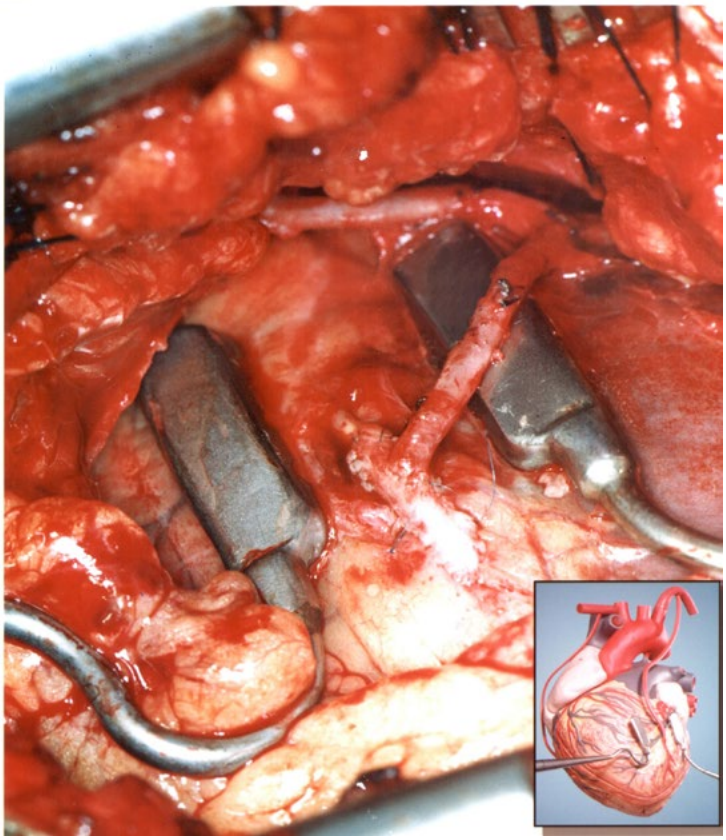
Wykład inauguracyjny prof. Paula F. Grundemana z University Medical Center Utrecht

Cardiovascular Innovation Lucky Failures

Innovation

The modern era of treatment of cardiovascular disease is characterized by technically driven challenges. Today, healthcare practitioners are highly dependent of other parties that create innovations for patient care. What is innovation, why do we need it, and what means valorization? Traditionally, three columns that should form the structure for potential innovative activities in our medical academic institutions are patient care, education and research. However, those initiatives that originate from research and clinical practice are scarce and usually do not convert into a new useful applicable product or method. Over the past decennia, a paradox surfaced, namely that independent medical academia's, having limited financial resources, became increasingly dependent on stock market based medical device industries that progressively dictate, and moreover, create the market needs. Good ideas that could make a difference are certainly present in medical academia's but need careful guidance before valorization should take place. In UMC Utrecht, the Innovation Center as the fourth column is now established to facilitate the process of bringing the academic idea to market (valorization) but it happened only after many years of failures and initial successes. Royalties in return to selling the concept made the medical academia less dependent on industry and may fuel new initiatives. In that sense, the medical academia became an entrepreneur.

William Pollard (born in 1913) stated: *Innovation and learning go hand in hand. The arrogance of success is to think that what you did yesterday will be sufficient for tomorrow*. In the past, failed experiments and coincidentally found side effects have led researchers to great discoveries like Fleming's penicillin and a hair growth stimulating compound sildenafil known as Viagra. An example of a faked experiment is the perfused beheaded dog head with Brukhonenko's autojector and another cautiousness example is the killing of an elephant with a bucket of LSD in a dose finding study. Looking back, those experiments were meaningless and ethically questionable. But indeed, great discoveries are not to be foreseen.



The Octopus

A meaningful innovation should fulfill a clear clinical need. Our awareness that patients after coronary bypass surgery suffered from unacceptable cognitive deficit made us think in the early fifties about alternatives how to perform the risky operation. The Utrecht Octopus Heart Stabilizer invented by us in 1994 obviates the use of the traumatic heart-lung machine while the heart keeps beating while bypasses are connected. The device is attached to the patient's heart by means of suction and bench-viced to the operating table. The bypass can be accurately sutured to the almost motionless narrowed coronary artery fixed by the Octopus. Patients have less blood loss, shorter hospital stay and the frail elderly seems to benefit most. It's world-wide acceptance by many surgeons (to date about 1.8 million patients received an Octopus operation since 1997) demonstrate ease of use, teachability and a validated concept. Nevertheless, the controversy about which patient should receive an Octopus operation is still very alive but for sure only skilled experienced surgeons are successful. Surgery through key holes with the Octopus

made it possible that patients receive a couple of bypasses without opening the chest while the heart keeps on beating. The process towards clinical implementation was not without failures, disappointments, coincidences, law suits and a big bag of luck. The process towards clinical application is demanding but rewarding in terms of received royalties.

The Utrecht Octopus (invention made in 1994) restrains the natural jerky motion of the diseased artery facilitating coronary bypass surgery while the heart keeps on pumping. Note the bypass conduit crossing the legs of the Octopus and it's connection to the coronary artery of a patient.

Coronary connector

In the same period, UMCU colleague heart surgeon Willem Suyker and his brother Paul, devised a disruptive micro-connector for automatic close-chest coronary bypass surgery. With persistence and perseverance, the private initiative of a clinician resulted in a technically highly reliable flawless device feasible to connect the mammary artery to the main coronary artery of the heart. The stapler has the potential to standardize least invasive coronary bypass surgery.

S^2AS connector, smaller than the head of a match, intended for stapling blood vessels with internal diameter of 1,8-2.5 mm.

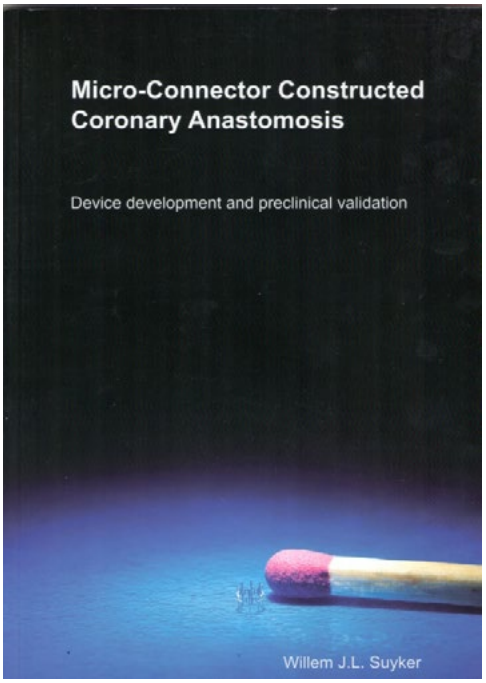
Polymeric heart valve for life

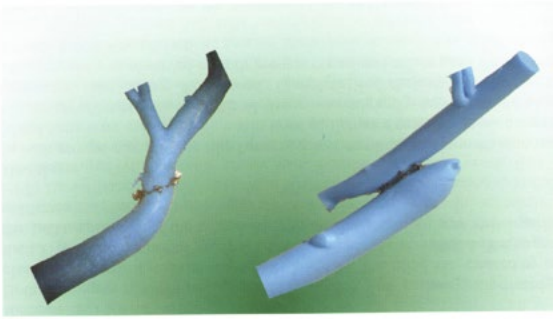
As example of open innovation, UMCU has started a collaboration in 2011 with the Dutch company DSM that produces the ultra strong medical grade polyethylene Dyneema Purity fiber. The UMCU started from scratch the development of a heart valve for life that aims to replace biovalves and prosthetic valves which have disadvantages like limited durability and use of blood thinners, respectively. The coincidental exposure to the material Dyneema in one of Gründeman's site visits to DSM, brought him to invent a foldable trileaflet valve that has the potential to be placed without cracking the chest and to be lifelong in patients with less blood thinners.

Innovation Center

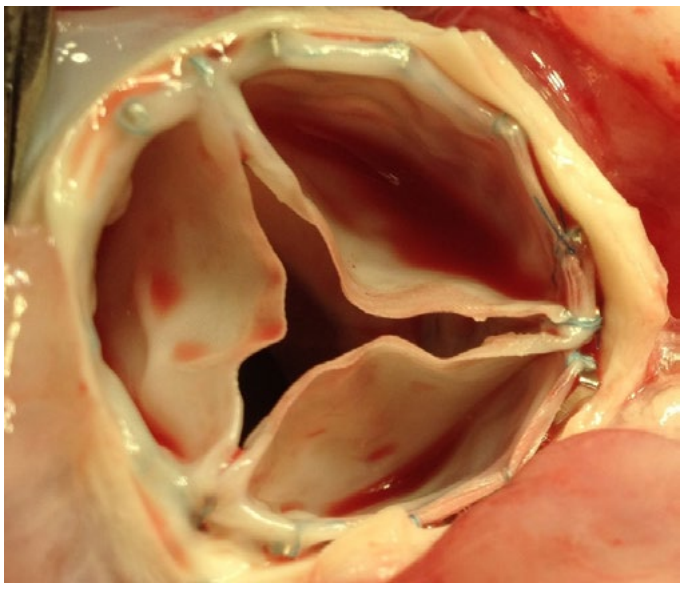
The importance of the right facilitating environment for inventions cannot be stressed enough. Leaders must acknowledge talents and stimulate hard-to-find inventors to make delicate difficult steps to cross the valley of death. Valorization can only be successful when the medical academia fully support this complex process. The GUMed has to be congratulated for making important steps in setting up the fourth column in it's healthcare organization: the Medical Innovation Center of GUMed.

In summary, cardiovascular innovations and it's valorization as experienced by UMC Utrecht were possible thanks to the contributions of many collaborators. We all face new indispensible mandatory challenges that hopefully make us doing a better job for the patient of tomorrow. ■





Left: Corrosion cast. Blood vessels are removed and replaced by plastic. After deployment, the connector (situated between bypass (upper part) and coronary artery) allows unrestricted blood flow to pass the connection. Right: After healing. Note again the smooth pass way for blood at the site of the connector



Chronic pre-clinical UMCU-DSM Dyneema Purity trileaflet valve covered with autologous tissue (25 mm in diameter)