



Life Lines

The Science Podcast from The American Physiological Society

Questions and Answers From Episode 6

Serotonin and Hypertension

Question and Answer Sheet

The Mystery of Serotonin and Hypertension

1) What is hypertension?

Answer: Hypertension is an increase in arterial blood pressure above a normal range.

2) Why is hypertension called the “silent killer”?

Answer: Typically, hypertension does not cause any obvious signs or symptoms, but it is still deadly. One cannot “feel” their blood pressure slowly rising over time.

Teacher Note: Hypertension can lead to heart attacks, heart failure, kidney damage, and strokes, all of which can cause death. Hence, the term “silent killer” because of the lack of “feeling” the high blood pressure combined with the potential death associated with this condition.

3) In this mystery, what chemical is the prime suspect and where is most of this chemical found?

Answer: Serotonin (also called 5-hydroxytryptophan or 5-HT for short) is the prime suspect. The gastrointestinal tract contains the largest amount of serotonin in the body. It is also found in the brain as a neurotransmitter and in the plasma as a hormone.

4) The prime suspect in this mystery is made from what amino acid? Name two foods that serve as a source of this amino acid.

Answer: Serotonin is synthesized from the amino acid tryptophan. Two important food sources are bananas and turkey. **Teacher aid:** Virtually all meats, including most fish, are excellent sources of tryptophan. It is also found in high levels in eggs, rice, and beans.

5) Name two important functions produced by the prime suspect.

Answer: Serotonin is involved in gastrointestinal motility and brain function.

Teacher Note: Many anti-depressive medications work via altering serotonin function.

6) Describe the basic mechanism by which chemicals of the body produce their physiologic effect.

Answer: Chemicals in the body, serotonin for example, produce their effects by binding to receptors. Similar to a key fitting into a lock and opening it, chemicals bind to cellular receptors and produce physiologic changes. Similar to the fact that specific keys only unlock specific locks, receptors are selective for specific

chemicals. In other words, serotonin receptors only bind serotonin and not the various other chemicals of the body.

- 7) What evidence from the literature prompted this physiologist to consider the mystery chemical as the prime suspect in causing hypertension?

Answer: Serotonin causes contraction of blood vessels, which can lead to hypertension, and people with hypertension have elevated levels of serotonin in their blood. Furthermore, blood vessels from hypertensive patients are more sensitive to serotonin.

- 8) What experimental evidence did this physiologist produce in her laboratory that made the prime suspect seem even more likely to be guilty?

Answer: Using experimental animals, she showed that blocking one of the serotonin receptors (5-HT_{2B}) decreased blood pressure in hypertensive animals. It was also shown that hypertensive animals had a greater number of the 5-HT_{2B} receptors.

- 9) What recent evidence generated by this physiologist helped save our prime suspect from a guilty verdict?

Answer: Serotonin was infused into experimental animals, both normal controls and hypertensive rats. This infusion caused blood pressure to go down in both groups. If serotonin was guilty, then it should have increased blood pressure, particularly the blood pressure of the hypertensive animals.

Summary: Hypertension means high blood pressure above a normal range. Hypertension is a “silent killer” because it occurs without any obvious symptoms. More than 90% of hypertension is called “essential hypertension,” which in short means the cause is unknown. Evidence in the literature and from work by this physiologist suggested that alterations in serotonin function might cause hypertension. The initial experiments by the investigator showed that blocking the 5HT_{2B} serotonin receptor decreased blood pressure in hypertensive animals, thereby strengthening the link between serotonin and hypertension. However, when serotonin was infused into experimental animals, blood pressure decreased. This finding does not support the hypothesis that serotonin may be involved in causing hypertension, thus “the jury is still out” with respect to linking an alteration in serotonin as a causative agent for hypertension.

