

Symbiodiniaceae Style Guide

Thank you for your interest in the revised Symbiodiniaceae taxonomy. Please find below our suggestions for how to incorporate the new names into your writing in a way that will maintain consistency across papers. This is offered as a guide—not a rulebook. If you have any questions that are not addressed here, please contact John Parkinson (parkinjo [at] oregonstate [dot] edu) so we can find a solution and add your example to the list. The guide can also be downloaded as a PDF.

Regards,

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A note on “old” Clade and ITS2 designations

To ensure clear links between past and present nomenclature when writing about new findings, we recommend that former Clade and/or ITS2 designations be included in the first mention of a given genus and/or species, if one exists. Thereafter, the older designations may be dropped. There will still be many instances where ITS2 designations are the only way to distinguish between undescribed species. They also may be helpful to use in figures. Therefore, it really is a personal decision as to whether the ITS2 type should be included for further clarity after the first mention in the text. Ditto for their inclusion in the abstract.

Unfortunately, Genbank is full of incorrectly assigned ITS2 designations, particularly within the hyperdiverse *Cladocopium* genus. To minimize confusion when reporting an ITS2 type, we recommend always including the Genbank Accession Number for the associated sequence. We also encourage authors to contact Genbank to correct any names associated with particular sequences if mismatches are identified.

A note on the word “zooxanthellae”

When possible please avoid the overuse of "zooxanthellae," except as a colloquial term. Based on the historical definition, there are many kinds of zooxanthellae, including diatoms and groups of dinoflagellates only distantly related to Symbiodiniaceae. Preferred alternative terms include “symbiotic micro-algae,” “endosymbiotic dinoflagellates,” “symbiodinian algae,” “endosymbionts,” etc.

A note on the word “*Symbiodinium*”

If trying to distinguish between the previous use of “*Symbiodinium*” (encompassing all of the Symbiodiniaceae) and the new use of *Symbiodinium* encompassing only the species within Clade A, the new use could be emphasized as: *Symbiodinium sensu stricto*.

Family Level Changes

Old: Coral symbionts belong to the dinoflagellate **genus *Symbiodinium***.

New: Coral symbionts belong to the dinoflagellate **family Symbiodiniaceae**.

Old: Corals host symbiotic algae (**genus *Symbiodinium***).

New: Corals host symbiotic algae (family *Symbiodiniaceae*).

Old: Micro-algal endosymbionts (*Symbiodinium*) reside within host coral tissue.

New: Micro-algal endosymbionts (*Symbiodiniaceae*) reside within host coral cells.

**Note that the family *Symbiodiniaceae* is not italicized, whereas the genus *Symbiodinium* is italicized.

Genus/Clade Level Changes

Old: Members of *Symbiodinium* Clade D are extremophiles.

New: Members of *Durusdinium* (formerly Clade D) are extremophiles.

New: Members of *Durusdinium* are extremophiles.

Old: Corals typically associate with *Symbiodinium* from Clades A, B, C, and D.

New: Corals typically associate with *Symbiodiniaceae* from the genera *Symbiodinium* (formerly Clade A), *Breviolum* (formerly Clade B), *Cladocopium* (formerly Clade C), and *Durusdinium* (formerly Clade D).

New: Corals typically associate with *Symbiodiniaceae* from the genera *Symbiodinium*, *Breviolum*, *Cladocopium*, and *Durusdinium*.

Old: *Symbiodinium* Clade I has only been recovered from forams.

New: '*Symbiodinium*' Clade I has only been recovered from forams.

**Note that quotation marks in the last example are meant to reflect that "Clade I" has not yet been given a formal genus name, and still technically falls within the *Symbiodinium* genus, though it is a genus-level entity that should be revised in the future. The same is true for Clade H, the foram lineages of Clades D and G, and Temperate A.

Species Level Changes

Old: The pale sea anemone associates with *Symbiodinium minutum* (ITS2 type B1).

New: The pale sea anemone associates with *Breviolum minutum* (ITS2 type B1).

New: The pale sea anemone associates with *Breviolum minutum* (ITS2 type B1; Genbank Accession AF333511).

New: The pale sea anemone associates with *Breviolum minutum*.

Old: Examples of free-living species include *S. pilosum* (A2), *S. voratum* (E1), and *S. kawagutii* (F1).

New: Examples of free-living species include *S. pilosum* (A2), *E. voratum* (E1), and *F. kawagutii* (F1).

New: Examples of free-living species include *S. pilosum*, *E. voratum*, and *F. kawagutii*.

Old: *Symbiodinium* C40 is a host-generalist lineage.
New: *Cladocopium* C40 is a host-generalist lineage.

**Note that if the species has yet to be described, avoid the abbreviation (e.g. "C. C40", which we feel is confusing); instead, keep the full spelling of the genus intact.

Key references and timeline for establishing genus-level taxonomy in the Symbiodiniaceae

Freudenthal HD (1962) *Symbiodinium* gen. nov. and *Symbiodinium microadriaticum* sp. nov., a zooxanthella: taxonomy, life cycle, and morphology. *Journal of Protozoology* 9:45-52

**First (invalid) description of the genus '*Symbiodinium*' Freudenthal and the type species '*Symbiodinium*' *microadriaticum*. Taxonomically, this description was invalid because it did not include a type specimen as required by the International Code of Botanical Nomenclature (ICBN) and the International Code of Nomenclature (ICN) for Algae, Fungi, and Plants (Article 8.4). This meant that all '*Symbiodinium*' species described before 2009 (see below) were also invalid. The invalidity was not recognized until LaJeunesse (2017).

Hansen G, Daugbjerg N (2009) *Symbiodinium natans* sp. nov.: a "free-living" dinoflagellate from Tenerife (Northeast-Atlantic Ocean). *Journal of Phycology* 45:251-263

**First valid description of the 'genus' *Symbiodinium* Gert Hansen and Daugbjerg and the type species '*Symbiodinium*' *natans*. Although unintentional, this was the first species description to properly validate the genus under ICN article 40.6 because it was the first to include a type specimen. This was not recognized until Guiry & Andersen (2018).

LaJeunesse TC (2017) Validation and description of *Symbiodinium microadriaticum*, the type species of *Symbiodinium* (Dinophyta). *J Phycol* 53:1109-1114

**First (failed) attempt to validate the genus '*Symbiodinium*' LaJeunesse by introducing type material for '*Symbiodinium*' *microadriaticum* and transferring all previously described (and technically invalid) species into the genus. This validation was later nullified by Guiry and Andersen (2018), who invoked ICN Article 40.6 to recognize that Hansen and Daugbjerg (2009) had previously and inadvertently validated the genus '*Symbiodinium*' Gert Hansen & Daugbjerg.

Guiry MD, Andersen RA (2018). Validation of the generic name *Symbiodinium* (Dinophyceae, Suessiaceae) revisited and the reinstatement of *Zooxanthella* K.Brandt. *Notulae Algarum*, 1-5.

**First recognition that *Symbiodinium natans* was the initial valid type species for the genus '*Symbiodinium*' Gert Hansen & Daugbjerg under ICN article 40.6. Also temporarily transferred all validly published '*Symbiodinium*' species (those described after '*S. natans*' chronologically) to the genus *Zooxanthella* K.Brandt using the argument that this was the earliest available genus name

for these species. However, this transfer was based on nomenclatural precedence, not biological relatedness, and inadvertently created a polyphyly that included dinoflagellates from the order Suessiales (the '*Symbiodinium*') with dinoflagellates from the order Peridinales (the *Zooxanthella*), though they are phylogenetically divergent. A more biologically parsimonious grouping would be established by LaJeunesse et al. (2018).

LaJeunesse TC, Parkinson JE, Gabrielson PW, Jeong HJ, Reimer JD, Voolstra CR, Santos SR (2018) Systematic revision of Symbiodiniaceae highlights the antiquity and diversity of coral endosymbionts. *Current Biology* 28:2570-2580.

**First valid revision to split the genus '*Symbiodinium*' Gert Hansen & Daugbjerg into multiple genera: *Symbiodinium* Gert Hansen & Daugbjerg; *Breviolum* J.E.Parkinson & LaJeunesse; *Cladocopium* LaJeunesse & H.J.Jeong; *Durusdinium* LaJeunesse; *Effrenium* LaJeunesse & H.J.Jeong; *Fugacium* LaJeunesse; and *Gerakladium* LaJeunesse. Also negated the Suessiales/Peridinales polyphyly established by Guiry and Andersen (2018) by transferring all relevant species back out of *Zooxanthella* K.Brandt and into their appropriate Symbiodiniaceae genera.