Organic vs inorganic what is the difference and why is it such a big deal? In the science world organic means it is containing carbon-based materials so inorganic would be the exact opposite. Inorganic means chemicals and substances that do not contain carbon. When a person thinks of the human body, they probably think that every part of it is organic, but that couldn't be farther from the truth. Inorganic phosphate, like the name suggests, doesn't contain any carbon, but it is a vital part to all living organisms as a nutrient (Spina et al 2013). Phosphate plays an important role in metabolism, which is any reaction in a cell that then leads to providing energy to the body. Phosphate plays a major role in the regulation of glucose storage after a meal is eaten; the glucose is saved in the muscles, liver, and body tissue that is used to store fat (Błaszczyk 2023). Another way inorganic phosphate aids in metabolism is distribution. Inorganic phosphate uses the supply of energy fuel and distributes the energy and other substances that are needed in metabolism to the brain and skeletal muscles (Błaszczyk 2023). Inorganic phosphate is also required for the body to make ATP and lipids (Sapio 2015). A phospholipid is a fatty compound, lipid, that has a head and a tail. The head of the phospholipid is hydrophilic while the tail is hydrophobic, a line of phospholipids can create a barrier in cells. Like the name suggests phospholipids have phosphate in them. The head of the phospholipid is composed of inorganic phosphate, and this is able to bind to a glycerol structure to create hydrophilic properties (Alger 2022). The negative charge of the head also contributes to the hydrophilic property. The tails are composed of a saturated fatty acid and then an unsaturated fatty acid to create the hydrophobic tails. With one side being hydrophobic and the other hydrophilic this allows phospholipids to create a great barrier when they are lined and stacked together. This barrier is called a phospholipid bilayer and is very important for all cell membranes. Inorganic phosphate is required to build cell membranes and is required for energy metabolism, which is the process of generating energy from nutrients (Wagner 2023). Lipids have to be stored somewhere and that is where multilamellar bodies come in. Multilamellar bodies, shortened to MLBs, are cellular organelles that are membrane bound (Hariri et al 2000). They vary in size but are all extremely small. Besides storing lipids, multilamellar bodies also function as a secretion organelle (Hariri et al 2000). Secretion organelles will produce then release a substance, in this case lipids. Inorganic phosphate is an extremely important molecule for all living organisms that not many people are educated about. This nutrient helps out the human body in many ways with metabolism and the making of lipids.

Recently researchers have found what seems to be a new structure while conducting experiments with *Drosophila melanogaster*, the fruit fly. The small structures that were found inside animal cells act like a storage unit for phosphate (Conroy 2023). The structure is classified as an organelle because it is a fundamental structure in cells. The newly discovered multilamellar organelles are named PXo bodies.

Xu and his colleagues found the characterizations of PXo bodies using co-staining. Figure 2 shows 7 panels that each use a different fluorescent dye that stains for specific characteristics. Panel E uses the stain LysoL which detects acidic components in the cell, usually

lysosomes. The staining in the panel turns up yellow meaning PXo bodies are acidic. To be more specific the next stain that was used is a lysosome marker, Lamp1, in panel F. The staining shows that the organelles, PXo bodies, are not lysosomes. Panel G was stained with Nile Red, a lipid dye and PXo bodies stained positive (Xu et al., 2023). Similar to panel F, panel H did not react positively to the stain that was used. Panel G used Man II which is a Golgi marker. The next two panels I and J have yellow stains on them showing that the PXo reacted positively to the dyes ConA and P-Cho. These two dyes mark for glycosylation, which is most likely performed by the Golgi apparatus, and if the organelle is made of phospholipids (Xu et al., 2023). Panel K used Dextran as a marker and the PXo bodies did not react meaning they are not part of the endocytosis pathway since Dextran marks for endocytic vesicles.

Figure 3 shows the levels of Pi in the cytoplasm. The researchers used a sensor called FLIPPi to track the levels of phosphate. It can be seen in the figures that when PXo-i, which reduces the expression of PXo, is in the cytoplasm there is a low FRET ratio meaning there is a high level of Pi in the cytoplasm. Luc-i is colored red in the picture which indicates a high FRET ratio. PXo is responsible for transposing Pi into PXo bodies, which is important to restrict the levels of Pi (Xu et al., 2023). The amount of PXo in the cytoplasm directly correlates with the levels of inorganic phosphate in the cytoplasm.

PXo bodies were examined on how they responded to the amount of Pi in the cell. It was found that the PXo bodies were notably smaller after PFA-induced Pi starvation, these smaller PXo bodies were typically engulfed by lysosomes (Xu et al., 2023). When there is not enough inorganic phosphate in the cell the PXo bodies will be smaller than normal. On the other end when the flies were fed a diet with additional inorganic phosphate the PXo bodies were larger (Xu et al., 2023). Along with the PXo bodies being larger when there was more Pi in the body they were also more abundant in number. Smaller numbers were seen when flies were fed PFA (Xu et al., 2023).\

In PXo bodies the most enriched class of lipids is Phosphatidylcholine (PC) with 45% of the phospholipids being PC. After short-term Pi starvation, there was a decrease in total phospholipids, but not neutral lipids with PC dropping down to 39% (Xu et al., 2023). In both of the PXo bodies, the amount of Phosphatidylethanolamine stayed the same because it is a neutral lipid. After feeding flies excess PC they had a larger number of PXo bodies, this suggests that PXo bodies might be a major deposit for phospholipids (Xu et al., 2023).

This data has convinced me that PXo bodies form distinct organelles that have a unique biochemical function in the cell. Based on Figure 2 PXo bodies have similarities with other organelles that are found in cells, but they do not have the exact same functions or components of the organelles that they are similar to, meaning they are different. This paper shows that PXo bodies are used for phosphate storage and there isn't another organelle that has that biochemical function. This organelle is unique and doesn't have the same characteristics of organelles that are already known to scientists.

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