

# Evolution of Poor Design

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September 12, 2013

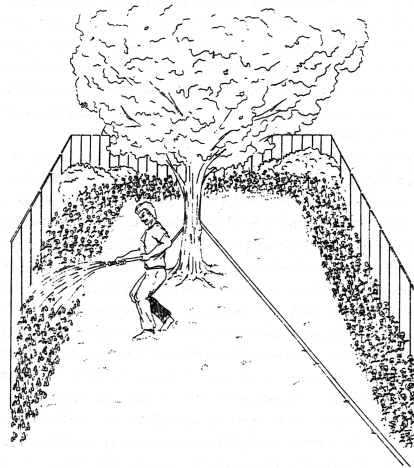
## Outline

- ▶ evolution of poor design
- ▶ male urogenital system
- ▶ the eye
- ▶ recurrent laryngeal nerve

## Evolution of poor design

- ▶ Selection is a tinkerer, not an engineer
- ▶ Makes small adjustments, keeps those that help
- ▶ Does not see the big picture
- ▶ Does not plan for the future

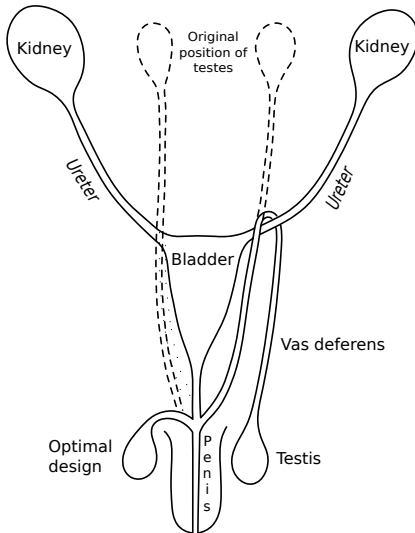
## What would you do next?



1. Get another length of hose?
2. Go back around the tree?

Evolution chose option 1.

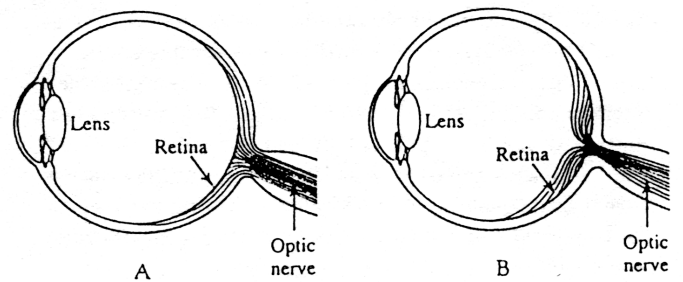
## Male urogenital system



- ▶ During evolution, testes moved from abdomen to scrotum.
- ▶ Went down wrong side of ureter.

Intelligent design?

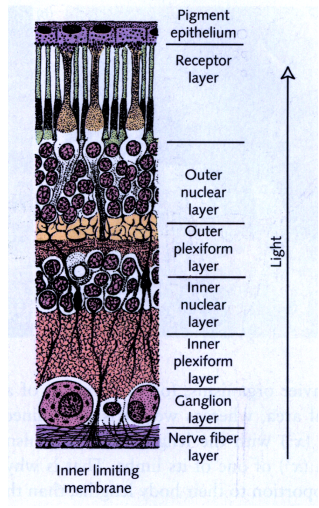
## Retina is inside out



A shows eye as it should be: retina facing light

B shows eye as it is: retina covered by nerves and blood vessels

Retina: detail



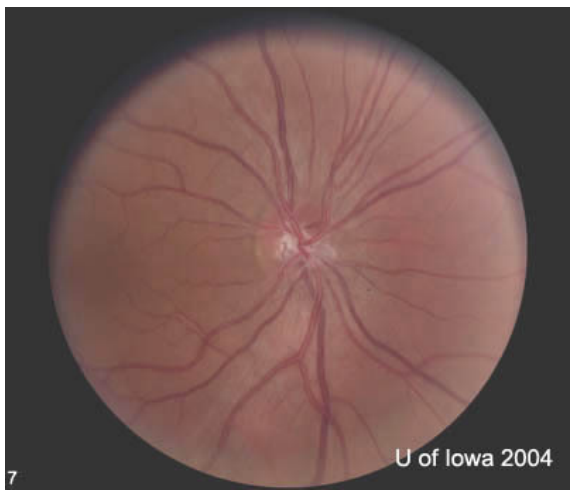
- ▶ Light comes from bottom
  - ▶ Light-sensitive cells are at top
- Intelligent design?

The retina as a lens

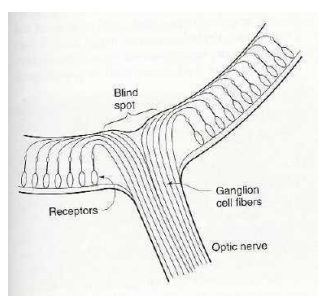
- ▶ Long cylindrical cells within the retina (Müller cells) act as optical fibers.
- ▶ These cells guide "light through the maze of interconnecting neurons to help it reach the light-sensing layer with only minimal scattering" (Ken Miller). They are "ingeniously designed light collectors" (Guck et al).

Is this not evidence of Intelligent Design?

Photo of retina



Blind spot



- ▶ Optic nerve must pass through retina to reach nerves in front.
- ▶ At this spot, your retina is blind.

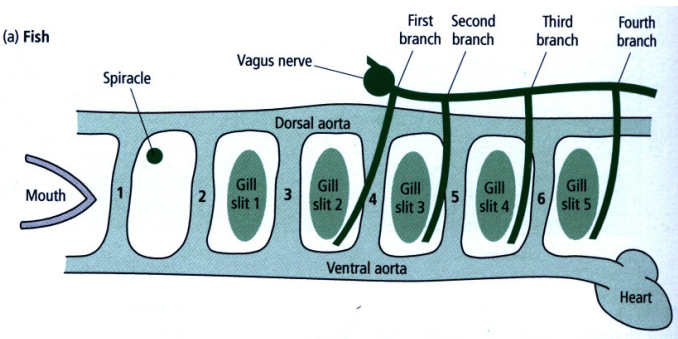
Find your own blind spot

- ▶ On a clean piece of paper, make a circle 1/2 inch across.
- ▶ Color it in with your pen or pencil, like this: ●
- ▶ 3 inches to the right, make an X about the same size
- ▶ Hold the paper at eye level, and cover your left eye.
- ▶ Focus on the dot, but remain aware of the X.
- ▶ Move the paper slowly toward your face.
- ▶ When the paper is about 1 foot away, the X will disappear.

Recurrent laryngeal nerve

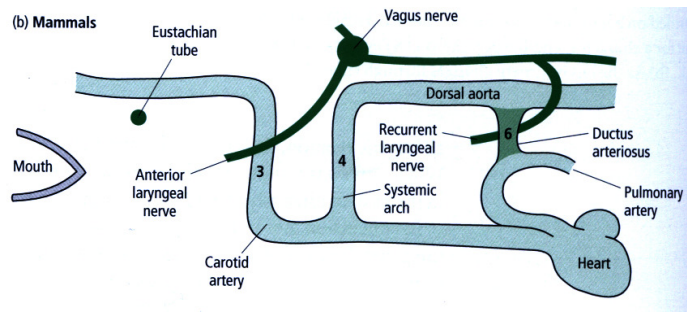
- ▶ Supplies motor function and sensation to the larynx (voice box).
- ▶ Indirect route: from brain down to chest, then back up to throat
- ▶ Why the long detour?

### Branches of vagus nerve in fish



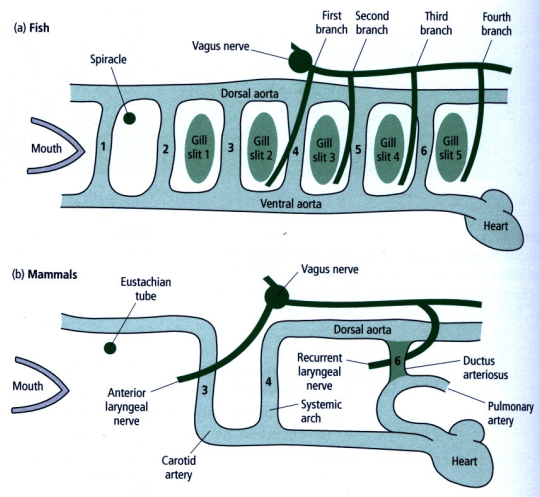
- ▶ Look at arteries 1–6, connecting dorsal and ventral aortas.
- ▶ Look especially at artery 6.
- ▶ Look at 4th branch of vagus nerve: route is direct

### Recurrent laryngeal nerve (RLN) in mammals



- ▶ 4th branch of vagus nerve has become RLN
- ▶ Still passes beneath 6, but this is now a detour.
- ▶ In giraffes, the nerve is 20 feet long, yet the direct route is only a foot.

### Fish-mammal comparison



### Pseudo-genes

- ▶ Genes are DNA sequences that code for protein.
- ▶ Some genes are “broken” and cannot make protein.
- ▶ What are such genes for?

### Vitamin C, or ascorbic acid

- ▶ Essential in human diets.
- ▶ Otherwise...scurvy
- ▶ Yet most animals don't need it.

### Why don't other animals need ascorbic acid?

- ▶ They make it in their livers
- ▶ Involves enzyme L-gulonolactone oxidase (GULO for short)
- ▶ We lack this enzyme.
- ▶ Why?

<h3>Why don't we make the GULO enzyme?</h3> <ul style="list-style-type: none"> <li>▶ Perhaps there is some adaptive reason. <ul style="list-style-type: none"> <li>▶ Some have suggested a role in extending lifespan.</li> </ul> </li> <li>▶ However: although we lack the enzyme, we all carry the gene that makes it.</li> <li>▶ Ours is just broken.</li> </ul>	<h3>The <math>\psi</math>GULO pseudogene</h3> <ul style="list-style-type: none"> <li>▶ We all carry the <math>\psi</math>GULO gene in our DNA</li> <li>▶ At the same position as the working copies in other animals.</li> <li>▶ Yet our copies make no GULO enzyme. . . They are broken.</li> <li>▶ If God didn't want us to have the enzyme, why did he give us the gene?</li> </ul>
<h3>Objection: perhaps <math>\psi</math>GULO has some undiscovered function.</h3> <p>Response: Suppose you saw someone using a broken pocketknife to tighten a screw. What would you conclude?</p> <ol style="list-style-type: none"> <li>1. It's a screwdriver, and any resemblance to a pocketknife is coincidental.</li> <li>2. It was built as a pocketknife, even if it now drives screws.</li> </ol> <p>In the same way, the structure of <math>\psi</math>GULO proves it was built to make the GULO enzyme, whatever its current function.</p> <p>What are we doing with such a gene?</p>	<h3>2nd objection: perhaps our GULO gene was silenced <i>after</i> creation</h3> <p>Response: Then humans, apes and monkeys share a common ancestor, because we all share the <math>\psi</math>GULO pseudogene.</p> <p>Even the damage that inactivated these genes is shared across species.</p>
<h3>The MYH16 gene</h3> <ul style="list-style-type: none"> <li>▶ Encodes a type of muscle fiber found only in jaw muscles.</li> <li>▶ Provides a quick, strong, bite.</li> <li>▶ Present in non-human primates and most other mammals.</li> <li>▶ In humans too, but ours is broken.</li> <li>▶ Why is it there?</li> </ul>	<h3>Summary</h3> <ul style="list-style-type: none"> <li>▶ Adaptations are often imperfect,</li> <li>▶ because selection does not see the big picture.</li> <li>▶ This evidence of poor design makes evolutionary sense.</li> <li>▶ It undercuts the argument that adaptation implies intelligent design</li> </ul>