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Polyhydroxybutyrate and inorganic polyphosphate are essential in structure/function relationship of a cold/pain/steroid receptor TRPM8

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Protein post translational modifications, such as glycosylation, acetylation, or phosphorylation, are widespread phenomena in cellular physiology. In our study, we focus on post translational modification (PTM) of a cold, pain, and newly recognized testosterone receptor, TRPM8 by a polyester comprised of repeated units of R-3-hydroxybutyrate, which forms a polymeric chain, poly-(R)-3-hydroxybutyrate (PHB). We term this modification PHBylation by analogy with the known protein modifications. However, PHBylation stands out of other PTMs that it is a covalent and permanent attachment of a large hydrophobic polymer that introduces significant conformational changes on the channel protein and therefore impacts its function. Along with PHB, we discovered that TRPM8 is modified with inorganic polyphosphate (polyP), where both polymers essentially contribute to the channel structure/function relationship. We found that PHB was critical for the temperature and ligand-induced TRPM8 channel activity. Furthermore, PHB mediated ligand binding to the channel, while polyP contributed to its voltage-sensitivity. These results indicate that TRPM8 functions in a form of supramolecular complexes with PHB and polyP. The formation of such complexes offers a new concept for model of a mammalian ion channel. It proposes indispensable roles of these PTMs, reflecting (a) temperature- or ligand-induced conformational changes that translate to channel gating; (b) proper protein folding and localization to the plasma membrane; and (c) PHB-poly P-rendered structure of anion-conducting core within the protein, which ensures ion selection and conduction along the uniform energy profile lining the internal cavity between both polymers.

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Building a sustainable future with bioplastics

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It might be said that, in the beginning, bioplastics got off on the wrong foot and are still trying to make up for it. Back when bioplastics first started to make their appearance in the market, the emphasis was not on the merits and properties of these ‘new’ materials, but on the end of life. The idea that bioplastics could serve as a panacea, solving problems ranging from the leaching of toxins into the environment to the plastic soup took hold in the minds of the public, an image that has proven exceedingly difficult to dispel. When talking about bioplastics, the first important thing is to make completely clear what they are, and – importantly – what they are not. Understanding this makes it possible to grasp the real reasons why bioplastics are now finally emerging as real players in the industry. We are only at the start of their development, but as new technologies and new materials emerge, it is clear that the potential is massive. To build a future where people, nature, and the economy can all thrive, it is vital to change the way we interact with our resources. Sourcing materials responsibly to protect the ecosystems that we rely on to survive is critical. Bioplastics can play a crucial role as one of the building blocks of a sustainable, circular economy. Bioplastics can also offer a solid business opportunity in unlocking Europe’s potential for a resource efficient economy - in which resource use is decoupled from growth. In this environment, bioplastics will be able to unfold their full economic and environmental potential, in Europe and elsewhere.

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