Homeostasis

- Your body is constantly trying to maintain homeostasis - maintaining cell populations and rebuilding what is wounded. The natural function of your tissues/organ keeps the body balanced on this point. You've hatched a scheme with some grad school peers to design an artificial tissue/organ which will function in a superior or augmented way. Perhaps you design a skeletal muscle that never fatigues, a skin graft that resists abrasion, or an eye that doesn't need to blink. What do you need to consider when integrating this super-tissue with the host? Do you think the body will automatically re-adjust to accommodate this new capacity?
- Respond to at least two of your classmates.

Cells and organs in human body function in homeostasis, they have a specific function within a larger system of our body, multiple positive and negative feedback loops exist to maintain in steady-state our whole organism. This tight control allows precise control of different function in the body, for example cardiac control of the sympathetic and parasympathetic branches of the autonomic nervous system. Various processes achieve this steady-state by maintaining key variables within a range of nominal values. Tissues or organs with enhanced characteristics override these preferred values and trigger regulation mechanisms. In the examples given, blinking is essential for eyes lubrification and cleans the dust or other undesirable particles. Integration of a super-tissue needs to consider the response of the body, designs it so it recapitulates the template tissue or designs an immunosuppression strategy.
This can be done: total artificial heart (TAH) is a superior heart with 79% survival rate to transplantation and overall, 1 year survival of 70%. After implantation, anticoagulants, antiplatelet, and rheologic products are used to reduce thromboembolic and bleeding complications [1].

[1] J. A. Cook *et al.*, “The total artificial heart,” *J Thorac Dis*, vol. 7, no. 12, pp. 2172–2180, Dec. 2015, doi: 10.3978/j.issn.2072-1439.2015.10.70.

[2] L. V. K. Reddy, D. Murugan, M. Mullick, E. T. Begum Moghal, and D. Sen, “Recent Approaches for Angiogenesis in Search of Successful Tissue Engineering and Regeneration,” *Curr Stem Cell Res Ther*, vol. 15, no. 2, pp. 111–134, 2020, doi: 10.2174/1574888X14666191104151928.

[3] J. F. Eichinger, L. J. Haeusel, D. Paukner, R. C. Aydin, J. D. Humphrey, and C. J. Cyron, “Mechanical homeostasis in tissue equivalents: a review,” *Biomech Model Mechanobiol*, vol. 20, no. 3, pp. 833–850, Jun. 2021, doi: 10.1007/s10237-021-01433-9.

[4] N. I. Callaghan, L. J. Durland, R. G. Ireland, J. P. Santerre, C. A. Simmons, and L. Davenport Huyer, “Harnessing conserved signaling and metabolic pathways to enhance the maturation of functional engineered tissues,” *npj Regen Med*, vol. 7, no. 1, p. 44, Sep. 2022, doi: 10.1038/s41536-022-00246-3.