* Slide 1: Title
* Slide 2: The bigger context of the described question, i.e., why is this relevant?
* Skin creams are usually emulsions – this can be O/W, W/O, W/Si, Si/W.
* Emulsions are comprised of two distinct, immiscible liquid phases, that are held together in a metastable mixture.
* The metastability is achieved through various stabilisation mechanisms including the use of emulsifiers.
* Emulsions are generally extremely important and exist in nature, food, and beauty:
  + Nature: Emulsification of food where bile acts as an emulsifier and helps with digestion and homeostasis as a whole.
  + Food: Mayonnaise is an emulsion
  + Cosmetics: Most are emulsions including moisturisers and creams.
* Slide 3: An analysis of the underlying fundamental principles of molecular engineering that are relevant for the design of suitable building blocks for the respective application.
* Skin creams use surfactant, referred to as emulsifiers, to achieve metastability.
* Surfactants are surface active agents that work at an interface to reduce the interfacial tension.
* There is a lot of interfacial tension between water and lipids so they do not mix.
* When a surfactant is added to a mixture of oil and water, it reduces the interfacial tension between them and allows them to mix and become a metastable mixture.
* This is achieved because of the structure of surfactants:
  + Surfactants always have a hydrophobic end and a hydrophilic head
  + This allows the hydrophilic head groups to bind to the water phase, and the hydrophobic tail to bind to the lipid phase, and holds them together.
  + This is shown below:

Diagram

Description automatically generated

* + Therefore, for surfactant design, surfactants must contain both a hydrophobic part and hydrophilic part.
* Another aspect of surfactant design is that must be considered is the intent of use of the surfactant:
  + The ratio of the size between the polar headgroup and that of the hydrophobic ‘tail’ determines the solubility of the resulting molecules in aqueous solution.
  + Therefore, if the surfactant is intended to be used for an O/W emulsion, the polar headgroup can be larger as there is enough space for it to exist. If it is for a W/O, the non-polar headgroup can be larger as there is enough space for it to exist.
  + <https://www.sciencedirect.com/science/article/pii/S0927775701011475>
* Another aspect of surfactant design to be considered is the surfactant parameters:
  + CMC, Cloud point, molecular weight, and HLB.
  + <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7210506/>
* Other references:
  + McMullen, R. L., Gorcea, M., and Chen, S. (2016). ‘Emulsions and their Characterization by Texture Profile Analysis’ in Dayan, N. (ed) *Handbook of Formulating Dermal Applications: A Definitive Practical Guide,* Ch. 6, pp. 129-153.
  + Yamashita, Y., Miyahara, R., and Sakamoto, K. (2017). ‘Emulsion and Emulsification Technology’ in Maibach, H., Sakamoto, K., Lochhead, R. Y., and Yamashita, Y. (eds) *Cosmetic science and technology theoretical principles and applications*, Ch. 28, pp. 489-506.
* Slide 4: A concrete solution to the described question.
  + Not sure what this means?
* Slide 5: Conclusions and outlook.