourning dove experiment (Koop, Huber and Clayton, Journal of Parasitology 98:46-48, 2012) found that "birds given the opportunity to preen in direct sunlight did not preen significantly more often, or more effectively, than did birds in shade." Bush and Clayton (2018) note that the study ran in cool weather, when sunning was "less than 1% of recorded behaviours," so not every parasite mechanism holds up. Other proposed functions include feather drying, restoring feather shape, helping moult, shaping plumage microbiota (in vultures), and warming preen oil to spread it. My assessment: bird sunbathing is multifunctional, vitamin D may be a side benefit, and calling it vitamin D seeking is speculation.

3. Mammals: grooming, sunbathing, and the cat-and-dog problem

Cats and dogs make almost no vitamin D in their skin, yet they sunbathe. How, Hazewinkel and Mol, "Dietary Vitamin D Dependence of Cat and Dog Due to Inadequate Cutaneous Synthesis of Vitamin D" (General and Comparative Endocrinology 96:12-18, 1994), measured total skin 7-DHC of 1,858 ng/cm² in dogs and 1,958 in cats, versus 17,620 in rats. After UVB exposure, vitamin D₃ rose 40-fold in rat skin and not significantly in dog or cat skin. Morris (Journal of Nutrition 129:903-908, 1999) [[Kitten 25\(OH\)D study](#)] showed that kittens on a vitamin D-free diet and exposed to direct California summer sun for 15 hours a week lost 25(OH)D at the same rate as indoor kittens and developed deficiency. Blocking the enzyme 7-DHC-Δ⁷-reductase restored synthesis [[7-DHC reductase inhibitor](#)]. Corbee et al. (2015) [[Carnivore skin synthesis](#)] extended skin testing to 22 carnivore species. Because cats bask avidly but gain almost no vitamin D from it, cat sunbathing is the clearest natural example that basking in mammals is not vitamin D seeking. It is better explained by thermoregulation, since cats have a high thermoneutral zone. Obligate and near-obligate carnivores get vitamin D from prey liver and fat. That is also true of polar carnivores eating fatty fish and marine mammals, though I found no study showing they choose such foods because of their vitamin D content.

Fur, grease and grooming. In an early rat experiment (Nelson and Steenbock, 1925, as recounted by Carpenter and Zhao, "Forgotten mysteries in the early history of vitamin D," Journal of Nutrition 1999) [[Carpenter & Zhao 1999](#)], rats on a rickets-inducing diet were protected when caged with an irradiated cage-mate. Carpenter and Zhao proposed that "activity of grease from irradiated fur deserves investigation." Hymøller and Jensen (Journal of Dairy Science 2010) [[Hymøller & Jensen 2010](#)] found dairy cows make vitamin D₃ across their whole skin surface despite hair cover. That weakens any claim that fur-bearing animals *must* groom to get vitamin D. Kalueff, Lou, Laaksi and Tuohimaa, "Increased grooming behavior in mice lacking vitamin D receptors" (Physiology & Behavior 82:405-409, 2004) [[Kalueff 2004](#)], found VDR-knockout mice "presented longer duration and higher frequency of grooming" in several

tests, unrelated to general activity or anxiety. This is sometimes cited as support for a grooming-vitamin D link. But the knockouts lack the receptor, not the vitamin, and the authors did not test UV or light preference, so it is at most suggestive.

Primates and other sunbathers. Wild toque macaques in Sri Lanka had mean 25(OH)D of 61.3 ± 4.0 ng/mL across 45 animals (Power and Dittus, American Journal of Primatology 79:e22655, 2017), with captive macaque values in the literature about three times higher. Captive black-tufted marmosets (*Callithrix penicillata*) needed direct sunlight for sufficiency, with a proposed normal range of 104.8–137.1 ng/mL [[Marmoset 25\(OH\)D](#)]. In aye-ayes, artificial UVB showed no group-level correlation with 25(OH)D. I found no study linking primate, bear, seal or sloth sunbathing to vitamin D status. Ring-tailed lemur "sun worship" postures are widely described but have not, to my knowledge, been tested against vitamin D status. Mammalian sunbathing is best treated as thermoregulatory, with possible vitamin D benefits that have not been studied.

The one mammalian experiment where vitamin D status changes UV-seeking. Kemény, Robinson, ... Nestler and Fisher, "Vitamin D deficiency exacerbates UV/endorphin and opioid addiction" (Science Advances 7:eabe4577, 2021) [[Kemény 2021](#)], put mice on a vitamin D-free diet for at least 8 weeks, with "rescue" by returning to normal diet, and also used VDR-knockout mice. Under daily low-dose UV (50 mJ/cm²), the knockouts showed stronger UV-induced pain relief. "UV exposure induced a strong CPP [conditioned place preference] in the Vdr^{-/-} mice, in contrast to a minimal and insignificant trend toward preference" in wild-type mice. Diet-deficient mice showed exaggerated morphine preference and withdrawal, and supplementation "restored the morphine preference pattern back to that of VitD-replete mice." The authors explicitly propose "a feedback loop... whereby VitD deficiency produces increased UV/endorphin-seeking behavior until VitD levels are restored by cutaneous VitD synthesis," which "may carry the evolutionary advantage of maximizing VitD synthesis." Keep in mind this is a learned place-preference test, not free choice between sun and shade, and the UV result was shown in receptor knockouts rather than in diet-deficient mice. It is still the closest mammalian parallel to the chameleon work.

4. Dietary self-selection: calcium and phosphorus appetites are real, vitamin D appetite is not demonstrated

Richter's rats. Curt Richter showed that parathyroidectomized rats, which cannot maintain blood calcium, would drink enough 2.4% calcium lactate solution from a separate container to stay alive and free of tetany (Richter and Eckert, Endocrinology 21:50–54, 1937; Richter and Birmingham, Endocrinology 29:655–666, 1941) [[Richter & Birmingham 1941](#)]. After surgery, intake sometimes rose 10- to 15-fold, and parathyroid grafts brought it back to normal "almost at once." Richter and Birmingham also found that vitamin D injections reduced the high calcium intake. That is the only classic experiment directly linking vitamin D to appetite, and it shows vitamin D *reduces* a calcium appetite rather than being sought itself. Later work confirmed that calcium hunger in parathyroidectomized rats is specific (they prefer CaCl₂ over MgCl₂ or NaCl; Physiology & Behavior 1999) [[Calcium hunger is specific](#)]. Tordoff's group gave rats a range of 1,25(OH)₂D doses to test its effect on calcium intake (American Journal of Physiology 1998) [[Tordoff 1998](#)], and Tordoff's review "Calcium: Taste, Intake, and Appetite" (Physiological Reviews 81:1567, 2001) [[Tordoff 2001](#)] summarizes the field. A modern retrospective in the American Journal of Physiology (2000) [[Curt Richter retrospective](#)] also notes that Richter's broader claims that animals self-select balanced diets "have not borne the test of time or experimental challenge."

Vitamins in general are learned, not innate. The classic "Self Selection of Diet" series (Scott and Verney, Journal of Nutrition, 1940s) [[Scott & Verney](#)] found that thiamine-deficient rats developed appetites for thiamine-containing diets only once clearly deficient, that "a small minority always made a poor choice," and that these appetites were "learned, probably as a result of beneficial experience." A 1968 Nutrition Reviews synthesis [[Nutrition Reviews 1968](#)] concluded that vitamin and mineral hungers are generally learned preferences, with sodium hunger the one innate exception. I found no study showing vitamin D-deficient rats or chicks selectively choosing vitamin D-containing food. The subagent's targeted search also turned up none. For a fat-soluble vitamin that takes weeks to affect status, the post-ingestion feedback needed to learn such a preference would be very slow. That makes a true vitamin D appetite unlikely on theoretical grounds too.

Poultry calcium appetite. Hughes and Wood-Gush, "A specific appetite for calcium in domestic chickens" (Animal Behaviour 19:490-499, 1971) [[Hughes & Wood-Gush 1971](#)], showed calcium-deficient chickens preferred calcium carbonate and even synthetic calcium lactate. They also presented evidence that "the appetite is a learnt preference rather than an unlearned homeostatic control, and that it is cue-dependent." Laying hens given free access to oyster shell eat most of it in the afternoon and evening. Mongin and Sauveur (British Poultry Science 15, 1974) [[Mongin & Sauveur 1974](#)] found oyster shell intake "very high between 16.00 and 20.00 h when egg calcification was in progress." Consumption of supplemental calcium falls as dietary calcium rises (Taher et al. 1984) [[Taher 1984](#)], and broilers converge on a common calcium intake target (Wilkinson et al. 2011). This is an impressive mineral-regulation system, but it tracks calcium demand, not vitamin D.

Osteophagy and geophagy. Bone chewing by giraffes, deer, cattle, caribou and others is usually attributed to phosphorus (and sometimes calcium) shortage, often during lactation or antler growth. Dixon et al. (Animal Production Science 59:921, 2019) found phosphorus-deficient heifers more attracted to weathered bones than phosphorus-adequate heifers. They concluded this is "primarily a learned response," driven by smell (aldehydes and ketones from fat breakdown), taste and appearance. Whether bone chewing actually delivers minerals is doubtful in some species. Bredin, Skinner and Mitchell (Onderstepoort Journal of Veterinary Research, 2008) [[Giraffe osteophagia](#)] found bone samples softened in sheep rumen fluid but lost no significant calcium or phosphorus: "there is an insignificant digestion of bones in the rumen." No study I found links osteophagy or geophagy to vitamin D status. Geophagy is usually linked to sodium, detoxification or gut protection, but I did not research it in depth.

5. Insects and invertebrates

Invertebrates can make vitamin D, but there is no evidence they seek it. Oonincx et al., "Evidence of vitamin D synthesis in insects exposed to UVb light" (Scientific Reports 8:10807, 2018) [[Oonincx 2018](#)], found UVB raised vitamin D3 in migratory locusts (0 to 226 IU/kg), house crickets (41 to 124 IU/kg) and yellow mealworms (50 to 3,067 IU/kg, plateauing near 6,400 IU/kg with longer exposure), but not in black soldier fly larvae. Black field crickets (*Gryllus bimaculatus*) had no detectable D3 even under about UVI 9.5 (Journal of Zoological and Botanical Gardens, 2021) [[Field crickets 2021](#)], perhaps because melanin shields their tissues. In insects, 7-DHC is a precursor of the moulting hormone ecdysone. I found no evidence that insects use vitamin D as a hormone or change their behavior in response to it. The practical relevance is ecological: UV-exposed prey is a small dietary vitamin D source for insectivorous lizards and birds. One leopard gecko in the Oonincx 2020 study ate 46% mealworms (versus 2-20% for the others), but that single animal is an anecdote, not evidence of vitamin D-guided

prey choice.

6. Humans: sun-seeking, endorphins, and the evolutionary hypothesis

Mechanism. Fell, Robinson, Mao, Woolf and Fisher, "Skin β -endorphin mediates addiction to UV light" (Cell 157:1527-1534, 2014) [[Fell 2014](#)], showed that low-dose UV makes mouse skin cells produce POMC, which yields both melanocyte-stimulating hormone (for tanning) and β -endorphin. This raised plasma β -endorphin and pain thresholds, and both effects were reversed by opioid blockade. After chronic UV, the opioid blocker naloxone caused withdrawal signs (trembling, shaking, teeth-chattering) and conditioned place aversion. None of these effects appeared in β -endorphin knockout mice. The abstract states: "primordial UV addiction... may theoretically have enhanced evolutionary vitamin D biosynthesis." Fisher said in the MGH release [[MGH release](#)] that such a mechanism "may have developed at certain stages of mammalian evolution through its contribution to the synthesis of vitamin D." Viros's commentary "Hooked on UVR" (Pigment Cell & Melanoma Research, 2014) [[Viros 2014](#)] offers an alternative: endorphin release as analgesia for sunburn inflammation.

Human behavioral data. Feldman et al., "Ultraviolet exposure is a reinforcing stimulus in frequent indoor tanners" (Journal of the American Academy of Dermatology 51:45-51, 2004) [[Feldman 2004](#)], studied 14 frequent tanners using identical-looking UV and non-UV beds under blinded conditions. Of 41 optional Friday sessions, 39 (95%) were taken in the UV bed. Participants were more relaxed ($P = .008$) and less tense ($P = .002$) after UV. Kaur et al. (JAAD 54:709-711, 2006) [[Kaur 2006](#)] found that opioid blockade with naltrexone reduced UV preference, and "four of 8 frequent tanners, but no infrequent tanners, exhibited withdrawal-like symptoms." The dose response was odd: symptoms appeared at 15 mg but not at 25 mg. These studies are tiny, and Wintzen et al. (2001) found no rise in plasma β -endorphin after whole-body UV in humans, so the human endorphin link is not settled [[Plasma \$\beta\$ -endorphin in tanners](#)].

Does low vitamin D make people seek the sun? No human study I found directly tests whether low 25(OH)D predicts more sun-seeking, tanning or cravings. The known correlation runs the other way: in Tangpricha et al. (AJCN 2004), 50 tanners had 25(OH)D 90% higher than 106 controls (115.5 ± 8.0 vs. 60.3 ± 3.0 nmol/L), and vitamin D deficiency was 8% in tanners vs. 41.5% in nontanners. In a U.S. survey of 8,027 adults (Clipp et al., Public Health Reports 2011) [[Clipp 2011](#)], 30% knew sun raises vitamin D, and 42% of those said they deliberately went into the sun to raise it. That is conscious, knowledge-driven behavior, not an innate drive. Kemény et al. (2021) found vitamin D deficiency more common in patients with opioid use disorder, with vitamin D levels inversely and dose-dependently linked to self-reported opioid use. Secondary sources give conflicting effect sizes for this link, so they should be checked against the paper. Seasonal human sun-seeking and winter mood are easily explained by light and circadian effects on mood, temperature and social patterns, which are major confounders for any vitamin D interpretation.

Evidence summary

Taxon / behavior	Key study	Vitamin D status manipulated?	Verdict
Panther chameleon UV basking	[Ferguson 2003]; [Karsten 2009]	Yes (dietary D3)	Strong: exposure tracks D status
Brown anole UV exposure	[Ferguson 2013]	Yes (dietary D3, crossover)	Moderate: seen in one of two species; cue appears to be visible light
Fence and tree lizard UV regulation	[Conley & Lattanzio 2022 data]; [Lattanzio 2026]	No	UV regulated separately from temperature; link to vitamin D is inferred
Turtle and tortoise basking	[Chessman 2024]	No	Mainly thermal; vitamin D synthesis minor and species-specific
Bird preen oil and sunbathing	[Uva 1983]; [Provitamin D in birds]	No	Conflicting physiology; no behavioral test
Cat and dog sunbathing	[Kitten 25(OH)D study]	Yes (physiology)	Counter-evidence: they bask but make almost no vitamin D in skin
Mouse UV reward	[Fell 2014]; [Kemény 2021]	Yes (diet; receptor knockout)	Suggestive mechanism; learned place-preference test; UV result from knockout mice
Rat and chicken calcium appetite	[Richter & Birmingham 1941]; [Hughes & Wood-Gush 1971]	Calcium, not vitamin D	Strong for calcium; vitamin D <i>reduces</i> calcium appetite
Bone chewing (osteophagy)	[Giraffe osteophagia]	Phosphorus, not vitamin D	Learned phosphorus seeking; mineral yield doubtful
Insects	[Oonincx 2018]	No	Some make vitamin D3; no evidence of seeking it
Human tanning	[Feldman 2004]; [Kaur 2006]	No	UV is rewarding; link to vitamin D status untested

Recommendations

For VitaminDWiki, I would present the chameleon and anole studies as the only rigorous demonstration of vitamin D "self-medication," and describe it carefully. The animals regulate light exposure according to vitamin D status. There is no evidence of conscious knowledge, and the proximate cue in anoles seems to be visible brightness. The Kemény 2021 mouse study deserves a place as the mammalian extension of this idea, clearly labeled as a hypothesis-generating model. Claims that birds sunbathe "to make vitamin D," or that cats and dogs bask for it, should be flagged as unsupported or, for cats and dogs, contradicted. Calcium and phosphorus appetites belong in a related "mineral wisdom" section, not a vitamin D one.

Several experiments would fill the gaps, and they are cheap and tractable. Repeat the Ferguson diet-crossover design in bearded dragons and in a basking turtle such as *Trachemys*. Give vitamin D-deficient vs. replete birds (for example quail or pigeons) a free choice between sun and shade, with preen-gland removal as a factor. Give diet-deficient wild-type mice a free choice between UV-lit and non-UV-lit chambers, not just conditioned place preference. In humans, test whether baseline 25(OH)D predicts UV-bed preference in blinded Feldman-style designs, or whether vitamin D supplementation reduces tanning frequency in a randomized trial.

Caveats

Several figures come from abstracts or secondary summaries rather than full texts: the chameleon effectiveness score and optimal UV window, the Kaur dose-response details, and the Kemény human opioid effect sizes. Treat them as provisional. The Lattanzio 2026 paper is very recent (online July 2026), and I relied on its abstract and introduction. Publication bias is likely: studies showing that animals *don't* adjust basking to vitamin D status are less likely to be published. The *A. lineatopus* null result is an important exception and suggests the behavior differs between species rather than being universal. Finally, "knowing" is anthropomorphic. Everything here fits simple feedback or learned-reward mechanisms, which is exactly how biologists interpret zoopharmacognosy in general.