



Cnidarians



A Detailed Approach

Cnidarian Characteristics

1. Radial or biradial symmetry
 2. Diploblastic, tissue-level organization
 3. Gel-like mesoglea between epiderm & gastroderm
- Bi - 2
 - Diplos – double
 - Blastos – bud
 - Meso – middle
 - Glia – glue
 - Epi – upon
 - Gaster – stomach
 - Derma – skin

Cnidarian Characteristics

4. Gastrovascular cavity
 - Vasculum – small vessel
5. Nerve Net
6. Cnidocytes (specialization)
 - Knide - nettle

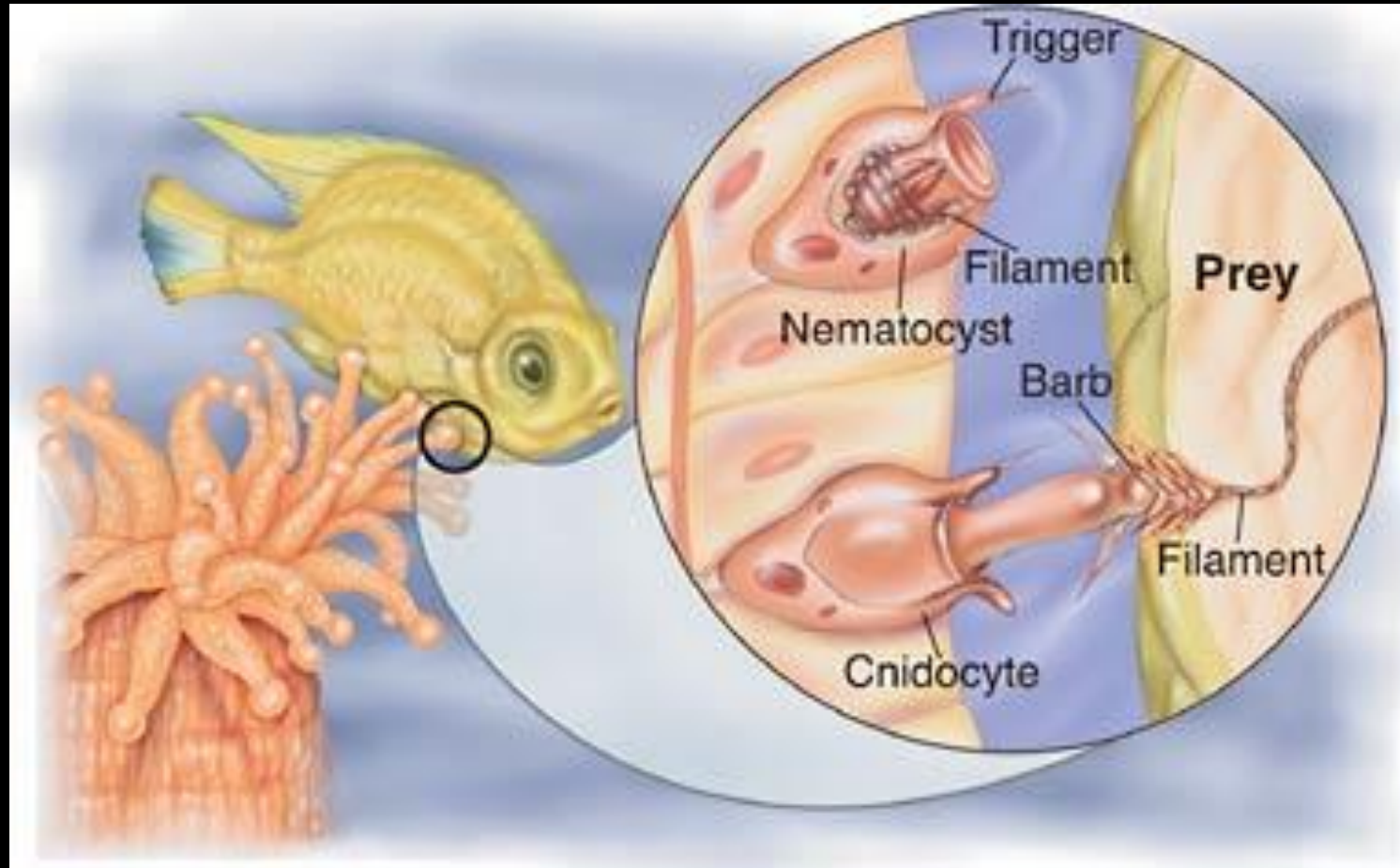
Cnidarian Body Plan

- Symmetry
 - Radial (pie slices)
 - Biradial
 - Mirrored across a middle plane
 - No differentiation
 - Mouth end – oral end
 - Other end – aboral end

The Body Wall

- 2 embryological layers
 - Epidermis – from ectoderm, outer layer
 - Gastrodermis – from endoderm, inner layer
 - Both specialize for protection, eating, movement, etc...
- Mesoglea
 - Not alive
 - Cells originate in epidermis or gastrodermis

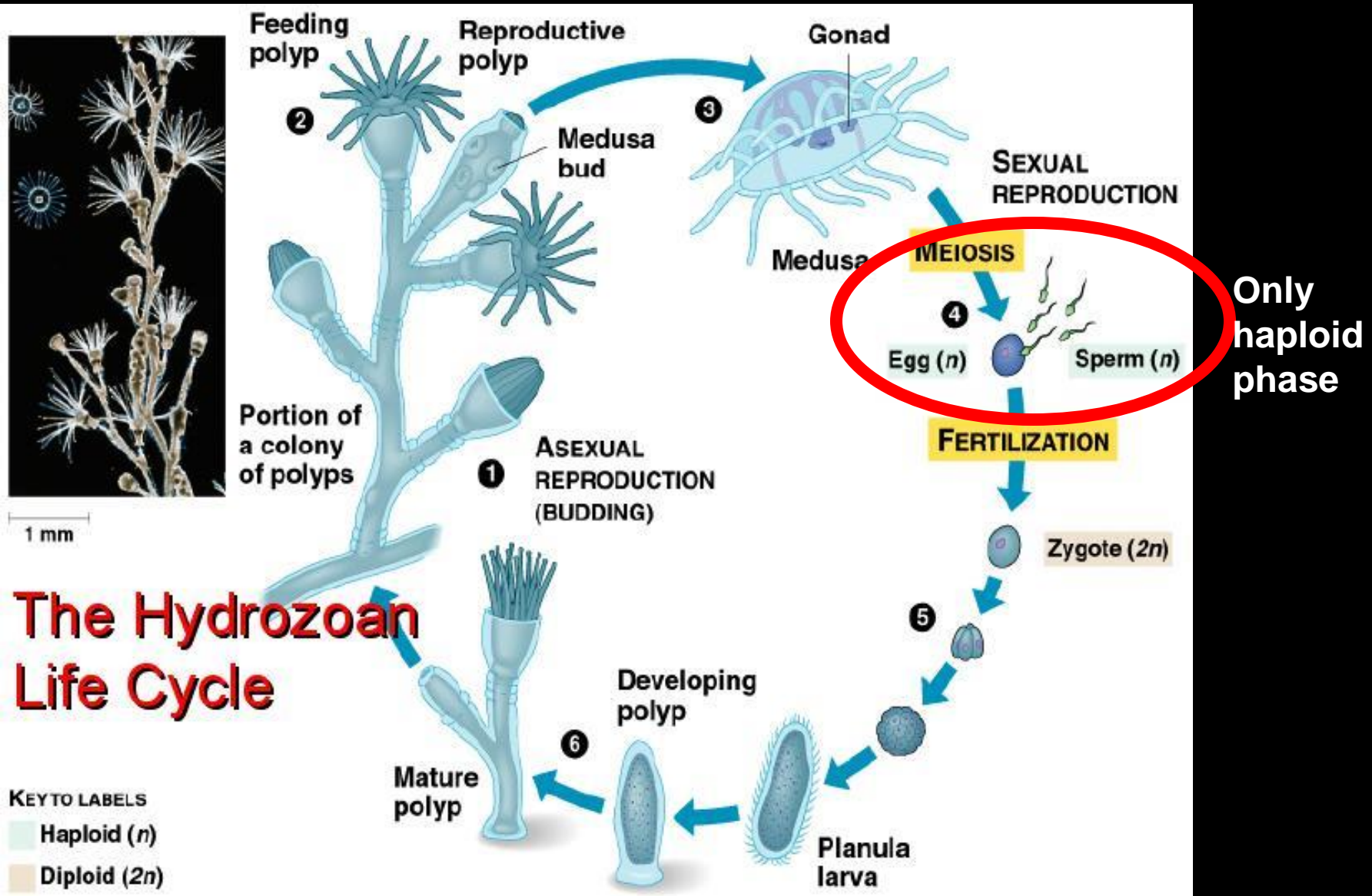
Nematocysts



Stinging Structure

- Cninoblast – early cnidocytes
- Cnidocytes – stinging cells
 - Cnidae (plural) cnida (singular)
 - discharged organelle (over 20 types)
 - Nematocyst a common type
 - Operculum – lid/flap
 - Cnidocyl – Modified cilia (trigger)
 - https://www.youtube.com/watch?v=Pu_ijC8HFRU
- Knide – nettle
- Blastos – germ
- Cilium – hair
- Kytos – hollow vessel
- Operculum - cover
- Nema – thread
- Kystis – bladder

Alternation of Generations



Alternation of Generations

- Both body types
- Polyp is (usually)
 - Asexual
 - Sessile
- Medusa
 - Dioecious
 - Motile, free swimming
 - More mesoglea than polyp
- Polypous – many footed
- Di – two
- Oikos - house

Digestion

- Gastrovascular Cavity – one opening
- Helps
 - Digestion
 - Gas exchange
 - Excretion
 - Gamete release
- All through mouth
- Gaster – stomach
- Vasculum – small vessel

Digestion

- Small crustaceans or fish get paralyzed
- Contractile cells make tentacles shorten
- Gastrodermal efforts
 - gland cells secrete mucus and enzymes (make food into “soup”)
 - Nutritive-muscular cells phagocytize “soup”
 - Food vacuoles complete digestion

Phaegin – eat

Kytos – hollow vessel

Excretion

- Nutritive-muscular cells move materials out (and in) through peristalsis (alternating compressions)

Locomotion

- Polyps
 - Somersaulting
 - Inchworm
- Medusae
 - Follow the current for horizontal motion
 - Contract for vertical motion

Nerve Cells

- Primitive
- Below epidermis, near mesoglea
- Interconnect to form 2D nerve net
- Movement based on strength of stimulus/
nerve impulse

Reproduction

- Mostly dioecious
- Sperm and eggs may be
 - released outward
 - into gastrovascular cavity
 - Retained within body until fertilization

Early development

- Blastula forms early
- Interior fills with cells that will become gastrovascular cavity
- Embryo elongates to form planula (free-swimming larva)

Planus – flat

Class Hydrozoa

- Most are marine
- Only cnidarians w/ freshwater members
- Distinguishing traits
 1. Nematocysts only in epidermis
 2. Gametes are epidermal & released out
 3. Mesoglea is mostly acellular

Nema – thread

Kystis - bladder

Hydrozoans

- Most live in colonial polyps
- Individuals specialized for
 - Feeding (gastrozoid or hydranth)
 - Tentacles for feeding
 - Secretes protein and chitin skeleton (perisarc)
 - Producing medusae (gonozoid)
 - Defending the colony

Zoon – animal

Hydra – water

Anthos – flower

Peri – around

Sarx – flesh

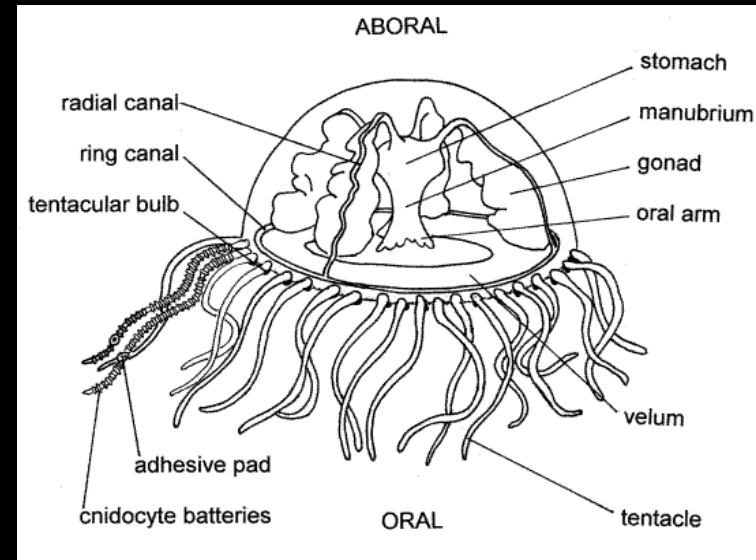
Gono – offspring

Zoid – individual animal

Gonionemus anatomy

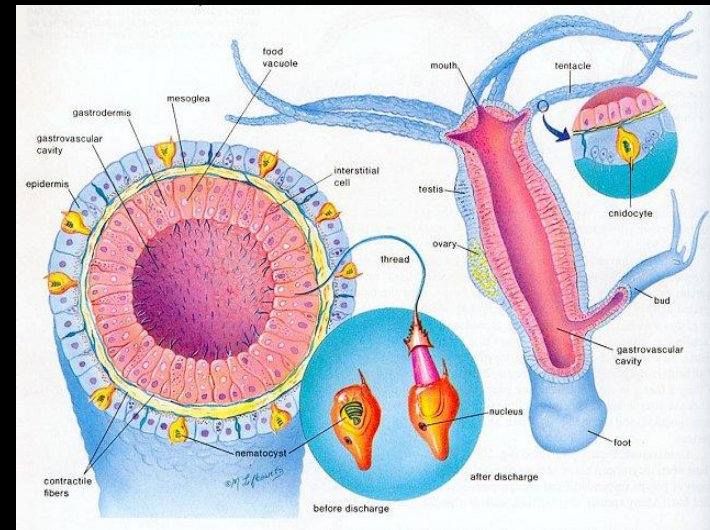
- Medusa stage predominates
- Typical hydrozoan medusae biology
 - Lives attached to seaweed
 - Margin (inner rim of bell) curves in to form lip called velum which helps project water

Velum – veil, covering



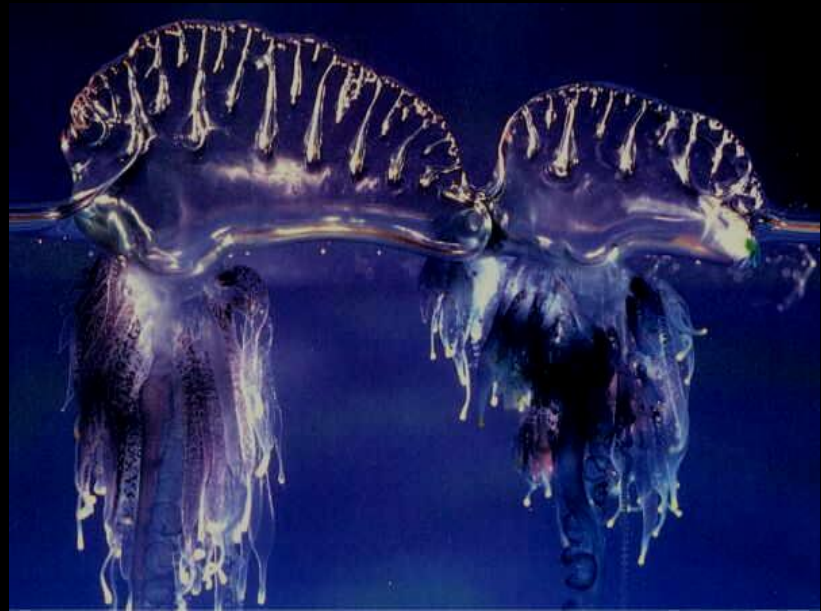
Hydra

- Hangs under floating plants in clean freshwater systems
- No medusa stage
- Reproduces asexually and sexually



Large Hydrazoan colonies

- Order Siphonophora
- Polypoid
 - Dactylozooids – predators
 - Digesters
- Medusoid
 - Swimming bells
 - Sac floats
 - Oil floats
 - Gonads
 - Leaflike defensive structures



Class Staurozoa

- All marine, found in colder water
- 8 tentacle clusters at mouth end
- Aboral end attaches to rock or seaweed
- Sexual reproduction creates crawling planula



Scyphozoan Danger

- Many are harmless
- Some are dangerous
 - *Mastigias quinquecirrha* (stinging nettle)
 - Avoid
 - Helmet shape
 - Long tentacles
 - Fleshy lobes



Aurelia

- Common on both North American coasts
- Margin of medusa has ring of short tentacles
- Mouth leads to 4 gastric pouches which contain cnidocyte-laden gastric filaments
- Radial canals lead from pouches to ring canal

Aurelia feeding

- Plankton feeder

Drops, resting, catching

Gathers plankton as it falls

Manubrium feeds

- Cilia move food to margin
- Oral lobes scrape food
- Cilia on oral lobes carry food to mouth

Scyphozoan reproduction

- Dioecious
- 2 gonads per gastric pouch (8 total)
- Gametes released to gastric pouches
 - Sperm exit through mouth
 - Eggs usually stay in body until fertilization

Class Cubozoa



- Cuboidal
- Tentacles hang from corners
- Polyps are very small

Cubozoan feeding

- Carnivores
- Hunt by injecting poison
- Tentacles pull food into mouth (1 min)
- Tentacles can stretch up to 10x

Cubozoan response

- Cubozoans have eyes
 - Small spots detect light
 - Larger spots contain cornea, lenses, and retinas
- Some possess dangerous nematocysts

Cubozoan Reproduction

1 pairing per year

1. Male puts tentacles in female's bell
2. Packets of sperm are passed along
3. Fertilization occurs in female (eggs are occasionally released)
4. Motile polyps (Planula)
5. Matures into medusa

Class Anthozoa

- Colonial or solitary
- All marine
- Found at all depths
- No medusae
- No cnidocil (trigger)
- Anemones, stony and soft coral

Anthozoa

Different from hydrozoa

1. Mouth of anthozoan leads to pharynx (throat)
2. Membranes called mesenteries containing cnidocytes and gonads divide GV cavity into sections
3. Mesoglea contains amoeboid mesenchyme (middle infusion) cells

Anemones

- Lifestyle
 - Solitary
 - Symbiotic relationships
 - ex: hermit crab
 - Anemone gets mobility
 - Crab gets protection
 - Clownfish
 - Fish gets protection
 - Anemone is cleaned, may get extra food

Anemone Mesenteries

- Some attach to outer margin and pharynx
- Others attach only to outer margin
- Holes allow water circulation
- At bottom – mesenterial filament
 - Cnidocytes
 - Siphonoglyph – ciliated gullet for water movement
 - Gland cells for digestion
 - Cells that absorb nutrients

Anemone Response

- When threatened, anemones collapse by releasing water and closing up.
- Refilling the hydrostatic skeleton relies on gradual water uptake

Anemone Locomotion

- Limited
 - Glide on pedal disks
 - Crawl on sides
 - Walk on tentacles
 - “swim” by thrashing around
 - Float using gas bubble in folds of pedal disk

Anemone Feeding

- Eat invertebrates and fishes
- Tentacles draw food in
- Radial muscles open mouth

Anemone Reproduction

- Asexual
 - Pedal laceration - Pedal disk breaks off
 - Transverse fission – divide into 2
- Sexual
 - Monoecious or dioecious

Anemone Reproduction (sexual)

- Monoecious
 - Protandry
 - Male gametes made 1st
 - Avoid self fertilization
- Dioecious

Stony Coral reproduction

- Sexual – like anemone
- Asexual
 - Budding
 - Makes members of colony

Stony Coral symbiosis

- Photosynthetic dinoflagellate zooxanthellae
 - Provide organic carbon
 - Helps with CaCO_3 by
 - removes CO_2
 - pH changes ppt CaCO_3
- Coral metabolism
 - Provide nitrogen
 - Provide phosphorus

Dinos – whirling

Flagellum – a whip

Zoon – animal

Xanthos - yellow

Stony Coral Environment

- 90 m depth limit (light related)
- Increased water temp can kill zooxanthellae (bleaching)

Octocorallian Corals

- Common in warm waters
- 8 pinnate (featherlike) tentacle
- 8 mesenteries
- 1 siphonoglyph
- Internal skeleton of protein or CaCO_3 .
- Sea fans, sea pens, sea whips, red corals, organ pipe corals