**Free response:**

You and your adviser are interested in understanding the role that astrocytes play in the neuroinflammatory response to mild traumatic brain injury. You know that microglia are the resident immune cells of the brain, and thus are responsible for secreting inflammatory cytokines like TNF-alpha and IL-6 to “activate” other cell types. You expect astrocytes receive these signals from microglia to participate in the inflammatory response, as they make up a large percentage of cells in the brain. Propose a molecular pathway by which astrocytes might be “activated” to assume a neuroinflammatory state after a brain injury.

**Free response:**

During lecture, you noticed that “activated” astrocytes can secrete both pro- and anti-inflammatory cytokines. You suspect there may be distinct phenotypes that astrocytes can assume, one that is pro-inflammatory and another which is anti-inflammatory. This would mirror the phenotypes shown in “activated” microglia, M1 and M2. You hope to determine whether these phenotypes exist. Propose an experimental method that would allow you to determine whether distinct phenotypes exist for “activated” astrocytes. You have access to both pro-inflammatory cytokines (TNF-alpha, IL-1alpha) and anti-inflammatory cytokines (IL-4, IL-10).

**Multiple Choice Question Group (all three pertain to the PCA figure)**

Note- The question set-up is exactly the same as the one in the practice quiz but the questions themselves are different.

Chart

Description automatically generated

You collect brain tissue from mice that underwent one, three, or five closed-head injuries (1xCHI, 3xCHI, 5xCHI) at a time period of 24 hours after injury. You gather data on cytokine expression and MAPK phospho-protein expression through a multiplexed ELISA. You conduct a PCA with your cytokine and MAPK data and see that your experimental groups are roughly separated along a combination of Principal Component 1 (PC1) and Principal Component 2 (PC2).

You forgot to label a few of your tissue samples, but you quantify them with the multiplexed ELISA anyway. You know that it would be inappropriate to include any of these unlabeled samples in your data analysis, but you’re curious about which experimental groups they belonged to.

Tube 1 has a relatively high amount of cytokines (especially IL-1alpha and IL-1beta) and also shows relatively high expression of MAPK phospho-proteins like phospho-p38 or phospho-Jnk. This animal was most likely:

1xCHI

3xCHI (correct)

5xCHI

Tube 2 has a relatively high amount of G-CSF and IL-3 but shows relatively low expression of MAPK phospho-proteins. This animal was most likely:

1xCHI (correct)

3xCHI

5xCHI

Tube 3 has low cytokine expression and a relatively high amount of MAPK phospho-proteins. This animal was most likely:

1xCHI

3xCHI

5xCHI (correct)