

Early Fibropapillomas in Hawaii and Occurrences in All Sea Turtle Species: the Panzootic, Associated Leeches Wide-Ranging on Sea Turtles, and Species of Study Leeches Should Be Identified

Greenblatt et al. (4) discussed when fibropapilloma (FP)-associated turtle herpesvirus (FPTHV) became established in Hawaiian populations of sea turtles without citing the earliest records of FPs in Hawaiian sea turtles (11). However, this was rather significant to their discussion since the records occurred only 10 years (from 1947 to 1952) (Fig. 1) after the first report in the Atlantic (9, 10) (Florida Keys, 1937) and thus suggested that FP was worldwide and not introduced into the Pacific (11), as their genetic data also would suggest.



FIG. 1. Fibropapilloma tumors in a green sea turtle (*Chelonia mydas*) collected from Waikiki, Hawaii, in 1952. Photograph by Charles E. Cutress.

Greenblatt et al. (4) stated that FP is only found in green (*Chelonia mydas*), loggerhead (*Caretta caretta*), and olive Ridley (*Lepidochelys olivacea*) sea turtles. While these may be the most commonly infected species, FP has been found in all sea turtle species (hawksbill sea turtles [*Eretmochelys imbricata*] [3, 11], even in Hawaii [11]; flatback sea turtles [*Natator depressus*] [7]; Kemp's Ridley sea turtles [*L. kempii*] [1, 6]; leatherback sea turtles [*Dermodochelys coriacea*] [8]; and their hybrids [loggerhead \times green sea turtles and loggerhead \times hawksbill sea turtles]).

Greenblatt et al. (4) discussed the recent worldwide increase in cases of FP without citing the paper that presented cases throughout the Caribbean and first suggested this was a worldwide panzootic (12). They also omitted the later review of FP (7).

Unlike most leeches, which must leave the host to reproduce, *Ozobranchus branchiatus* and *O. margoi* can complete their complete reproductive cycle on the turtle hosts. Thus, they are not necessarily limited to coastal areas, as stated by Greenblatt et al. (4). Greenblatt et al. (5) somehow managed to publish an entire paper on these leeches without ever explaining exactly which species they were studying, nor they did

state the species (*Ozobranchus* sp.) in reference 4. Both *O. branchiatus* and *O. margoi* occur on Hawaiian green sea turtles (2). It might be instructive in their rebuttal to explain which species of leech they analyzed.

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Author's Reply

Regarding Dr. Bunkley-Williams' letter concerning the reports by Greenblatt et al. (1, 2), I offer the following response. Greenblatt et al. (1) suggested, based on genetics data, that

FPTHV was around longer than the manifestation of FP disease (tumors) in turtles. No mention or inference is made that FPTHV was recently introduced into the Pacific, as Dr. Bunkley-Williams implies.

Greenblatt et al. (1) simply listed the most common species of turtles affected by FP. Given the scope of the paper (not a review), an exhaustive list of all confirmed or suspect cases of FP in all turtles is inappropriate. FP, as defined by the presence of histologically characterized tumors concomitant with the presence of FP herpesvirus DNA, has been repeatedly confirmed in olive Ridley, green, and loggerhead sea turtles, where the prevalence of the disease approaches a consistently measurable number (e.g., >5%). The other cases the author cites, in particular the hawksbill, are isolated individuals, some of which were confirmed by histopathology and others not, and none of which have been assayed by molecular virology for the presence of the viral genome. Indeed, three-fourths of the FP cases in hawksbill turtles cited by Williams and Bunkley-Williams, (4) are labeled as "presumed FP" due to lack of histology.

Contrary to Dr. Bunkley-Williams' assertion, the seminal review by Herbst (3) was cited in our *Journal of Virology* paper (1), as reference 12, and in our *Virology* paper (2).

Lastly, at this stage, the species of leech is somewhat superfluous and not the point of the Greenblatt et al. (2) publication. The main thrust of the paper was to advance the concept of leeches as potential vectors of FPTHV. Further investiga-

tions are certainly merited to tease out if a particular species of leech is more likely to be a carrier of the FPTHV, and in such a case, accurately determining the *Ozobranchus* species would be imperative.

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