

Types of Gastrulation

Unipolar ingression occurs in:

Anthozoa: Not reported in this group.

Cubozoa: Not reported in this group.

Scyphozoa: *Haliclystus octoradiatus* (Wietrzykowski, 1912), *Thaumatoscyphus distinctus* (Hanaoka, 1934).

Hydrozoa: *Aequorea forskalea* (Claus, 1883), *Clytia flavidula* (Metschnikoff, 1886), *Clytia gregarium* (Freeman, 1981; Byrum, 2001), *Clytia hemisphaericum* (Bodo and Bouillon, 1968), *Clytia viridicans* (Metschnikoff, 1886), *Eutima (Octorchis) gegenbauri* (Metschnikoff, 1886), *Eutonina indicans* (personal observation), *Halocordyle disticha* (unipolar ingression in a stereoblastula) (Thomas et al., 1987), *Laodicea cruciata* (Metschnikoff, 1886), *Leuckartiara leucostyla* (= *Tiara leucostyla*; Metschnikoff, 1886), *Leuckartiara pileata* (= *Tiara pileata*; Hamann, 1883), *Melicertidium octocostatum* (Gemmill, 1922), *Mitrocoma annae* (Metschnikoff, 1886), *Obelia lucifera* (Bodo and Bouillon, 1968), *Obelia nigra* (Bodo and Bouillon, 1968), *Podocoryne carnea* (Bodo and Bouillon, 1968) *Polyorchis penicillatus* (personal observation), *Rathkea fasciculata* (Metschnikoff, 1886), *Spirocodon saltatrix* (Uchida, 1927), *Stomotoca apicata* (Rittenhouse, 1910), and *Tima pellucida* (Metschnikoff, 1886).

Multipolar ingression occurs in:

Anthozoa: Pure multipolar ingression seems to be absent, but this morphogenetic movement accompanies other morphogenetic activities. See section on mixed forms of gastrulation.

Cubozoa: *Carybdea rastonii*. (Okada, 1927).

Scyphozoa: *Aurelia marginalis* (Mergner, 1971) and *Nausithoë aurea* (Morandini and de Silveira, 2001).

Hydrozoa: *Aeginopsis mediterranea* (Metschnikoff, 1886), *Gonionemus vertens* (in a stereoblastula) (Bodo and Bouillon, 1968), *Gonothyrea loveni* (under uncrowded conditions; when crowded it uses morula delamination; Wulfert, 1902), *Melicertidium octocostatum* (Gemmill, 1920), and *Obelia* sp. (Fioroni, 1979).

Animals only utilizing blastula delamination include:

Anthozoa: *Ptilosarcus guernei* (Chia and Crawford, 1973) and *Renilla* sp. (Wilson, 1883).

Cubozoa: *Tripedalia cystophora* (Conant, 1897).

Hydrozoa: *Geryonia (Liriope) fungiformis* (Mergner, 1971), *Gonionemus depressens* (Kume and Dan, 1968), *Lensia conoidea* (Carré, 1917), *Muggiaea atlantica* (Freeman, 1983), and *Nanomia cara* (Freeman, 1983).

Scyphozoa: Not reported in this group.

Examples of animals only utilizing morula delamination include:

Anthozoa: *Sympodium coralloides* (Kowalevsky and Marion, 1883).

Cubozoa: Not reported in this group.

Hydrozoa: *Abylopsis tetragonia* (Carré, 1967), *Aglaura hemistoma* (Metschnikoff, 1886), *Campanularia angulata* (Metschnikoff, 1886), *Clava squamata* (Harm, 1903), *Cordylophora caspia* (Kirchner, 1935?), *Dynamena pumila* (Müller-Calé, 1913), *Forskalia edwardsi* (Carré, 1967), *Gonothyrea loveni* (under crowded conditions; Wulfert, 1902), *Halammohydra vermiformis* (Swedmark and Tessier, 1966), *Laomedea flexuosa* (Müller-Calé, 1913), *Otohydra vagans* (Swedmark and Tessier, 1966), *Plumularia echinulata* (Müller-Calé, 1913), *Plumularia setacea* (Metschnikoff, 1886), *Rhopalonema velatum* (Metschnikoff, 1886), *Sertularella polyzonias* (Müller-Calé, 1913), *Sphaeronectes gracilis* (Carré, 1969), and *Turritopsis nutricula* (complex developmental mode intermediate between morula delamination and syncytial cleavage; Brooks and Rittenhouse, 1907).

Scyphozoa: Not reported in this group.

Syncytial delamination occurs in the following:

Anthozoa: Not reported in this group.

Cubozoa: Not reported in this group.

Hydrozoa: *E. armatum* (Timchomiroff, 1887) and *Eudendrium racemosum* (Mergner, 1957).

Scyphozoa: Not reported in this group.

Cnidarians gastrulating by invagination include:

*Note: Ingression frequently precedes invagination in the Scyphozoa, but cells which ingress are not thought to contribute to the archenteron.

Anthozoa: *Actinia bermudensis* (Cary, 1910), *Actinia equina* L. (Siewing, 1969), *Adamsia palliata* (Gemmill, 1920), *Bolocera turdiae* (Gemmill, 1922), *Cerianthus lloydii* (Nyholm, 1943), *Edwardsia* sp. (Wietrzykowski, 1914), *Epiactis prolifera* (Uchida and Iwata, 1954), *Halcampa duodecimcirrata* (accompanied by ingression of cells from the blastoderm; Nyholm, 1949), *Metridium marginatum* (McMurrich, 1891), *Nematostella vectensis* (invagination appears to be accompanied by polar ingression of cells from the archenteron tip;

personal observation), *Pachycerianthus multiplicatus* (Nyholm, 1943), *Peachia quinquecapitata* (Spaulding, 1972), *Sagartia troglodytes* (Faurot, 1903 and 1907), and *Urticina crassicornis* (Appellöf, 1900).

Cubozoa: Not reported in this group.

Hydrozoa: Not reported in this group.

Scyphozoa: *Aurelia aurita* (preceded by unipolar ingression; Hyde, 1894), *Aurelia flavidula* (preceded by ingression; Fioroni, 1979), *Chrysaora hyoscella* (preceded by unipolar ingression; Hadzi, 1907; Tessier, 1929), *Cotylorhiza tuberculata* (preceded by ingression; Goette, 1887), *Cyanea capillata* (preceded by unipolar ingression; Hyde, 1894), *Linuche unguiculata* (invagination accompanied by polar ingression of cells from archenteron tip...ingressing cells are thought to contribute to the entoderm; Conklin, 1909), *Mastigias papua* (preceded by ingression; Uchida, 1926), *Nausithoë marginata* (Metschnikoff, 1886), *Nausithoë punctata* (Komai, 1935), and *Pelagia noctiluca* (preceded by unipolar ingression; Metschnikoff, 1886).

Epiboly is found in the following:

Anthozoa: Not reported in this group.

Cubozoa: Not reported in this group.

Hydrozoa: *Aglantha digitale* (Freeman, 1983).

Scyphozoa: Not reported in this group.

Mixed delamination is found in the following:

Anthozoa: Not reported in this group.

Cubozoa: Not reported in this group.

Hydrozoa: *Bougainvillia superciliaris* (Gerd, 1892), *Cordylophora lacustris* (Morgenstern, 1901), *Eleutheria dichotoma* (Weiler-Stolt, 1960), *Hydra* spp. (Brauer, 1891a; Mergner, 1971), *Hydractinia echinata* (Bunting, 1894), *Halecium tenellum* (Hamann, 1882), *Liriope mucronata* (Metschnikoff, 1886; Brooks, 1886), *Polyxenia leucostyla* (Metschnikoff, 1886), *Sarsia eximia* (Bodo and Bouillon, 1968), *Tubularia larynx* (delamination accompanied by unipolar [rare] or multipolar [common] ingression; Mergner, 1971), and *Tubularia mesembryanthemum* (Brauer, 1891b).

Scyphozoa: Not reported in this group.

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