

Meningitis and How Bacteria Invade the Brain

Animation to accompany EP news release

RG – 3.20.2023

version 3b

Description (for internal use only)

A one-and-a-half minute animation that describes how bacteria hijack crosstalk between nerve and immune cells to cause meningitis.

This video is intended for a lay audience and will be made available through the HMS website and HMS's video and social media channels.

1

[image/animation: illustration of a skull/brain]

[VO:]

Researchers at Harvard Medical School have revealed how bacteria break through the brain's protective layers and cause meningitis, a highly fatal disease that often leaves survivors with serious neurologic damage.

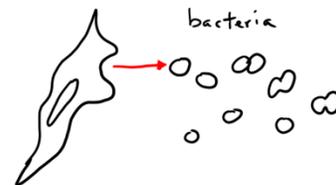


3

[image/animation: show a macrophage engulfing bacteria and sending out a signal]

[VO:]

Typically, when bacteria enter the body, immune defenses spring into action to disarm the invaders.



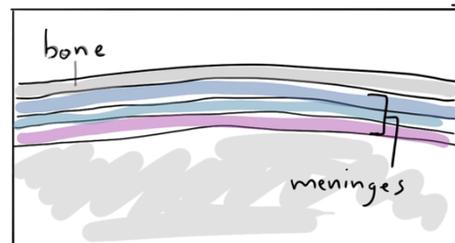
2

[image/animation: **zoom in** to see the layers of the meninges]

[VO:]

The brain's protective layers, called meninges, shield the brain from injury and infection.

However, in meningitis, bacteria are able to invade the brain unhindered. Why?

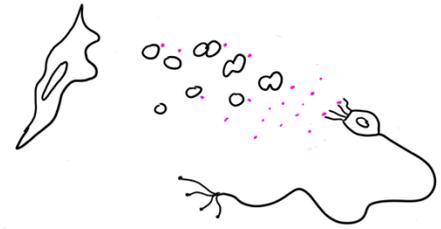


6

[image/animation: bacteria releases toxins]

[VO:]

The researchers found that in meningitis, when bacteria reach the brain's topmost protective layer, they release a toxin.

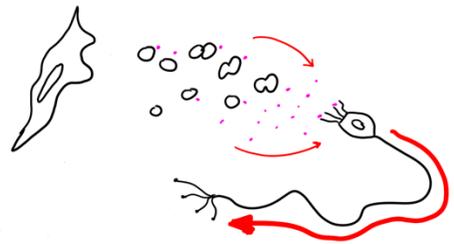


7

[image/animation: toxin reach the neuron]

[VO:]

The toxin then activates nearby nerve cells causing the intense headache typical of meningitis, ...

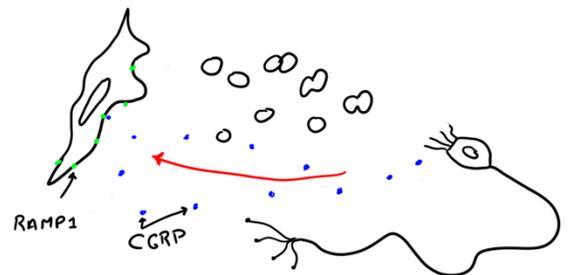


8

[image/animation: neuron releases CGRP]

[VO:]

... the toxin then prompts the nerve cells to release a chemical called CGRP.

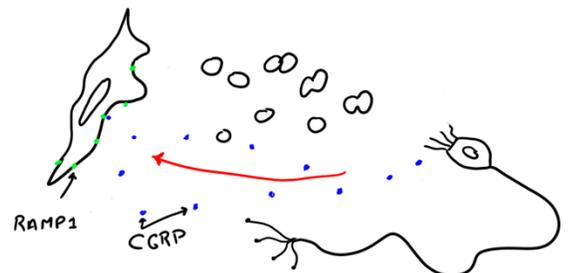


9

[image/animation: the CGRP attach to RAMP1 receptors on the macrophage]

[VO:]

CGRP attaches to receptors on immune cells called macrophages, which typically disarm the invaders and summon other immune cells to help.



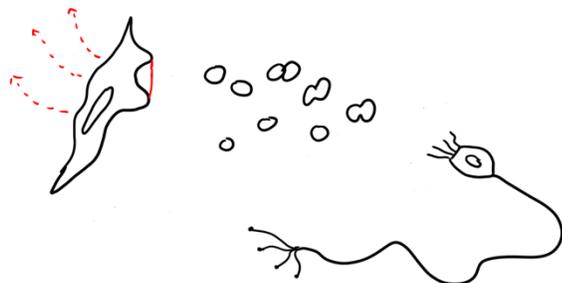
10

[image/animation: macrophage's "mouth" closes and the alarm signaling ceases]

[VO:]

The chemical disables these immune cells and prevents them from engulfing the bacteria and from sounding the distress signal to the immune system.

In effect, the bacteria subvert the brain's immune defense by hijacking the crosstalk between nerve and immune cells.

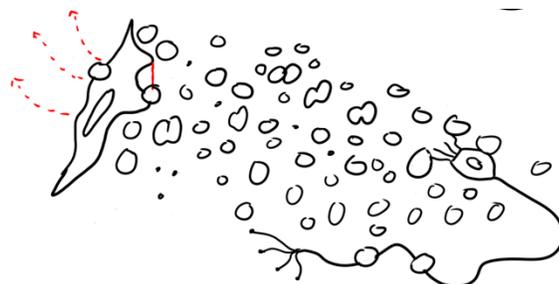


11

[image/animation: bacteria multiply]

[VO:]

And without the immune defense, the bacteria proliferate and spread into the brain.



12

[image/animation: back to the view of the skull/brain]

[VO:]

This work, which was done in mice, can pave the way to new therapies. Drugs that block either the chemical CGRP or the immune cell receptors that interact with it could target the critical early stages of infection.

This approach could become the basis for much-needed treatments for meningitis.



END