Battery longevity should be the primary reason for device selection at implant

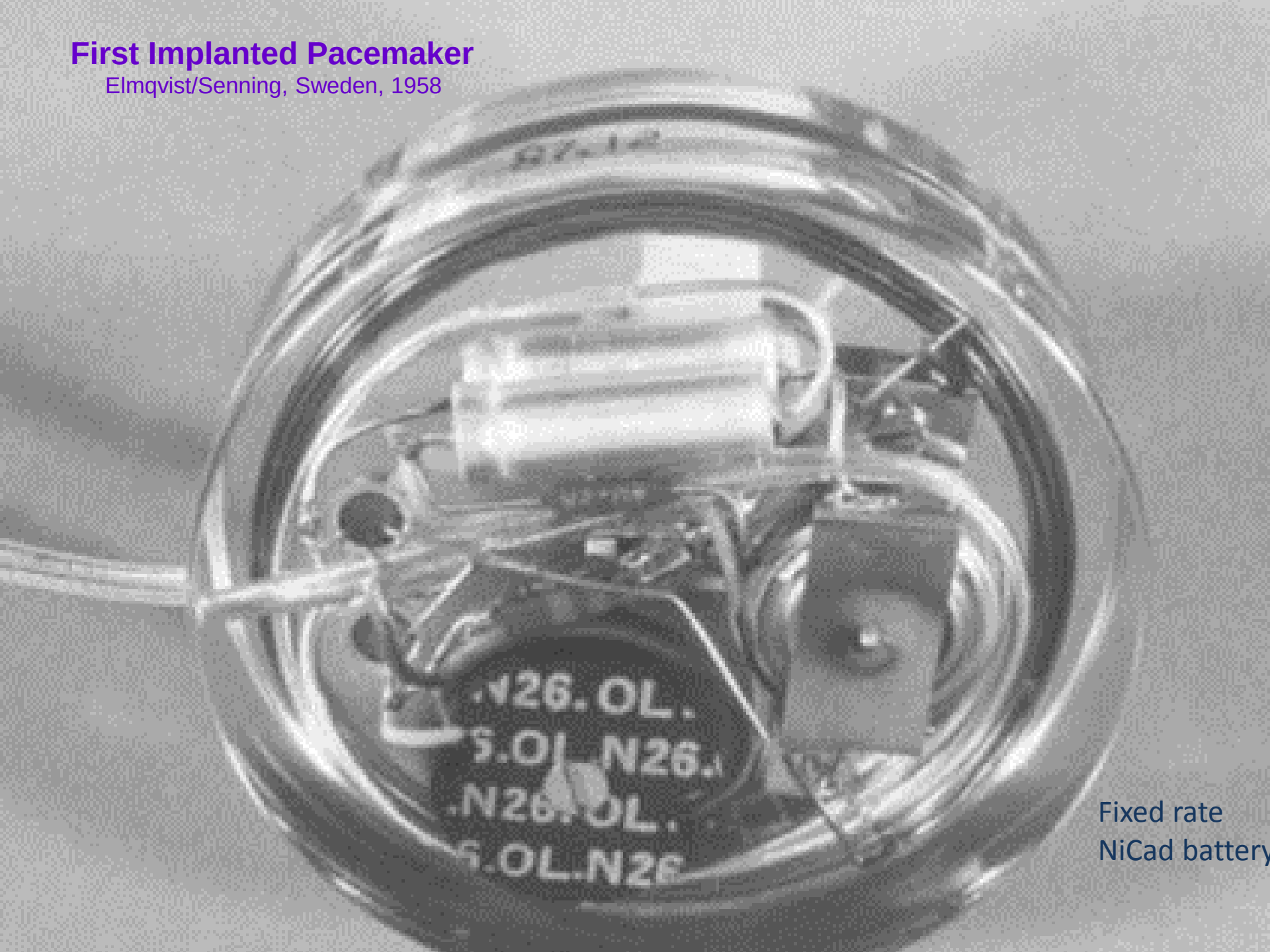
Antagonist

Ian Wright

Imperial Healthcare NHS Trust

First Implanted Pacemaker

Elmqvist/Senning, Sweden, 1958



Fixed rate

NiCad battery

- Dual chamber pacing late 1970s
- Rate responsive pacing mid-1980s
- Electrogram storage 1990s
- Histograms, trend data
- Thoracic impedance monitoring
- Remote monitoring
- ….

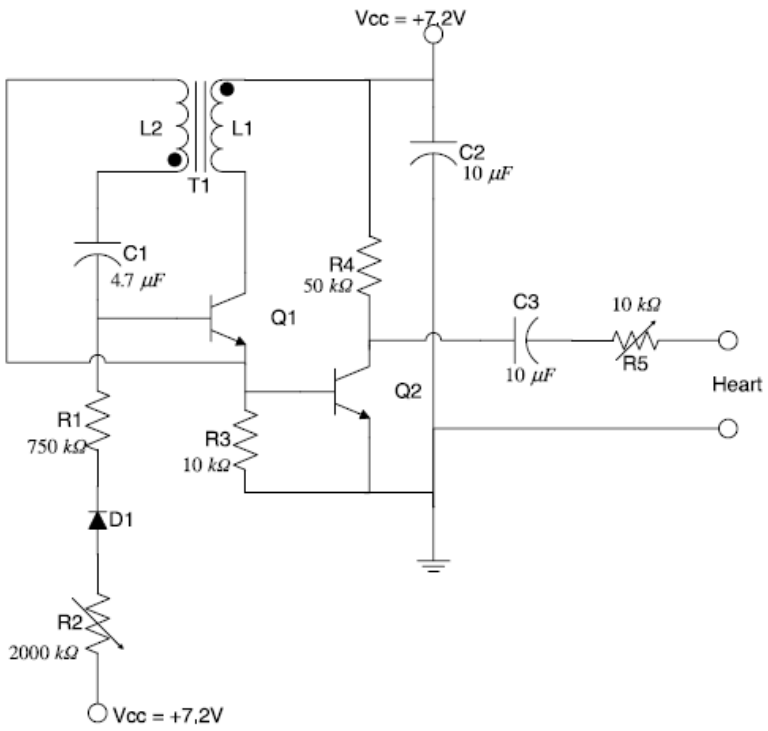


Fig. 2.7. Schematic of the first implanted pacemaker [13]

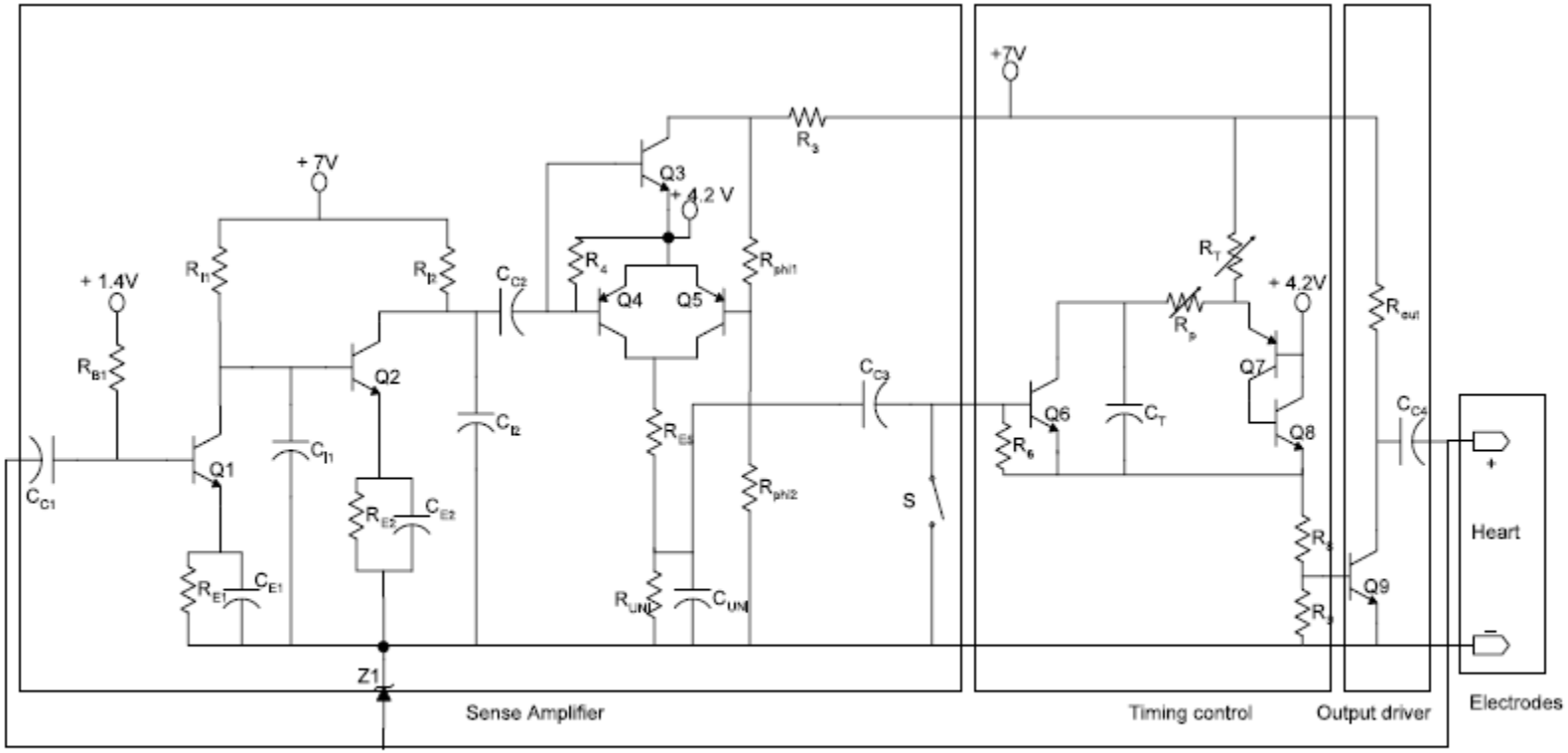


Fig. 2.9. Schematic of the pulse generator of the first demand pacemaker [15]

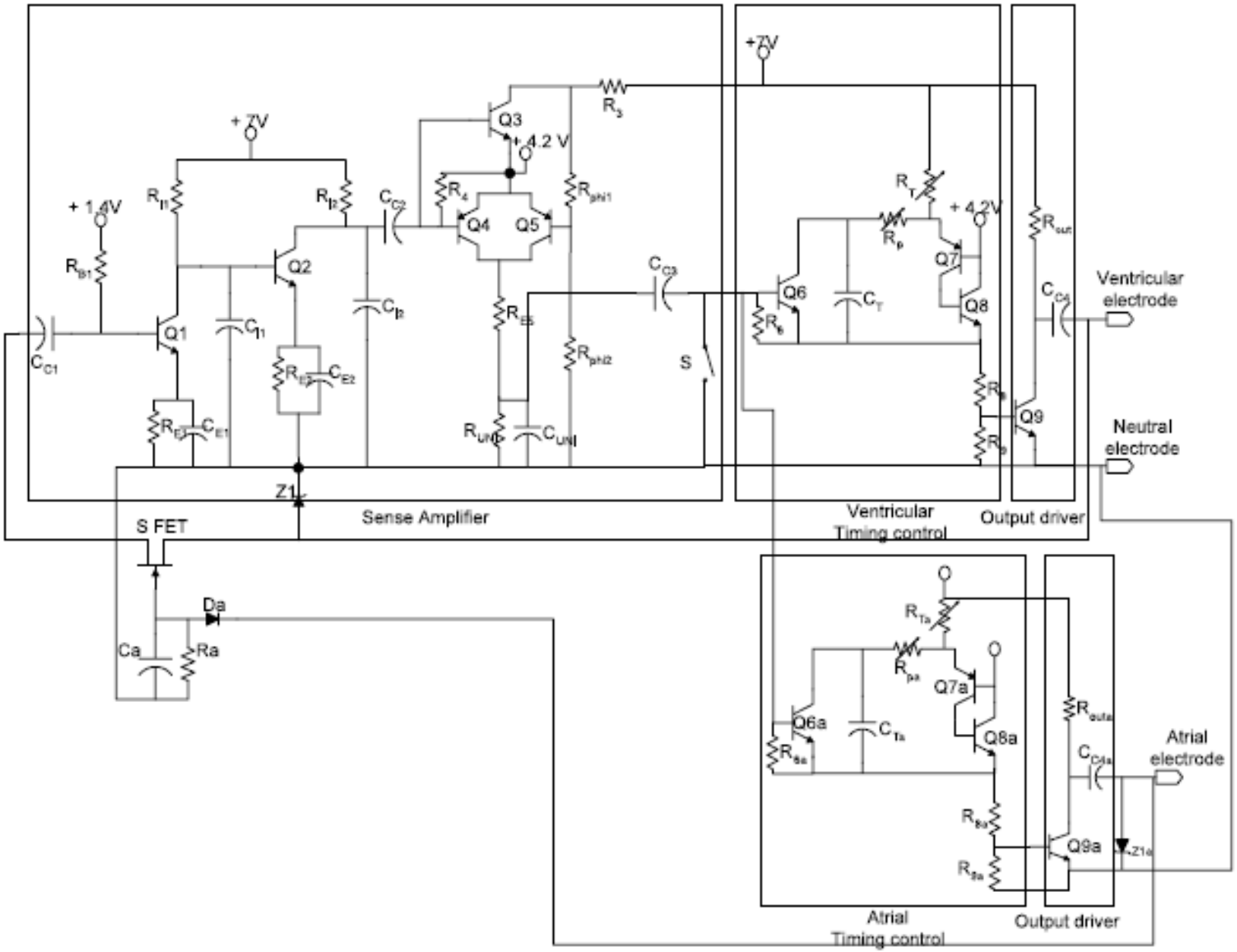


Fig. 2.10. Schematic of the dual-chamber demand pacemaker [16]

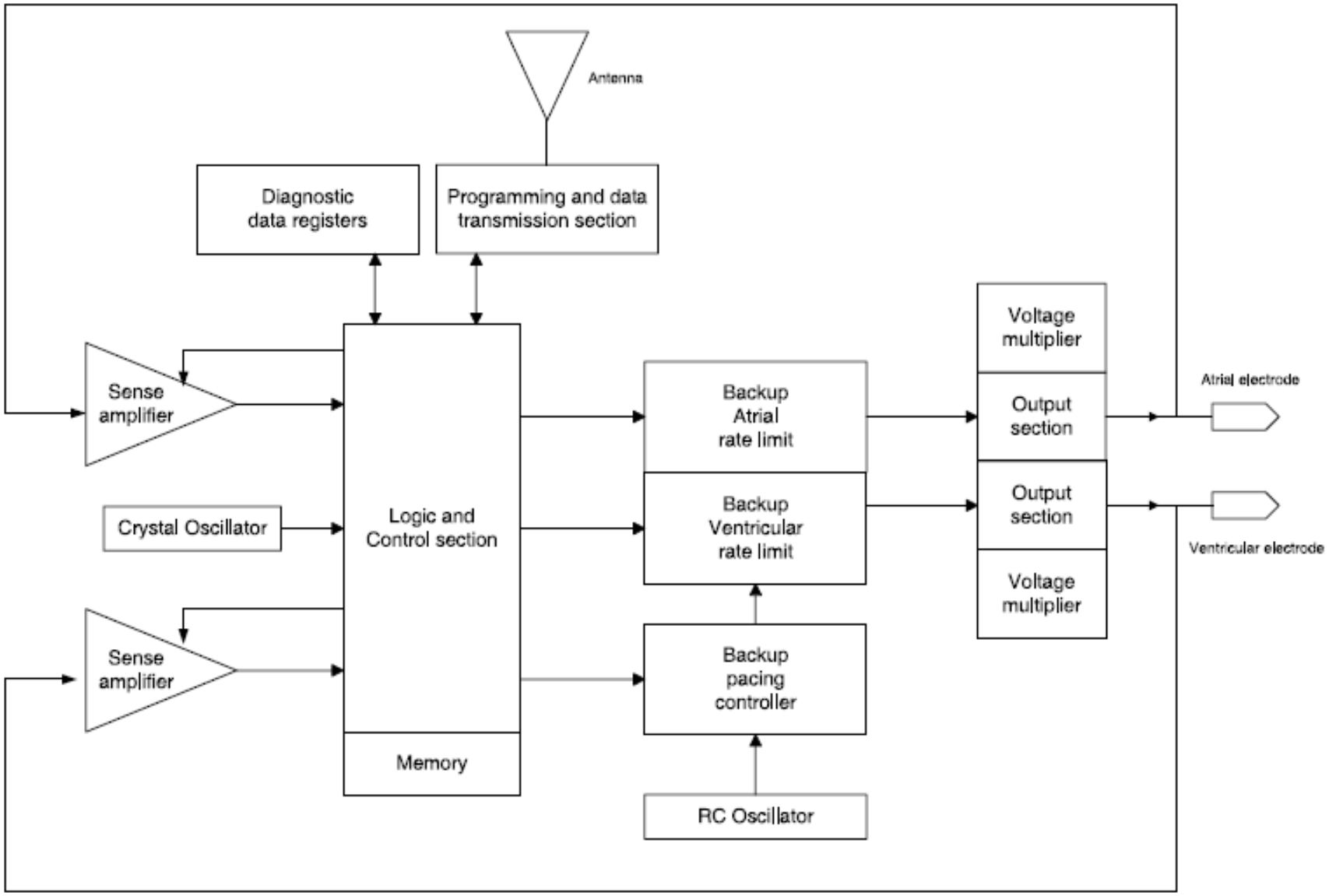
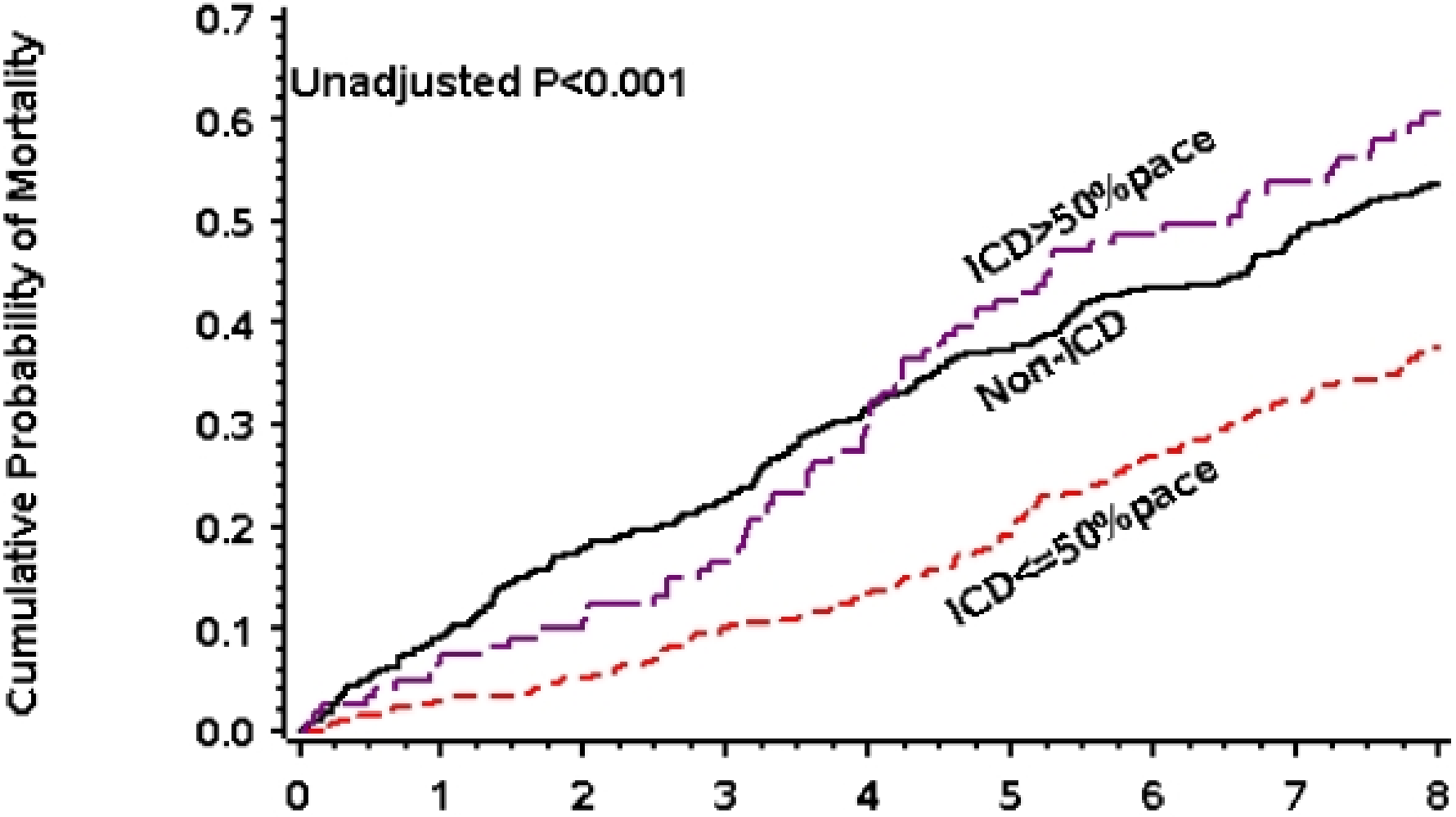
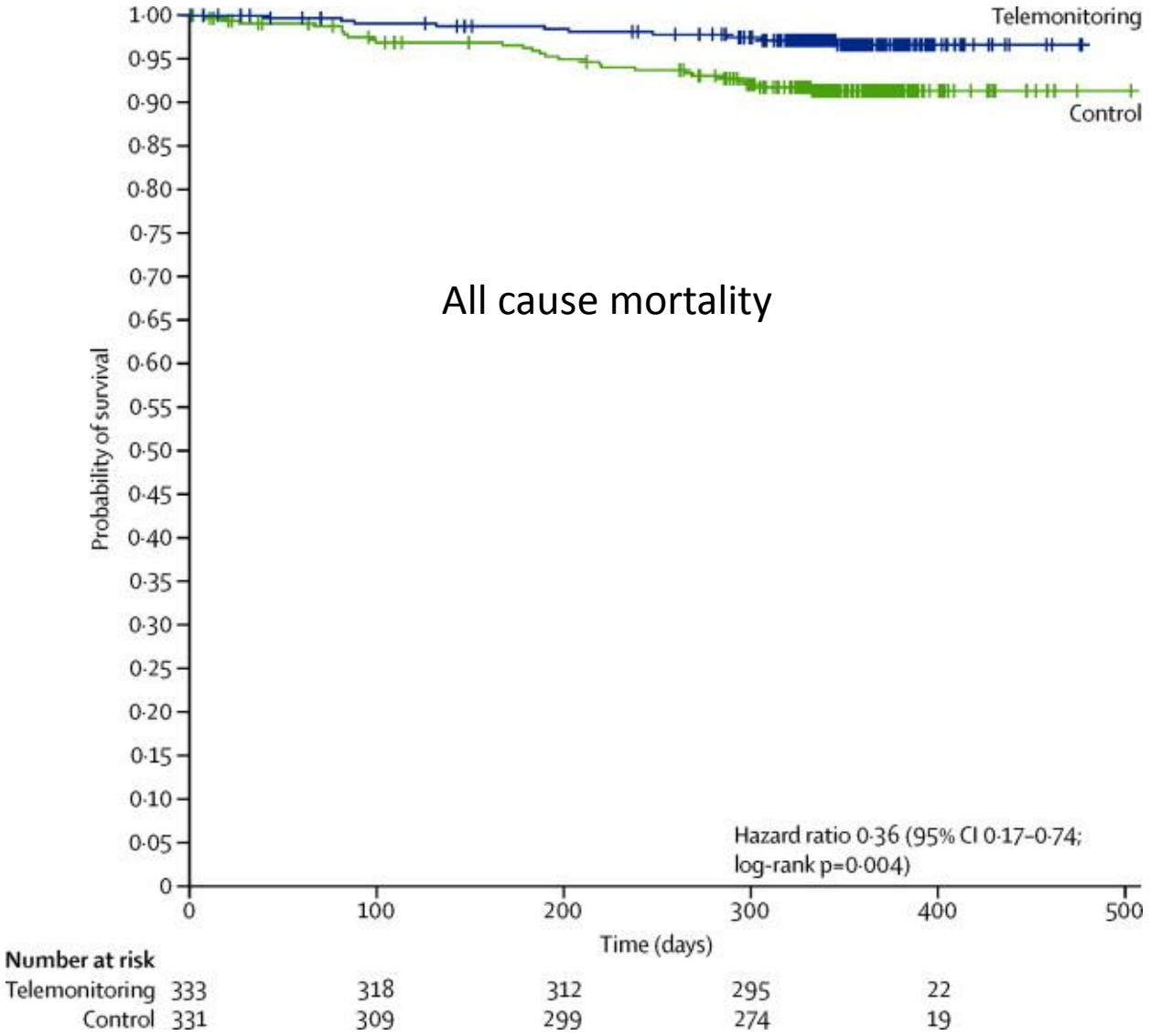


Fig. 2.12. Block diagram of a typical modern pulse generator [4]

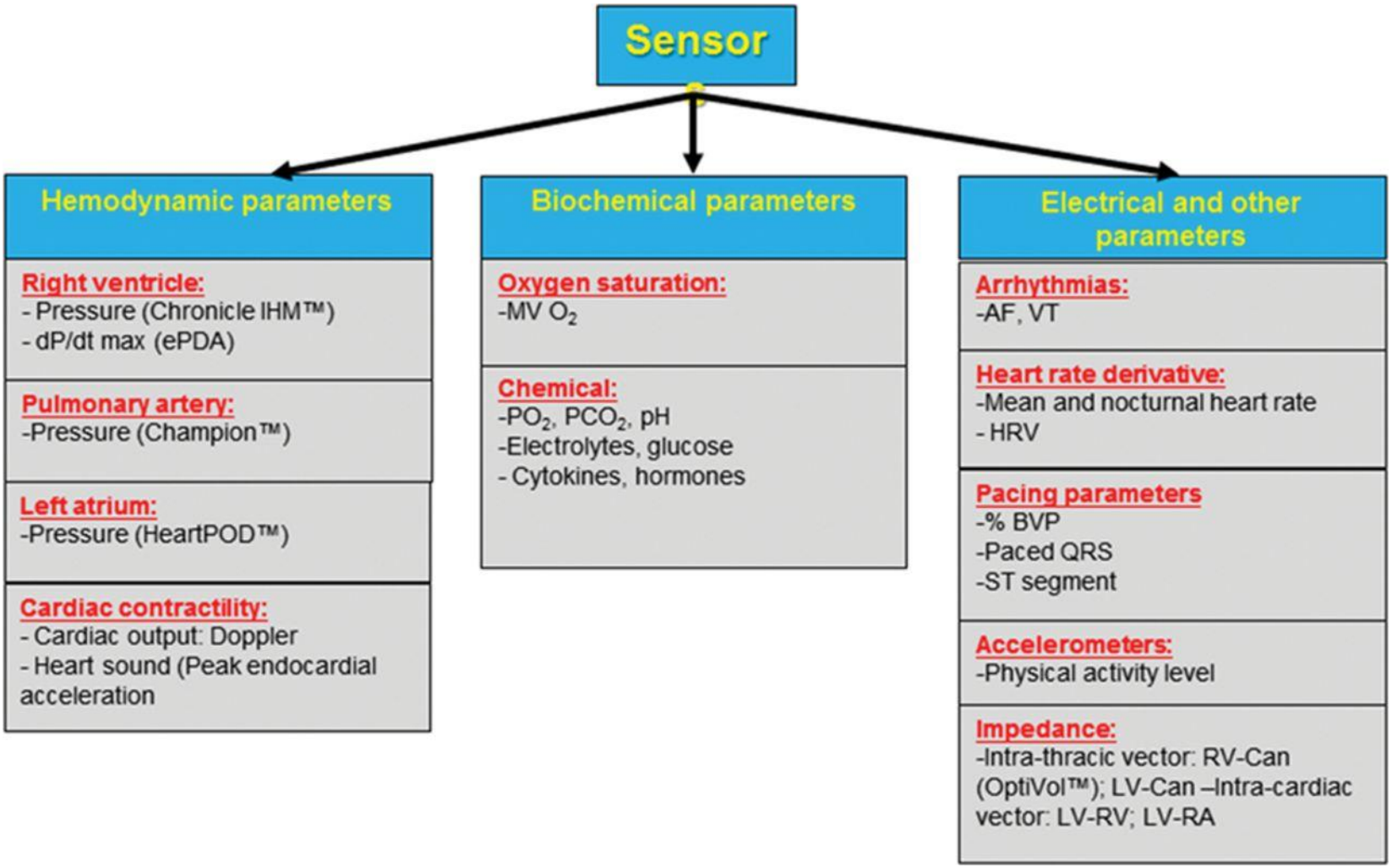


Probability of long-term mortality by percent of right ventricular pacing in patients without LBBB in the MADIT II trial with extended follow up

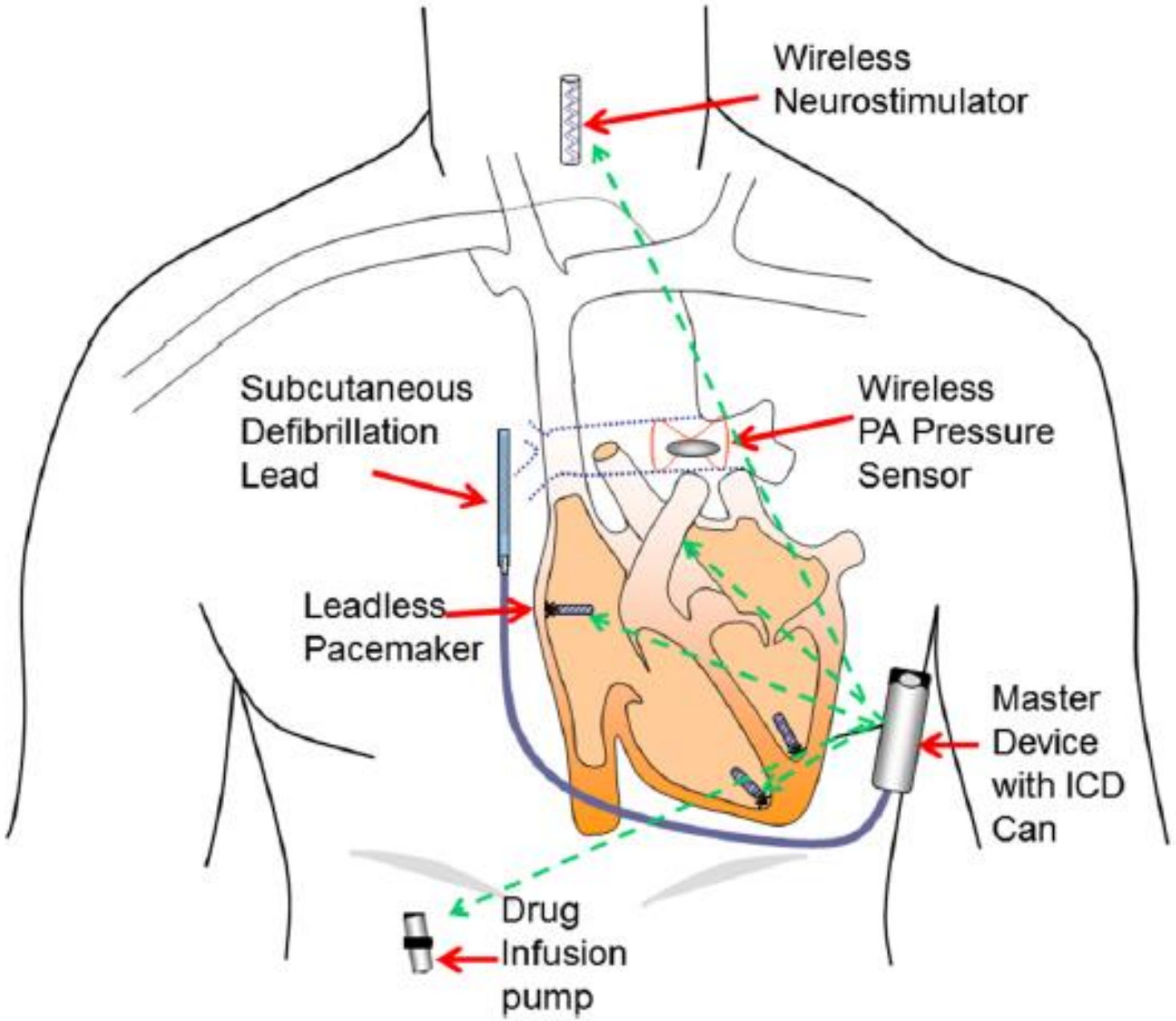
Implant-based multiparameter telemonitoring of patients with heart failure (IN-TIME): a randomised controlled trial. Lancet 2014



Sensors for monitoring heart failure.



Chu-Pak Lau et al. Circulation. 2014;129:811-822



Lau et al Circ 2014

- **What is a pacemaker for?**
  - Prevent symptoms and in some cases death from bradycardia
  - Provide diagnostic information to aid detection and treatment of arrhythmias (AF)
  - Provide diagnostic information to aid detection and treatment of heart failure

- **What is an ICD for?**
  - Prevention of sudden cardiac death
  - Treatment for symptomatic ventricular tachycardia
  - Prevent symptoms and in some cases death from bradycardia
  - Provide diagnostic information to aid detection and treatment of arrhythmias (AF)
  - Provide diagnostic information to aid detection and treatment of heart failure

- **What is CRT for?**
  - Prevent symptoms and death from heart failure
  - Prevention of sudden cardiac death
  - Treatment for symptomatic ventricular tachycardia
  - Prevent symptoms and in some cases death from bradycardia
  - Provide diagnostic information to aid detection and treatment of arrhythmias (AF)
  - Provide diagnostic information to aid detection and treatment of heart failure

NICE National Institute for Health and Care Excellence

NICE guidance

ENDURALIFE powered CRT-D devices for treating heart failure

Medical technologies guidance

Published: 17 March 2017
nice.org.uk/guidance/mtg33

- Extended battery life is of clinical and patient benefit and associated with fewer replacement procedures

- The average reported device infection rates
  - 1.6% for prospective studies
  - 1.0% for case-control studies and
  - 1.2% for retrospective cohort studies

Polyzos et al. (2015)

- Mortality
  - 0.4% (95% CI 0.1% to 1.1%).
- The rate of reoperation/pocket revision
  - 2.7% (95% CI 0.8% to 5.1%).

Zeitler et al. (2015)

ICD risks likely reducing

- Low rate of sub-pectoral generator placement
- No DFT testing

- Battery longevity in isolation provides limited patient benefits
- Features that promote effective delivery of treatment by their nature can consume battery
- Focussing on battery longevity above all other considerations will stifle innovation
- The discussion should be broader than the battery alone

Pacemaker Club Battery longevity feed
By dwelch

- With my first pacer at 19 years old I used to worry about battery life – why cant they make one that lasts forever?

- Now I am an engineer and understand a few things

- My first pacemaker was huge compared to my current one
- More importantly I like having a newer, better, smaller pacer every 7-10 years
- What if the next TV you buy is the last you will ever own, or your computer – no upgrades… or you mobile , or your car
- Over time there are no more over-the-air TV signals for that TV, or wifi becomes obsolete ,unlinking that old PC of yours from the world

- Pacemaker programmers for you model die off and become few and far between
- The software and engineers that designed and were familiar with your pacemaker are no longer with the company
- and the tribal knowledge about how to interrogate your device is lost and the next programmer doesn't properly include your pacemaker – nobody can afford to maintain interrogation equipment if the devices last 20 or 30 years

- If your hospital changes to use a single company do you want to be the only patient with a different brand?
- You want the world to have more than a monopoly but less than a handful otherwise costs go up

- If they introduced a 30 year pacemaker today, I would beg my doctor for the 7-10 year model for the next 3 or 4 I plan to need for the rest of my life