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Design objectives for an autonomous cardiovascular therapeutic intervention system

IOWN

Towards an autonomous closed-loop intervention system

IOWN ACCELERATION

IOWN Evolution · Well-being · Lifelong Health Support
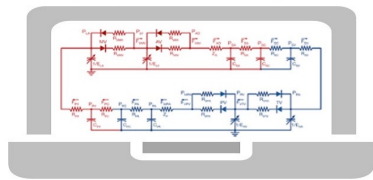
Background

The cardiovascular system has many compensatory mechanisms to maintain homeostasis. A "compensated" system can function despite perturbations, stressors, or defects. However, beyond certain limits there can be a sudden, functional deterioration of a system that had previously been compensated.
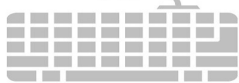
Summary

We use a modeling and simulation approach to discover what those boundaries are and how to avoid them. Not only to optimize therapeutic benefit but also to avoid catastrophic system failures that may result from "autoregulatory exhaustion," or failures by metabolomechanical feedback systems.

Near-term realization in animal models (~ 1 year)

Optimized Drug Combination and Dosages via Cardiovascular Bio Digital Twin

Controlled Drug Delivery Device

Cardiac Medications with Different Effects

Input Desired Target Patient Response
(e.g., Left Atrial Pressure, Blood Pressure, Cardiac Output)

Monitoring Patient Response To Drug Therapy

Cardiac Patient

Mid-term realization to clinical translation (3~5 years)

Features

- Predict situations where drugs alone can never achieve effective treatment; that medical devices need to be added
- Optimize therapeutic interventions based on optimization of myocardial oxygen demand and supply such that the weakened/damaged heart can rest and recover
- Deliver multiple classes of drugs (e.g., catecholamines, nitrates, diuretics), not serially but simultaneously

Future_benefits

Overcome some challenges related to Health Equity, i.e., how to provide sophisticated care to remote underserved areas with limited resources.

Collaboration partners

National Cerebral and Cardiovascular Center

Exhibiting Company

NTT Research, Inc.

Contact

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