

Phylum Rotifera (rotifers)

2200 species

a group of microscopic animals discovered when microscopes were first being developed

1st described in 1696 by Rev John Harris as "an animal like a large maggot which could contract itself into a spherical figure and then stretch itself out again; the end of its tail appeared with a forceps like that of an earwig."

von Leewenhoek himself describe a few species in the early 1700's

"wheel bearers" = characteristic ciliated crown = **corona**; resembles rotating wheels

most are 0.1-0.5 mm; but some up to 3 mm long

- some even smaller than some protozoa

most are transparent, a few are brightly colored

of all invertebrates, the rotifers are most characteristic of freshwater habitats

most species are found in freshwaters; also some (<5%) are found in other habitats:

brackish waters

a few marine

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a few are terrestrial, in moist soils & mosses

most aquatic forms are **benthic** or **interstitial** fauna

some are planktonic and play major role in planktonic food chains

→ reproduce quickly into large populations

→ important as food for larger zooplankton and fish in aquatic ecosystems

some epizoic or parasitic

a few are sessile, living inside tubes or gelatinous secretions

a few are colonial

great diversity in shape within the phylum

→ somewhat correlated with their mode of life:

floaters → globular and saclike

creepers & swimmers → elongated and wormlike

sessile → vasselike

some species are cosmopolitan with a worldwide distribution

others with very restricted ranges

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rotifers are notable in that they have a much **faster metabolism** than many other cold blooded invertebrates

Body Form

body consists of: **head, trunk, and foot**

head

ciliated **corona (or crown)**

used both for locomotion and feeding

gives impression of spinning wheel

often with **sensory bristles** or **papillae**

mouth is inside corona

trunk

elongated or sac-like

contains visceral organs

often has sensory antennae

often with false segmentation visible

in some: cuticle is very thick, caselike, fibrous layer

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= **lorica**

foot

narrow, often tapered, with 1 to 4 toes

often arranged in plates or rings

often telescopically retractile (external segmentation)

foot is an attachment organ

toes contain cement glands (=pedal glands)

pedal glands secrete adhesive material

used by both sessile and creeping forms

foot reduced in pelagic forms

many species secrete a wide variety of protective **tubes** in which they live:

gelatinous

constructed of small pieces of debris

sometimes colored yellow, green or brown

eutely as in nematodes

Body Wall

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syncytial epidermis (= hypodermis)

secretes thin flexible **cuticle**

in some species some or all of the cuticle is thickened into a rigid casing (= **lorica**)

bands of muscles below epidermis

some circular; some longitudinal

body cavity a fluid filled **pseudocoelom**

amoeboid cells circulate in fluid

Movement

some swim using coronal cilia

some with creeping or leechlike movement

some sessile

Feeding & Digestion

carnivores: feed on protozoa and small animals

most feed by sweeping particles into mouth with corona

can filter 100,000 x's its own volume/hr

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→ rotifers are sometimes used in fish tanks to clear up water clouded by organic particles

some are **predatory** and seek out their prey; probably by touch or chemical stimuli

inside mouth food is directed to a uniquely modified **pharynx** called a **mastax** that is constantly working back and forth

lots of variation in size & shape

operated by bands of muscles

contains hard chitinous jaws (= **trophi**) that suck in and grind up food

complete digestive tract

both digestion and absorption occurs in the stomach

short intestine leads to anus in foot

some species of rotifers have symbiotic zoochlorellae within the cells of the stomach wall

Respiration

rotifers have no specific organs for respiration

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→ their small size allows them to exchange respiratory gasses by diffusion across their body wall

rotifers have a relatively high metabolic rate compared to other aquatic invertebrates

generally have high O₂ requirements

others are capable of withstanding anaerobic or near anaerobic conditions for extended periods

eg some live in anoxic mud or in sewage treatment plant filters

Excretion

pair of protonephridial tubes with **flame cells**

tubes empty into **bladder**, then to **cloaca**

Nervous System

bilobed brain dorsal to mastax

sends pairs of nerves to sense organs and viscera

senses:

eye spots
sensory bristles
papillae
dorsal antennae

Life Cycle

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rotifers are notable in that they have a much faster metabolism than many other cold blooded invertebrates

they can grow and reproduce very quickly

they can grow from an egg to a reproducing adult in 18 hrs

rotifers can have up to 40 generations/yr

in some species, females undergo **cyclomorphosis**

= a cyclical change in form of offspring throughout the year

rotifer species are also noted for variations in size and appearance in different habitats

many rotifers are quite tolerant to desiccation (= **anhydrobiosis**)

under harsh conditions some can cease metabolism and dehydrate

can survive for years and then be rehydrated and active within a few hours

some can form true **cysts** that are even more resistant to extreme cold and heat

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Reproduction

rotifers have poor ability to regenerate parts

sexual reproduction predominates

rotifers are **dioecious**

however, females predominate in most populations

in some species males are unknown

males, when present, are minute, degenerate and/or short-lived

commonly only $\sim 1/3^{\text{rd}}$ as long as females

in some species males are only found for a few weeks each year

in others males are degenerate (no digestive tract)

males are ready for mating within an hour after hatching

rotifers have internal fertilization

the male dies soon afterwards

in some species the males are unknown

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→ females can reproduce by parthenogenesis

in some species, females can produce different kinds of eggs:

amictic eggs:

diploid eggs produced by parthenogenesis

produced during most of the year

mictic eggs:

haploid eggs

capable of being fertilized by male sperm

produced only at certain times of the year

if a female with mictic eggs is not impregnated she immediately lays the eggs and they hatch as males

resting (winter) eggs:

heavy and thick shelled

overwinter on sediment

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extremely resistant to drying and extreme temperatures

in some rotifers, the eggs are retained in the female until they hatch (ovoviviparous)

→ rotifers bear live young

Evolutionary Relationships

while rotifers are typically considered with the pseudocoelomate phyla, new molecular evidence indicates that they are more closely related to coelomates than pseudocoelomates

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