

# LECTURE 3 - OUTLINE



## Diversity & General Morphology II

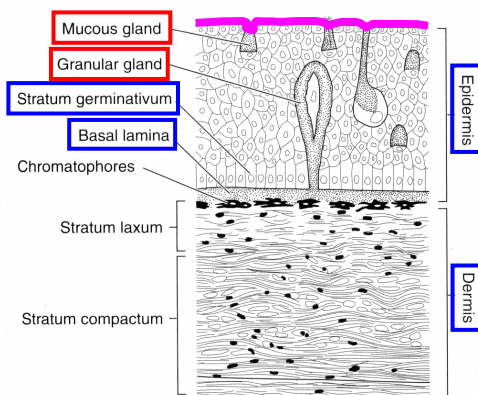
1. General Morphology
  - Integument
  - Scales
2. Life in Water
3. Unique Habitats & Adaptations
  - Depth
  - In a Sea Cucumber?

BIOL 4340 – Lecture 3 - 1

## General Morphology – Integument

### Integument

- epidermis - stratified squamous, resting on basal lamina
- outermost layer a thin noncellular film (mucous cuticle)



### Functions of Mucus

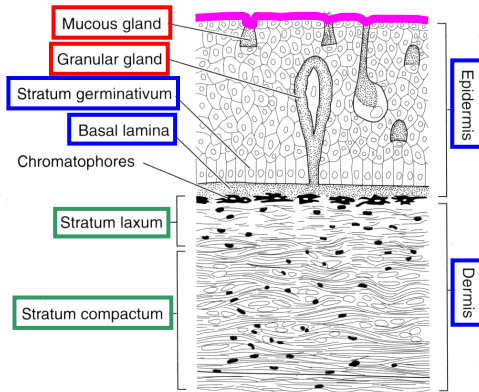
- bacterial invasion
- ectoparasites
- binds irritants
- slippery to predators
- reduces drag
- alarm substance/pheromone
- reduce water exchange

BIOL 4340 – Lecture 3 - 2

## General Morphology – Integument

### Integument

- epidermis - stratified squamous, resting on basal lamina
  - outermost layer a thin noncellular film (mucous cuticle)
- dermis - fibrous connective tissue - relatively few cells



### Dermis

- fibroblasts
- chromatophores
- fat cells
- blood vessels
- nerves
- macrophages

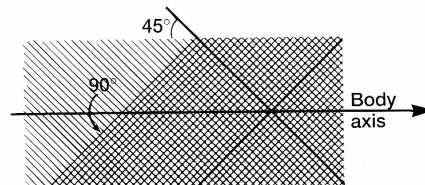
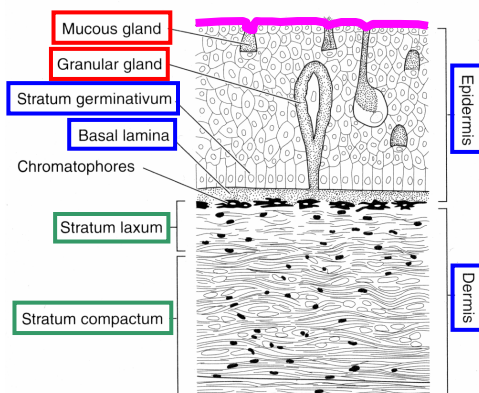
### Dermal skeleton (scales)

BIOL 4340 – Lecture 3 - 3

## General Morphology – Integument

### Integument

- epidermis - stratified squamous, resting on basal lamina
  - outermost layer a thin noncellular film (mucous cuticle)
- dermis - fibrous connective tissue (helical cross fibering)



flexible bias is at 45°

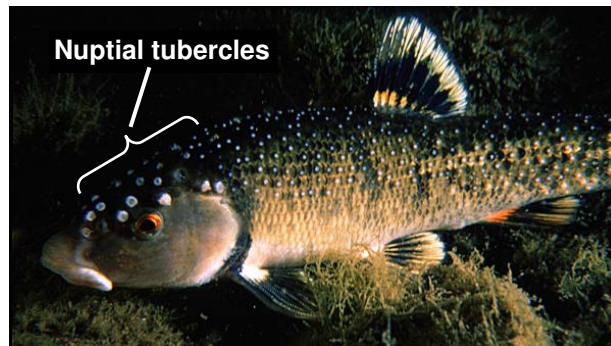
BIOL 4340 – Lecture 3 - 4

## General Morphology – Integument

### Integument

- epidermis - stratified squamous, resting on basal lamina
  - outermost layer a thin noncellular film (mucous cuticle)
- dermis - fibrous connective tissue

nuptial tubercles - keratinous bumps on body, fins, and/or scales of male fish in breeding season

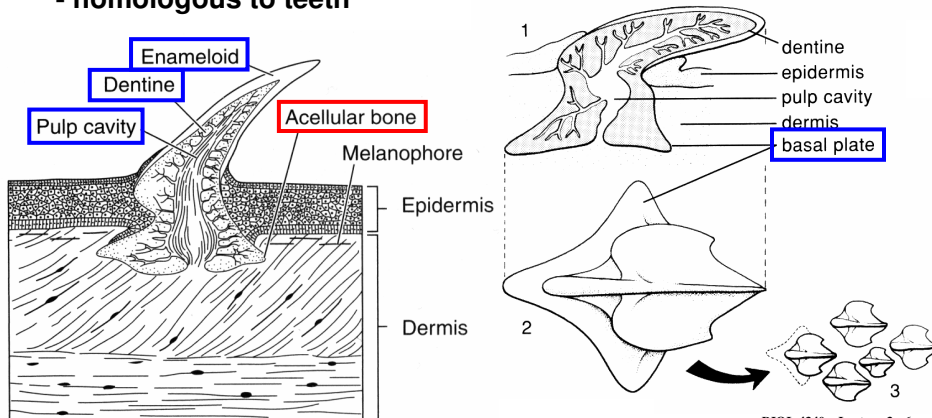


BIOL 4340 – Lecture 3 - 5

## General Morphology – Scales

### Placoid scales (dermal denticles)

- characteristic of cartilaginous fishes (e.g. sharks)
- dentine surrounding a vascular pulp (odontoblasts)
- enamel (vitrodentine) surrounds dentine (ameloblasts)
- homologous to teeth



BIOL 4340 – Lecture 3 - 6

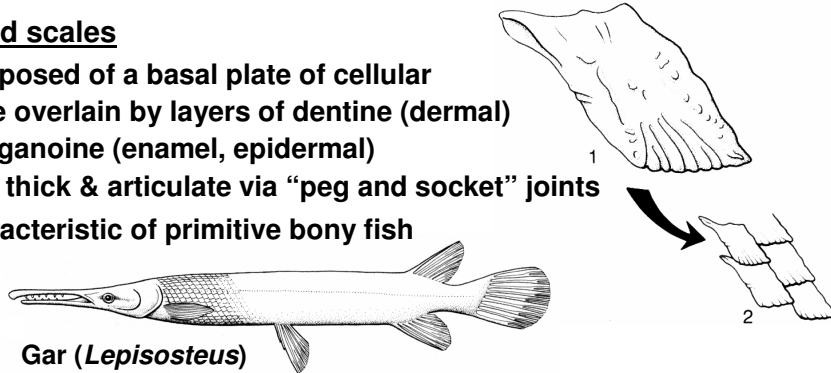
## General Morphology – Scales

### Placoid scales (dermal denticles)

- characteristic of cartilaginous fishes (e.g. sharks)
- dentine surrounding a vascular pulp (odontoblasts)
- enamel (vitrodentine) surrounds dentine (ameloblasts)
- homologous to teeth

### Ganoid scales

- composed of a basal plate of cellular bone overlain by layers of dentine (dermal) and ganoine (enamel, epidermal)
- very thick & articulate via “peg and socket” joints
- characteristic of primitive bony fish

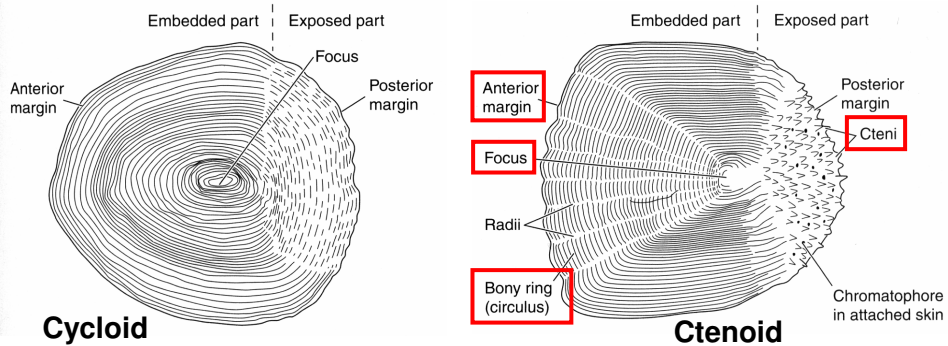


BIOL 4340 – Lecture 3 - 7

## General Morphology – Scales

### Cycloid and Ctenoid scales

- characteristic of all other bony fishes
- very thin and almost completely dermal in origin
- derived from bony basal plate of ganoid scales
- imbricate (i.e. overlap like tiles on a roof)

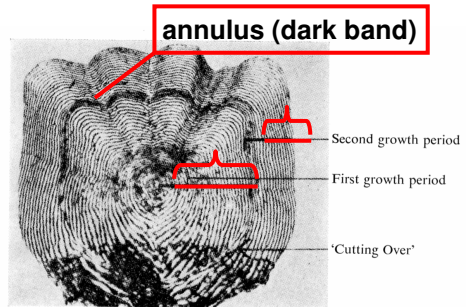
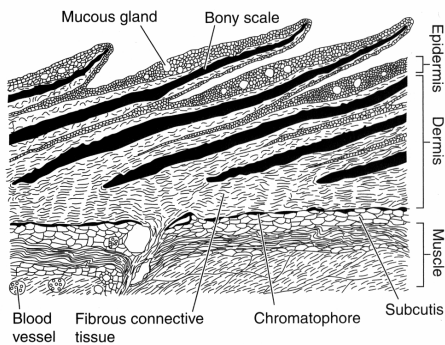


BIOL 4340 – Lecture 3 - 8

# General Morphology – Scales

## Cycloid and Ctenoid scales

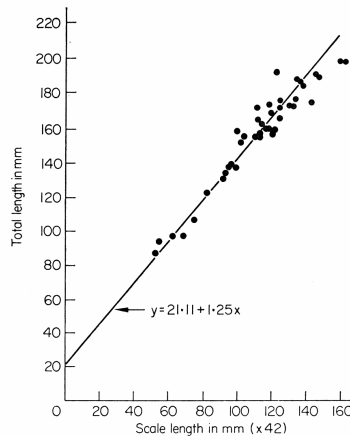
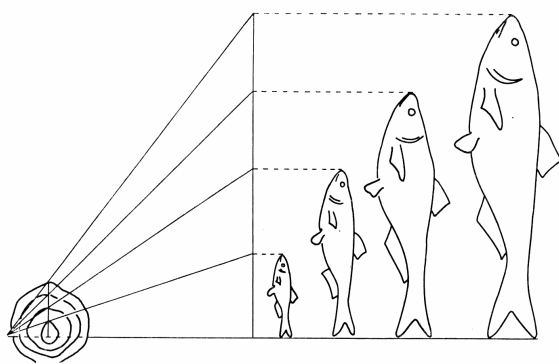
- characteristic of all other bony fishes
- very thin and almost completely dermal in origin
- derived from bony basal plate of ganoid scales
- imbricate (i.e. overlap like tiles on a roof)



BIOL 4340 – Lecture 3 - 9

# General Morphology – Scales

## Cycloid and Ctenoid scales



### False annulus

- created by any retardation in growth
- spawning/migration/injury/parasitism/pollution

BIOL 4340 – Lecture 3 - 10

## Life in Water

Property	Water	Air	Water:Air Ratio
Density (g ml <sup>-1</sup> )	1.00	0.0012	~ 850
Viscosity (kg m <sup>-1</sup> s <sup>-1</sup> )	1.00	0.02	50
Velocity of sound (m s <sup>-1</sup> )	1485	343	4.33
O <sub>2</sub> content (ml l <sup>-1</sup> )	4 - 7	210	1/30
Salts	freely available	not directly available	
Water	abundant but may be osmotically unavailable	rare, difficult to find and keep	

BIOL 4340 – Lecture 3 - 11

## Life in Water

### incompressibility

- reduced effects of gravity
- more thrust can be obtained by pushing against water
- high density means more resistance, hence streamlining (fusiform shape) in active forms
- lateral-line system



### velocity of sound

- sound carried farther and faster in water than in air
- most fish have an excellent sense of hearing
- sound intercepted internally by structures denser (otoliths) or less dense (swim bladder) than water

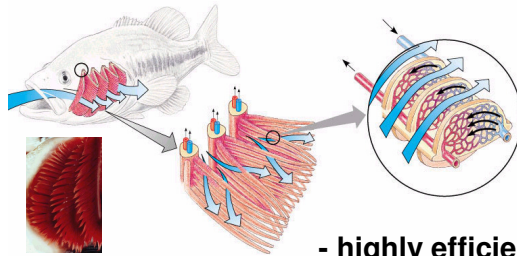
Oyster Toadfish



BIOL 4340 – Lecture 3 - 12

# Life in Water

## water O<sub>2</sub> content



- large surface area
- short diffusion distance  
tuna = < 1  $\mu\text{m}$
- high rate of irrigation

- highly efficient at extracting O<sub>2</sub> (50-90%)

## salts

- minerals & trace elements can be absorbed from water
- diffusion gradients across gill can present a problem
- efficient mechanisms for maintaining mineral balance

BIOL 4340 – Lecture 3 - 13