

Precision cardiology in the digital era

As *Nature Reviews Cardiology* marks its 15th anniversary, we are entering a new era of precision cardiology, driven by drug development, technological innovation and artificial intelligence.



The broad spectrum of ... cardiovascular drugs highlights the expanding purview of contemporary cardiovascular medicine



With this issue, *Nature Reviews Cardiology* marks 15 years of publication. Originally launched under the title *Nature Clinical Practice Cardiovascular Medicine*, the journal has evolved into the leading Reviews journal in the field of cardiovascular medicine and research. During this time, many regions of the world have seen a reduction in the morbidity and mortality associated with cardiovascular disease as a result of improved prevention, diagnosis and treatment strategies; nevertheless, cardiovascular disease remains the leading cause of death globally. In a specially commissioned Viewpoint article¹ published in this issue, six of our Advisory Board members reflect on the changes that have occurred in their subspecialties over the past 15 years, what they think is the most exciting ongoing research and how they see the field evolving in the next 15 years. They also speculate on how scientific journals might adapt to keep pace with social media and open access publishing. As a snapshot of the shifting interests in the field, we also present an [online collection](#) of the most-cited articles from each year that the journal has been published.

Since 2004, practice-changing innovation has occurred in medical therapies, imaging modalities, and interventional and surgical techniques. The armamentarium of cardiovascular drugs has been greatly expanded, with many new lipid-lowering, antithrombotic, antihypertensive and antidiabetic drugs producing a reduction in cardiovascular end points in randomized clinical trials. Lately, PCSK9-inhibitor therapies have achieved dramatic lowering of LDL-cholesterol levels beyond that achieved with statins. Non-vitamin K antagonist oral anticoagulants are revolutionizing the prevention and treatment of thrombosis. The combination of sacubitril and valsartan (the first-in-class angiotensin receptor–neprilysin inhibitor) has increased the options for the treatment of patients with heart failure and reduced ejection fraction. Novel antidiabetic agents have been developed, including SGLT2 inhibitors, DPP4 inhibitors and GLP1 receptor agonists. Beyond controlling blood-glucose levels, the SGLT2 inhibitor dapagliflozin was reported at the 2019 ESC Congress to reduce hospitalization and death in patients with heart failure and reduced ejection fraction, with or without diabetes mellitus.

The broad spectrum of what are now considered to be cardiovascular drugs highlights the expanding purview of contemporary cardiovascular medicine. For example, cardiology now has a substantial interest in what was

previously considered to be medical endocrinology, and a new discipline of cardio-oncology has become established. The breakdown of disciplinary boundaries is inevitable as patients with complex comorbidities are increasingly being treated holistically by collaborative teams of health-care providers.

The pace of innovation in interventional cardiology has been similarly fast. Bare-metal stents have evolved into drug-eluting stents. The success of transcatheter aortic valve implantation is being extended to patients at lower levels of surgical risk, and the technology has been applied to the mitral and tricuspid valves. Transcatheter procedures to ablate atrial fibrillation are performed with high degrees of success, and other interventional procedures, such as renal sympathetic denervation, are being investigated with renewed interest.

A major paradigm shift has been the increasing recognition of the inflammatory component of atherosclerosis and the potential therapeutic utility of immunomodulatory drugs for cardiovascular diseases. The realization that even patients who are well treated with LDL-cholesterol-lowering drugs have a residual risk of cardiovascular events and that a major component of this residual risk is often associated with low-level, chronic inflammation opens up many new avenues of therapeutic research.

Three general themes are emerging in cardiology. The first is a shift from treating disease and preventing the secondary recurrence of cardiovascular events to the primary and even primordial prevention of cardiovascular risk and the promotion of cardiovascular health. Second is the widespread advent of wearable and implantable technologies, allowing continuous monitoring of cardiovascular parameters. The utility of these technologies, such as for preventing, detecting and diagnosing cardiovascular diseases, is only just being harnessed. This advance links to the third revolution: the amassing of big data sets from electronic health records, registries, clinical trials and biobanks and the deployment of machine learning and other forms of artificial intelligence to analyse and extract meaningful information. Coupled with so-called 'omics' approaches, these technologies are showing great promise to achieving the ultimate aim of precision cardiology: personalized care tailored to individual patients.

1. Kalman, J. M. et al. *Nat. Rev. Cardiol.* <https://doi.org/10.1038/s41569-019-0261-7> (2019).