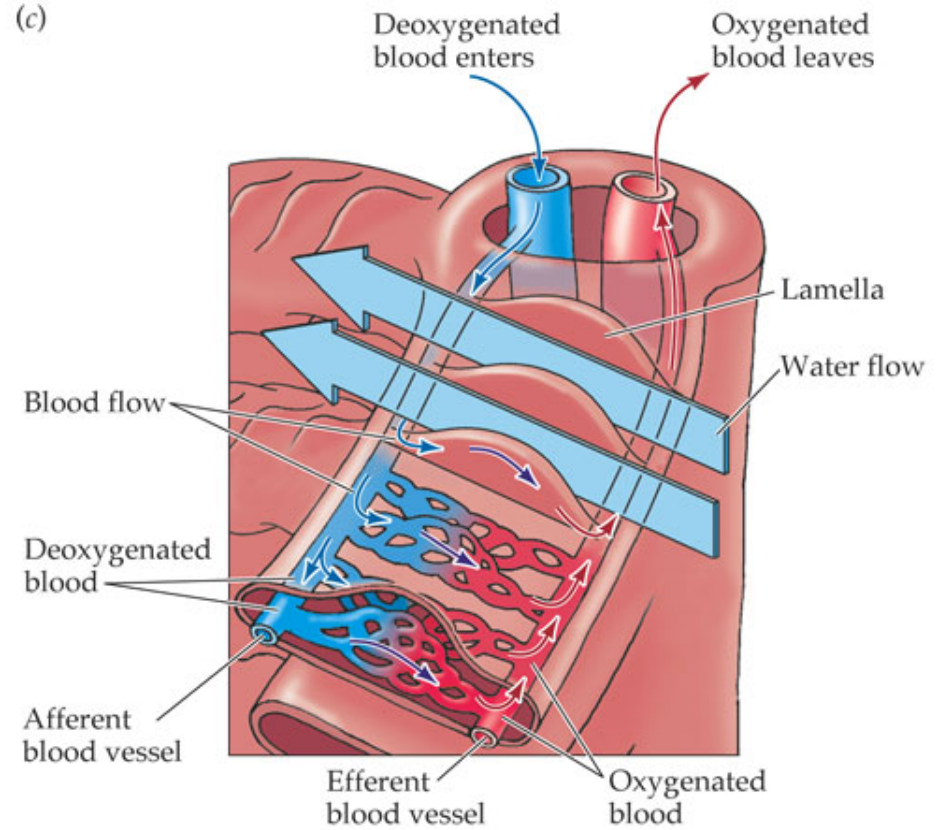
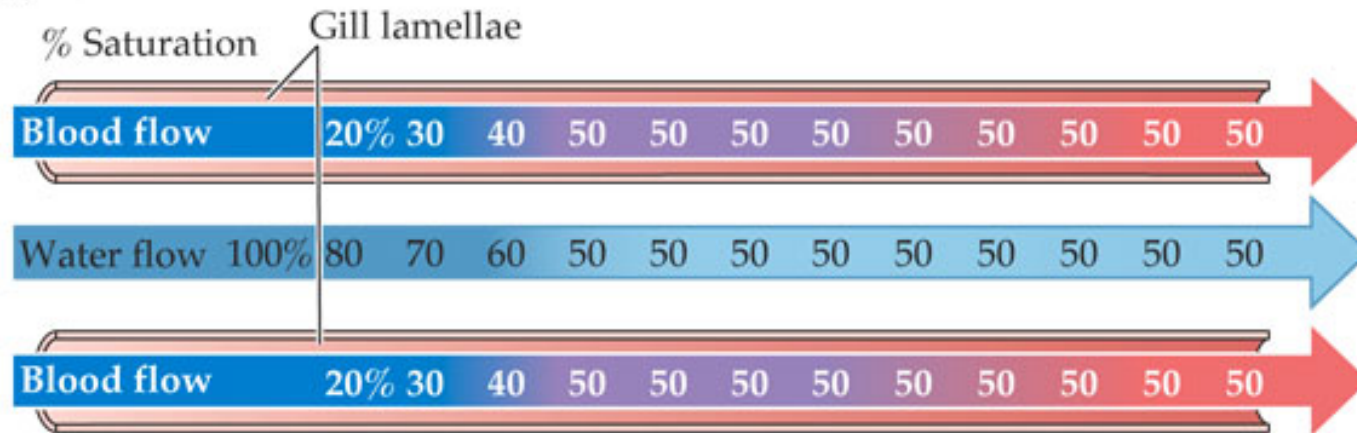


(c)

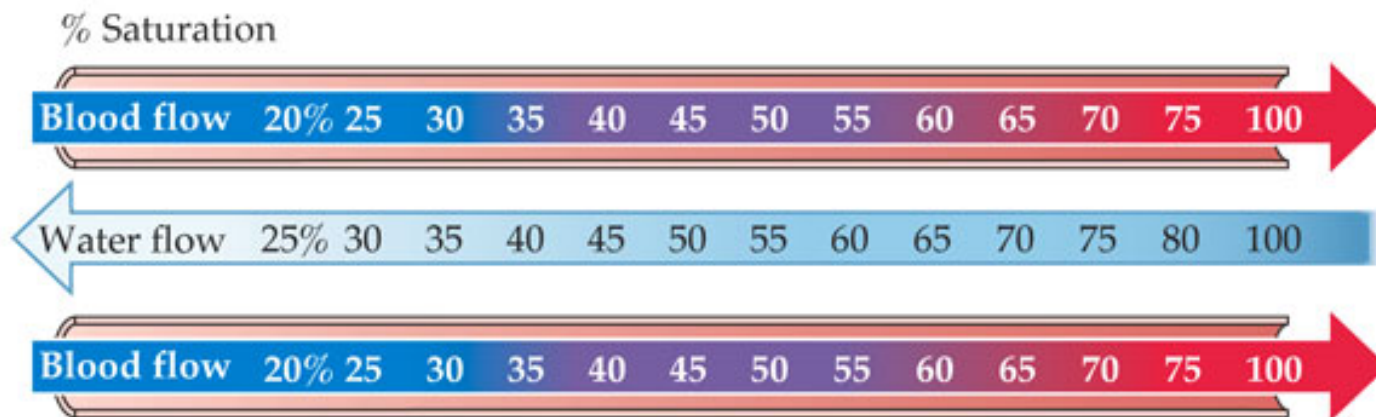


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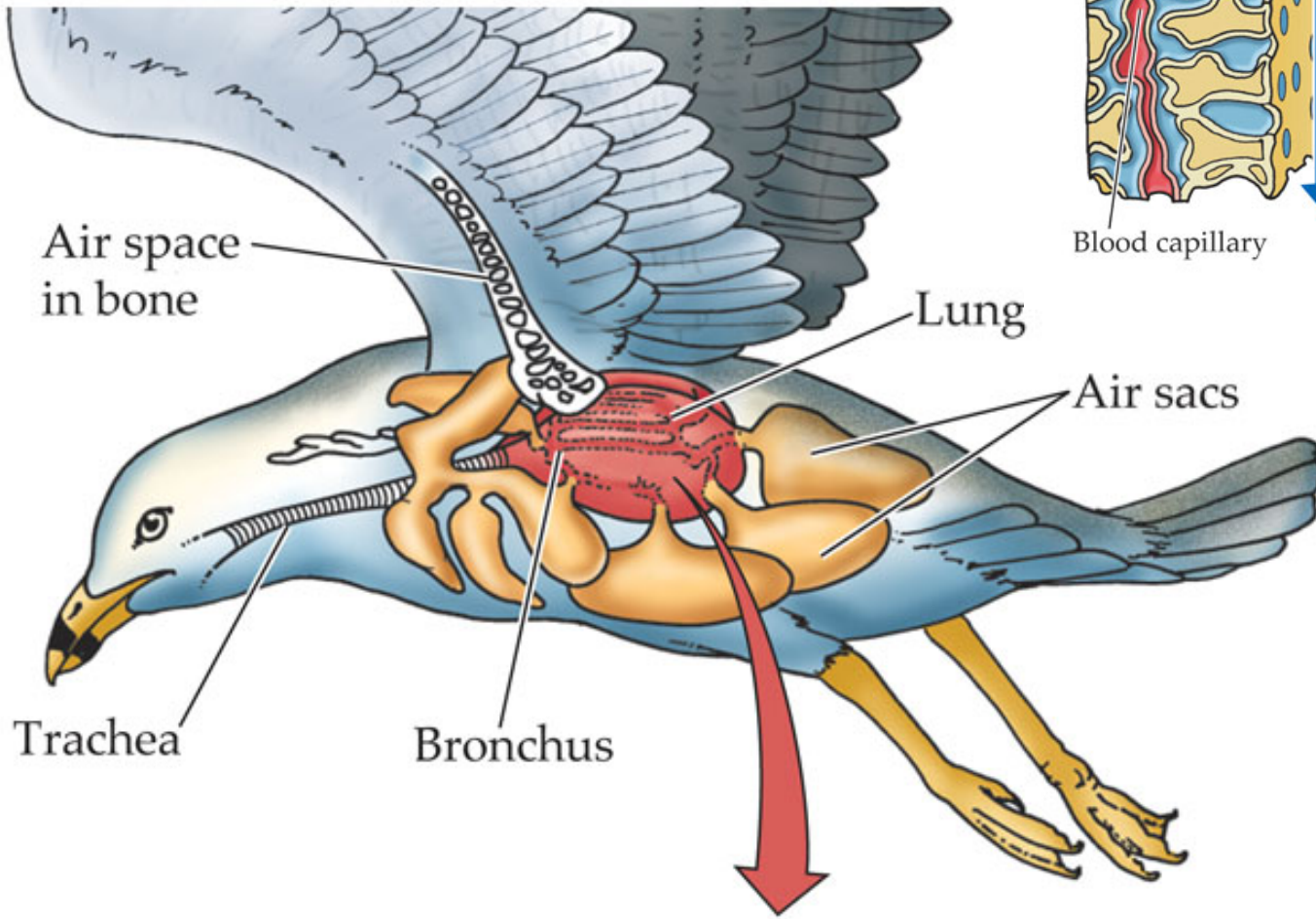
(a) **Concurrent flow**



(b) **Countercurrent flow**







Air space  
in bone

Lung

Air sacs

Trachea

Bronchus

Blood capillary

Air capillaries

Parabronchus

Air

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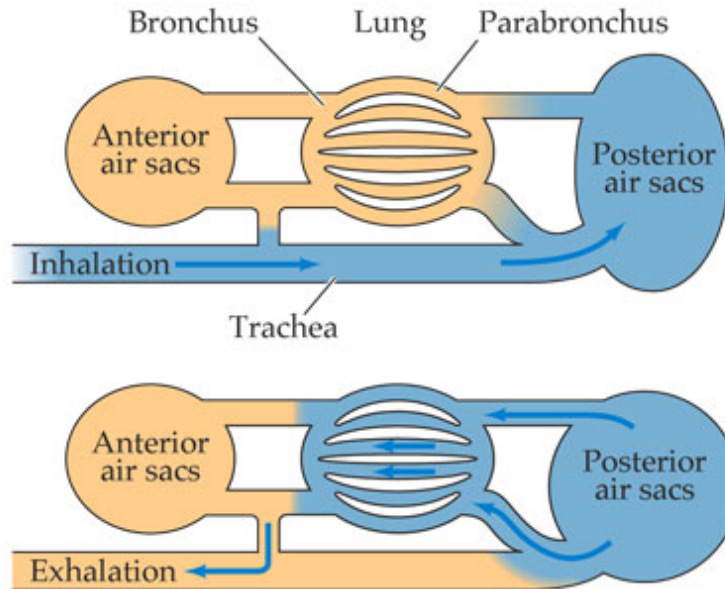
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## EXPERIMENT

**Question:** How does air flow through a bird's respiratory system?

**METHOD** Place oxygen sensors at different locations in a bird's respiratory system. Give the bird one breath of pure O<sub>2</sub>, followed by a breath of normal air. Record when oxygen reaches different sensors.

**RESULTS**  
**Breath 1**

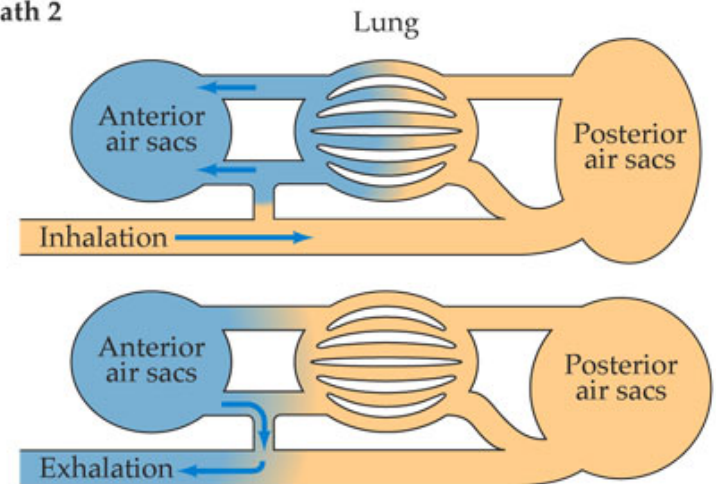


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© 2004 Sinauer A

## EXPERIMENT

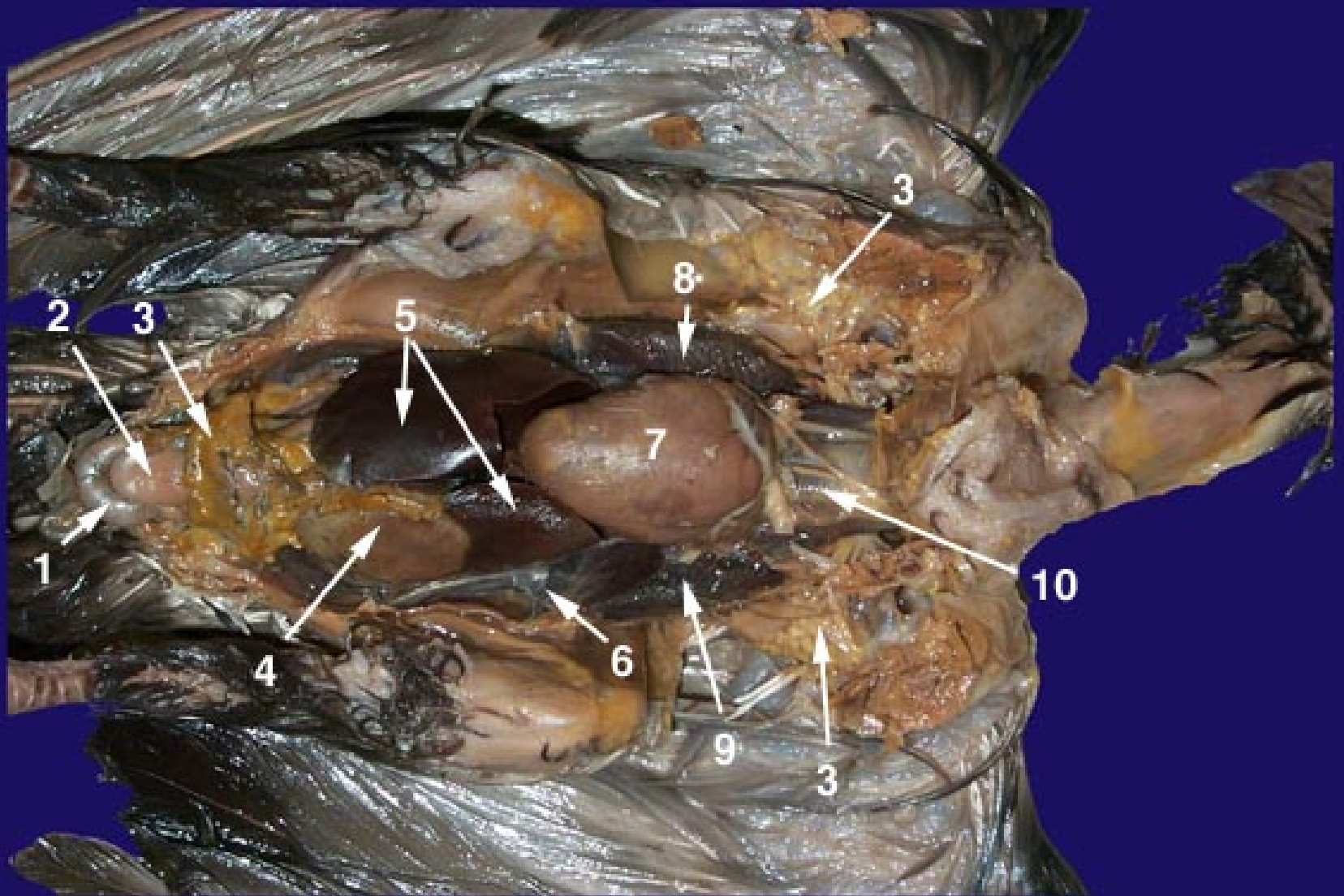
**Question:** How does air flow through a bird's respiratory system?

**Breath 2**

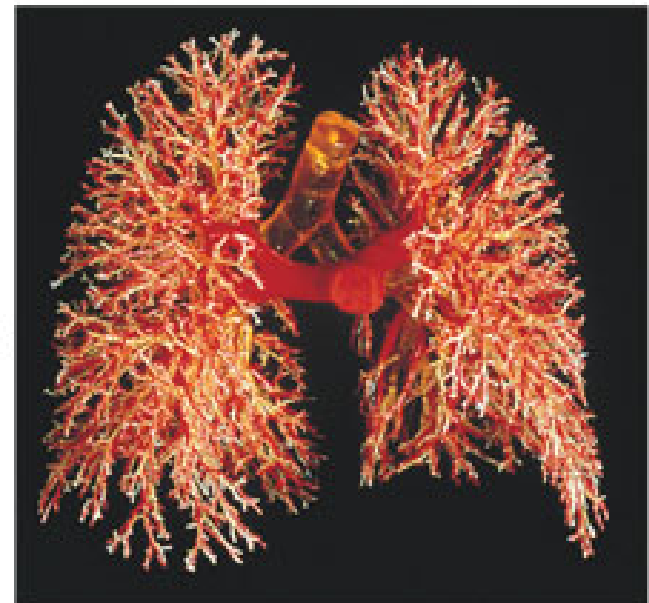
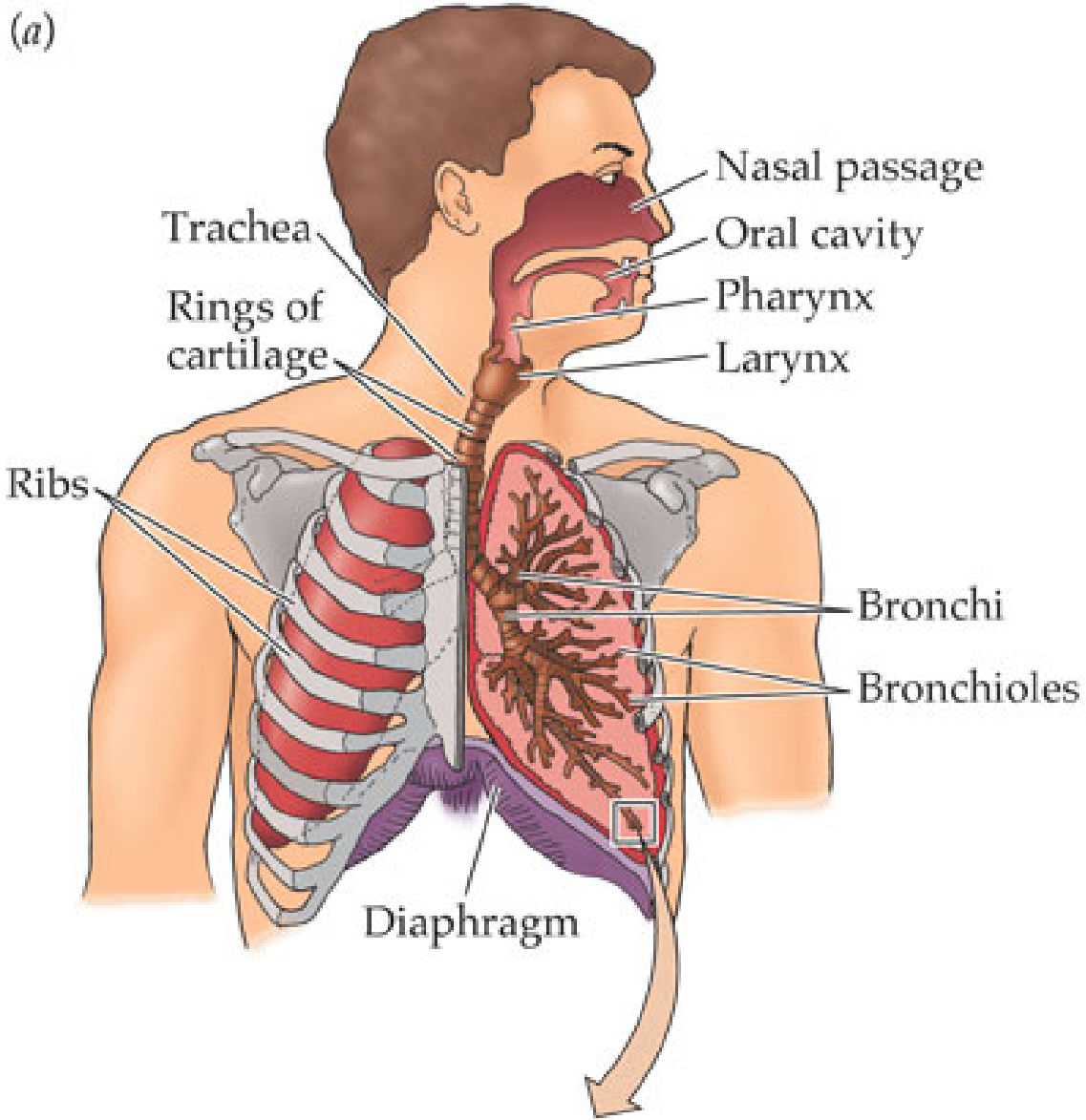


**Conclusion:** Air travels through the lungs in one direction, from the posterior to the anterior air sacs. Two cycles of inhalation and exhalation are required for the air to travel through the bird's respiratory tract.

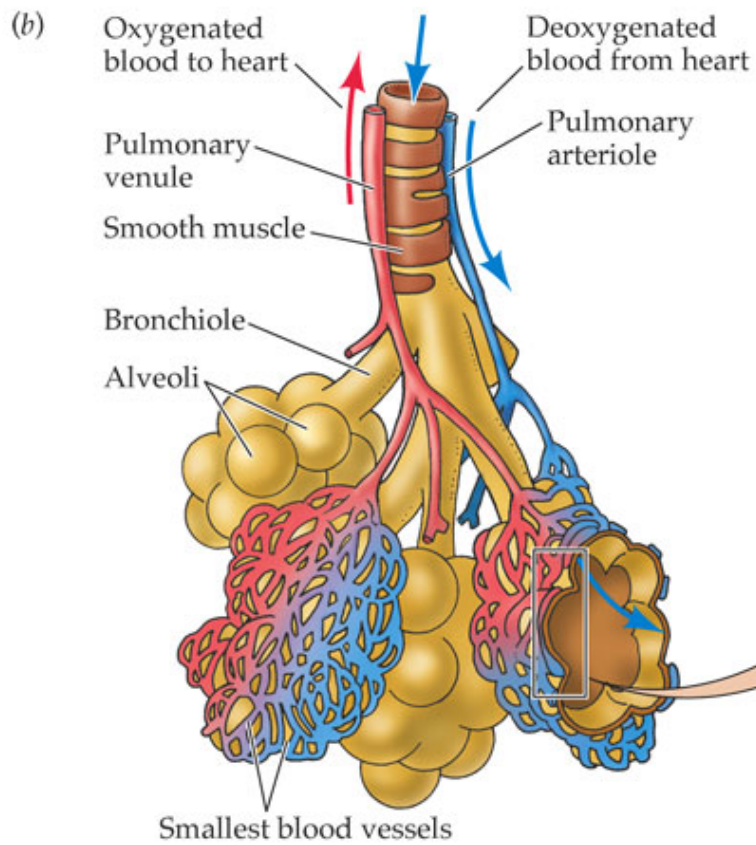
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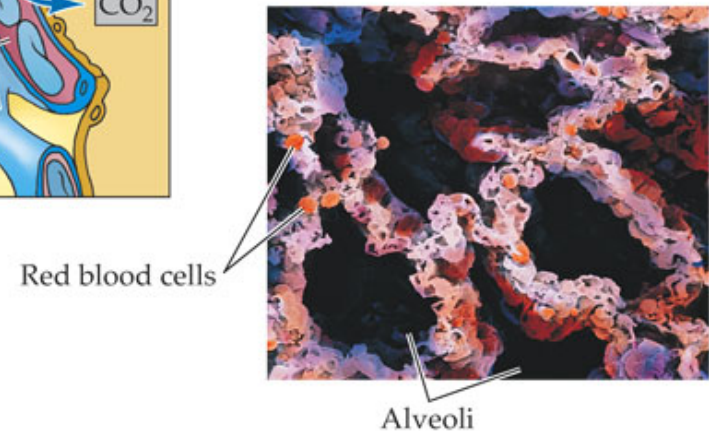
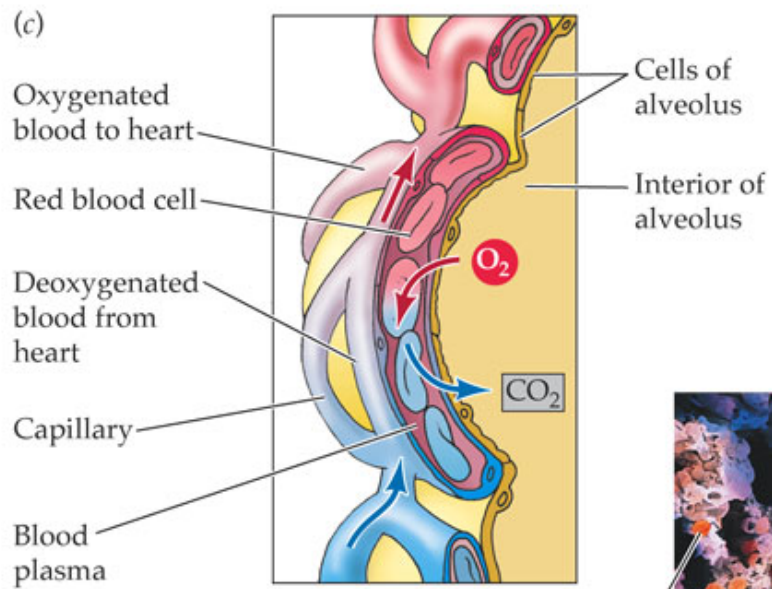
- |             |              |
|-------------|--------------|
| 1 intestine | 6 air sac    |
| 2 pancreas  | 7 heart      |
| 3 fat body  | 8 right lung |
| 4 gizzard   | 9 left lung  |
| 5 liver     | 10 trachea   |



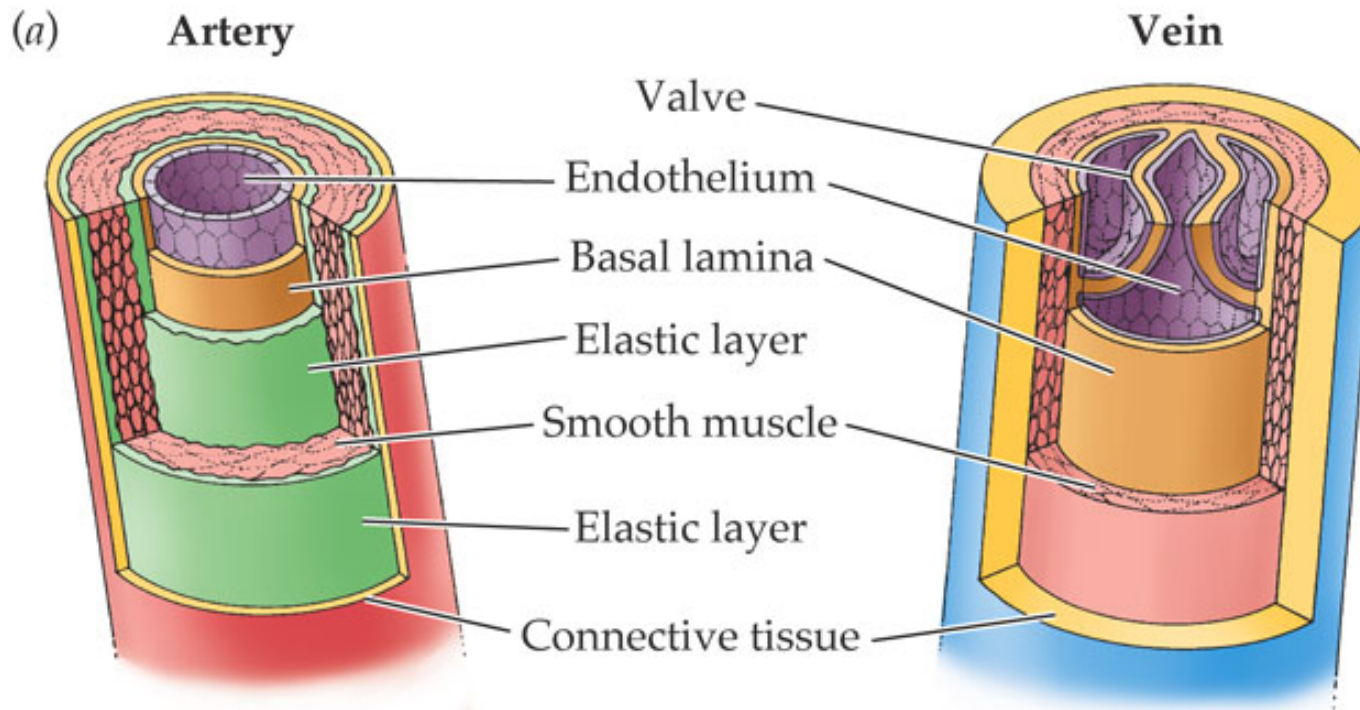


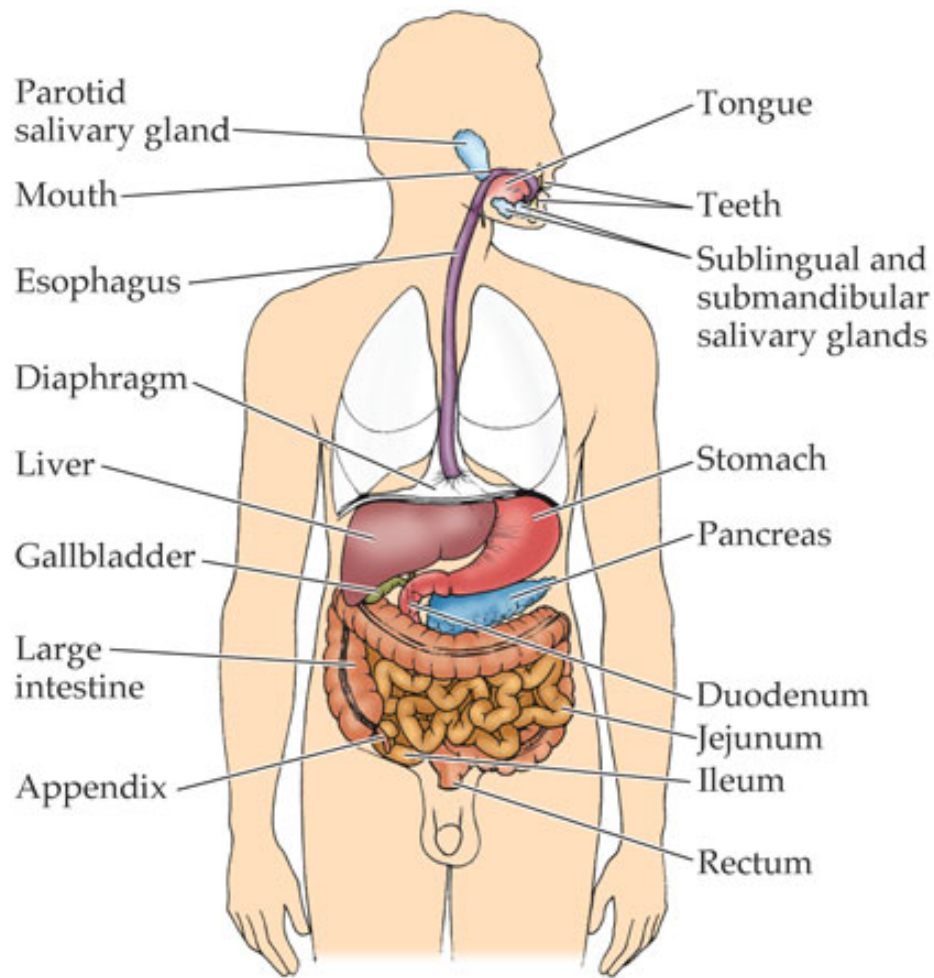


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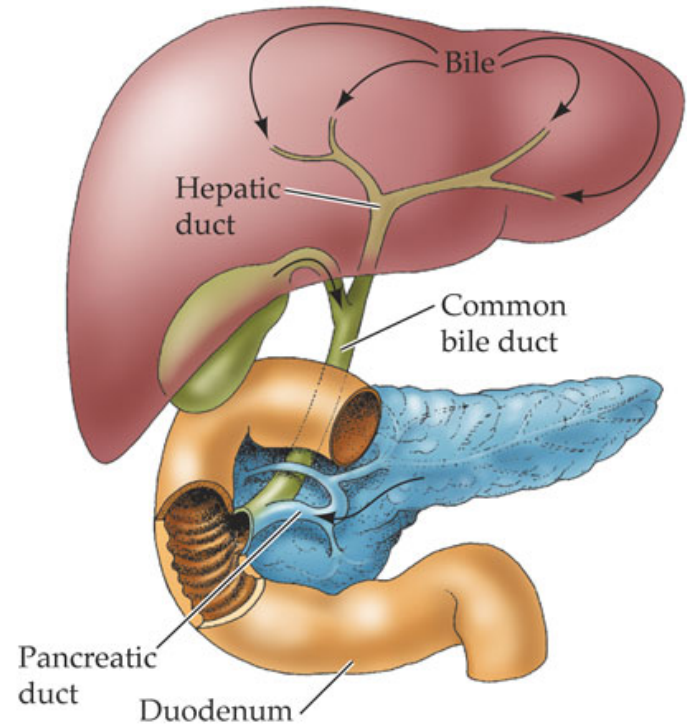






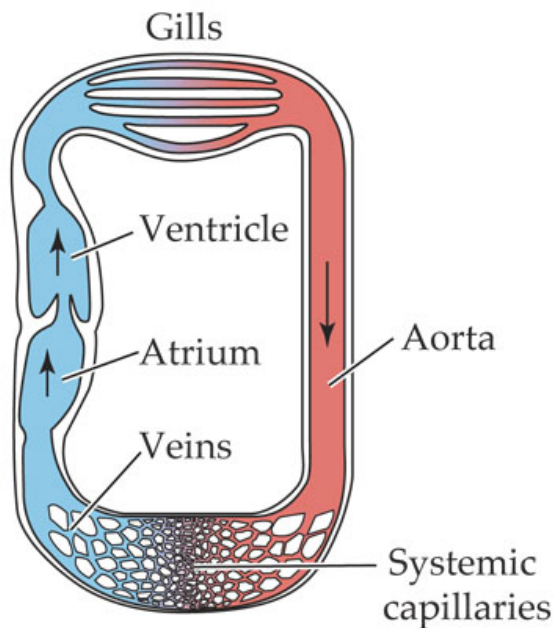
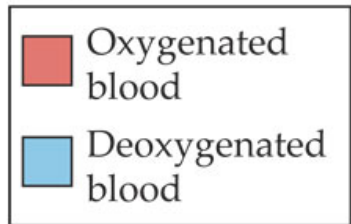


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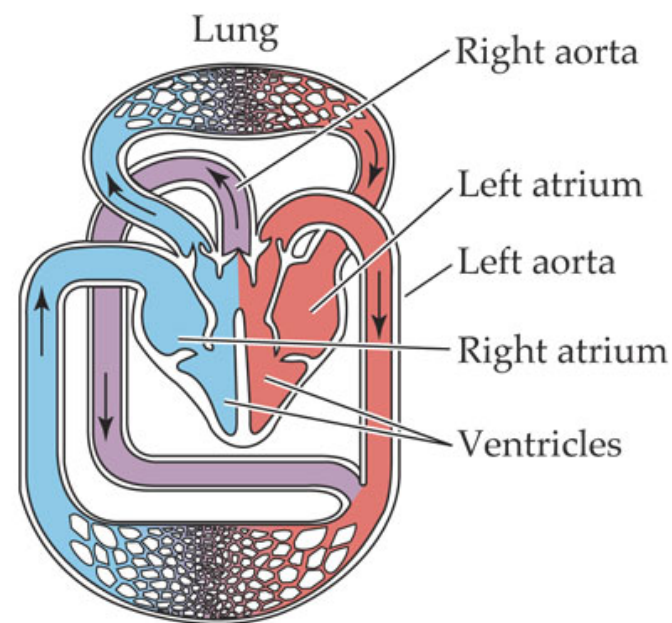
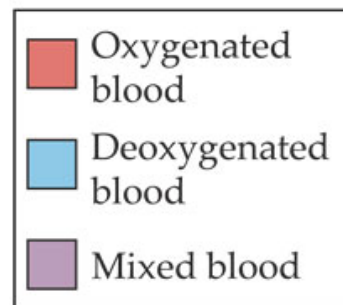
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## Fish



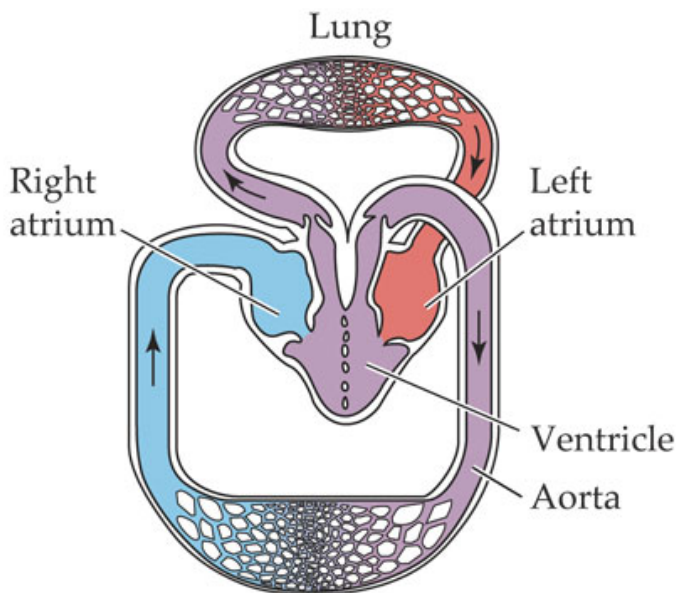
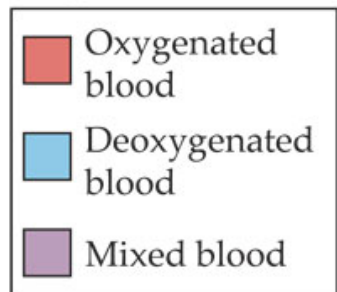
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## Reptiles



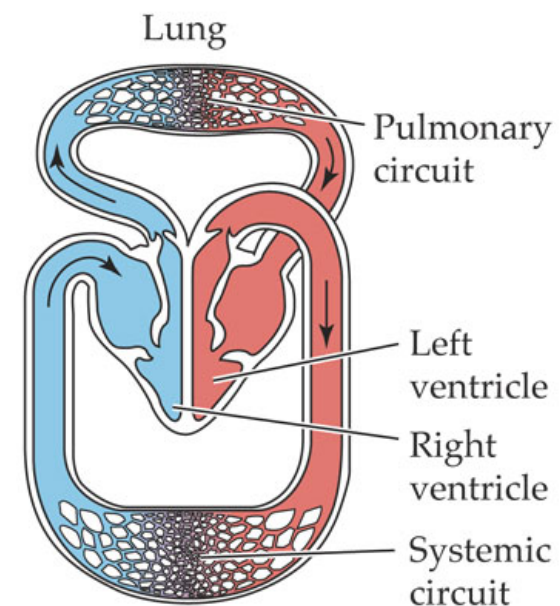
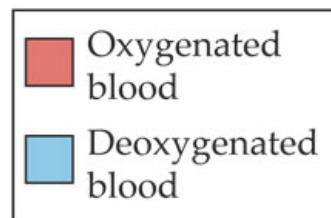
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## Amphibians



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## Birds and mammals



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