# Article information:

Controlling the contractile strength of engineered cardiac muscle by hierarchal tissue architecture - ScienceDirect  
<https://www.sciencedirect.com/science/article/pii/S0142961212004656>

# Article summary:

1. The non-muscle components of the heart, such as collagen fibrils and fibroblasts, may serve as important structural alignment cues in inter- and intra-cellular organization of cardiac myocytes.

2. Increasing peak systolic stress in engineered cardiac tissues corresponds with increasing sarcomere alignment, suggesting that boundary conditions encoded in the extracellular space can regulate muscle tissue function.

3. Structural organization and cytoskeletal alignment are critically important for maximizing peak force generation in engineered cardiac muscle.

# Article rating:

May be slightly imbalanced: The article presents the information in a generally reliable way, but there are minor points of consideration that could be explored further or claims that are not fully backed by appropriate evidence. Some perspectives may also be omitted, and you are encouraged to use the research topics section to explore the topic further.

# Article analysis:

The article "Controlling the contractile strength of engineered cardiac muscle by hierarchical tissue architecture" discusses the impact of non-muscle components on the contractile function and physiology of cardiac muscle. The authors hypothesize that structural alignment cues in inter- and intra-cellular organization of cardiac myocytes may have functional benefits, and they aim to determine the effect of alignment on contractile function and muscle physiology.

The article presents a detailed methodology for micropatterning surfaces to build 2-dimensional myocardium from neonatal rat ventricular myocytes with distinct architectures: isotropic, anisotropic, and parallel arrays of multicellular myocardial fibers. The authors use image analysis of sarcomere orientation combined with muscular thin film contractile force assays to calculate the peak sarcomere-generated stress as a function of tissue architecture.

The results show that increasing peak systolic stress in engineered cardiac tissues corresponds with increasing sarcomere alignment. This change is larger than would be anticipated from enhanced calcium handling and increased uniaxial alignment alone. The authors suggest that boundary conditions encoded in the extracellular space can regulate muscle tissue function, and that structural organization and cytoskeletal alignment are critically important for maximizing peak force generation.

Overall, the article provides valuable insights into the role of non-muscle components in regulating cardiac muscle function. However, there are some potential biases and limitations to consider. For example, the study only uses neonatal rat ventricular myocytes, which may not fully represent human cardiac muscle physiology. Additionally, while the authors acknowledge previous studies on microcontact printing showing that alignment of ECM on cell culture substrates potentiates the alignment of cultured myocytes into anisotropic monolayers that propagate excitation wavefronts faster in one direction than another, they do not explore potential counterarguments or limitations to this approach.

Furthermore, while the article notes that perturbation of non-muscle structures in diseased hearts is commonly associated with maladaptive remodeling and decreased cardiac output, it does not fully explore the potential risks or limitations of using micropatterning to engineer cardiac tissue. Additionally, the article may be somewhat promotional in nature, as it highlights the potential benefits of micropatterning for tissue engineering without fully exploring potential drawbacks or limitations.

In conclusion, while the article provides valuable insights into the role of non-muscle components in regulating cardiac muscle function, there are some potential biases and limitations to consider. Further research is needed to fully explore the potential benefits and risks of using micropatterning to engineer cardiac tissue.

# Topics for further research:

* Limitations of using neonatal rat ventricular myocytes in cardiac tissue engineering
* Counterarguments to microcontact printing for alignment of ECM on cell culture substrates
* Risks and limitations of micropatterning for engineering cardiac tissue
* Non-muscle components involved in maladaptive remodeling of diseased hearts
* Role of cytoskeletal alignment in maximizing peak force generation in cardiac muscle
* Extracellular boundary conditions and their impact on muscle tissue function

# Report location:

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