

DAS Maastricht 2023

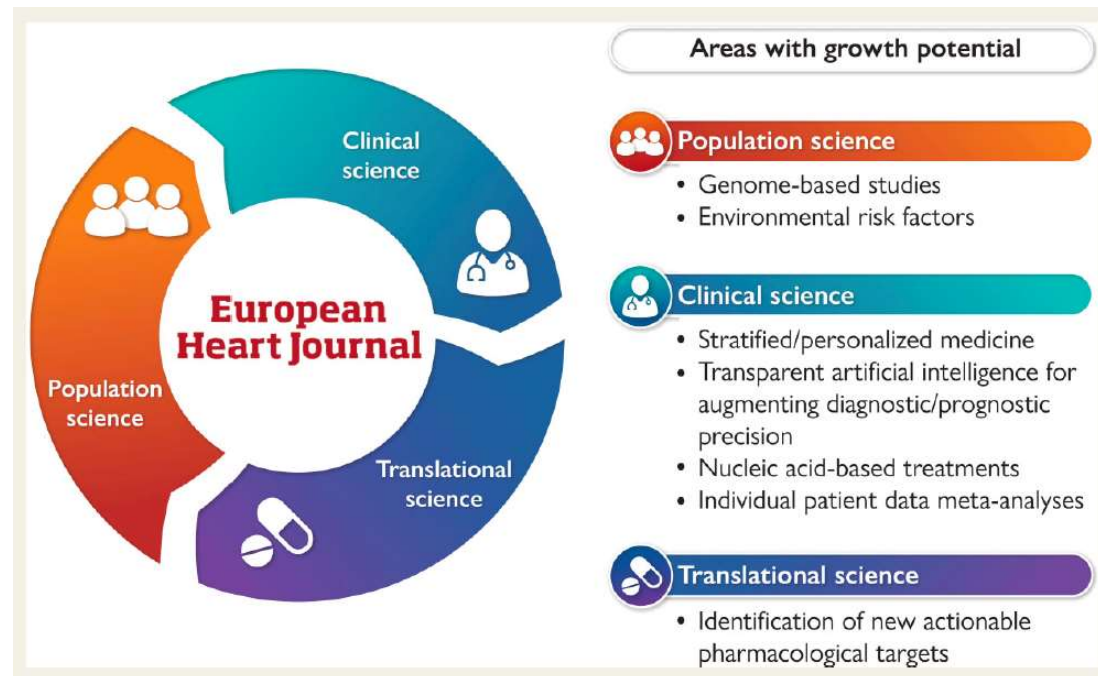
**Come l'intelligenza artificiale cambierà l'assistenza
cardiovascolare (ovvero 'A glimpse of the future')**

**Filippo Crea
Institute of Cardiology
Catholic University of the Sacred Heart
Rome, Italy**



The *European Heart Journal*: fulfilling the mission

Filippo Crea ^{1,2,*}, Lina Badimon ³, Colin Berry ⁴, Raffaele De Caterina ⁵, Perry M. Elliott^{6,7}, Robert Hatala⁸, Peter Libby⁹, Cecilia Linde¹⁰, and Anne Tybjaerg-Hansen^{11,12} on behalf of the EHJ Editorial Board



Main topics

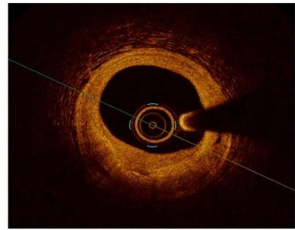
- **Environmental pollution**
- **Polygenic risk scores**
- **Artificial intelligence**
- **Nucleic acid-based therapies**
- **Personalized/stratified management**

Association of the combined effects of air pollution and changes in physical activity with cardiovascular disease in young adults

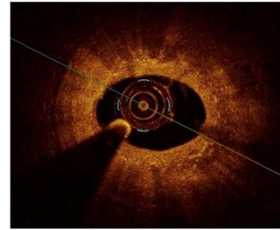
Seong Rae Kim ¹, Seulggie Choi², Kyuwoong Kim ³, Jooyoung Chang²,
Sung Min Kim², Yoosun Cho⁴, Yun Hwan Oh ⁵, Gyeongsil Lee⁴, Joung Sik Son ⁴,
Kyaе Hyung Kim ^{4,6}, and Sang Min Park^{2,4*}

Air pollution and plaque instability

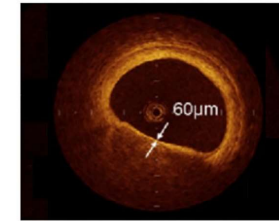
Healed



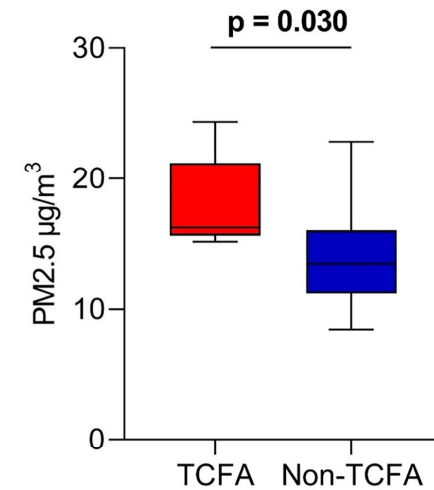
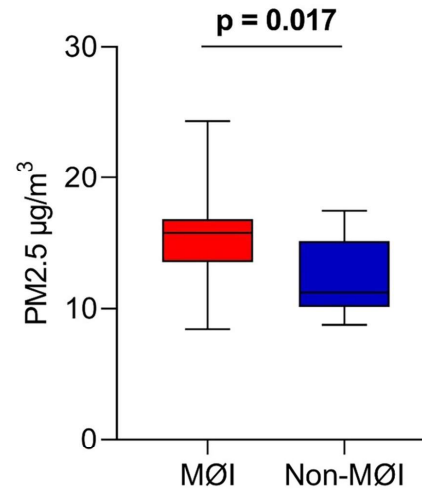
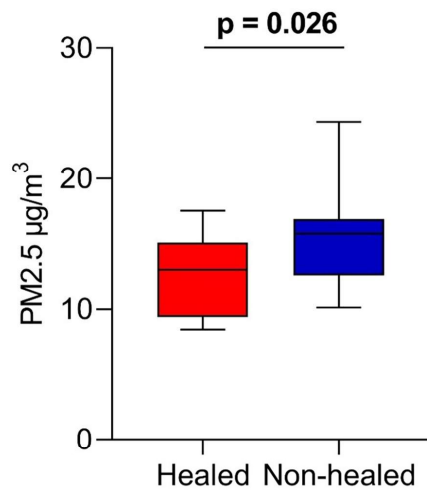
MØI



TCFA



Recurrent ACS



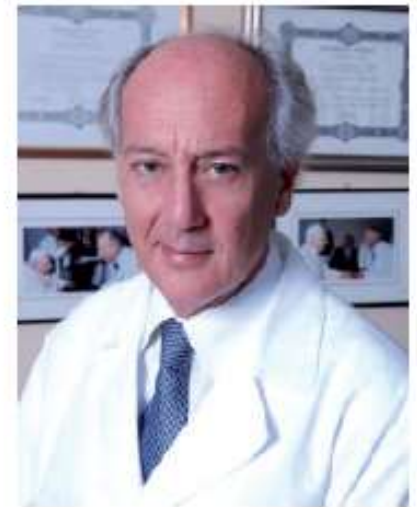
(Russo et al, EHJ 2023)

Light and noise pollution and socioeconomic status: the risk factors individuals cannot change

Filippo Crea  ^{1,2}

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ESC





European Society
of Cardiology

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doi:10.1093/eurheartj/ehaa846

CLINICAL RESEARCH

Epidemiology and Prevention

Outdoor light at night and risk of coronary heart disease among older adults: a prospective cohort study

Shengzhi Sun^{1,2†}, Wangnan Cao^{3†}, Yang Ge ⁴, Jinjun Ran ², Feng Sun⁵,
Qiang Zeng⁶, Mengdi Guo ⁷, Jianxiang Huang⁷, Ruby Siu-Yin Lee⁸,
Linwei Tian^{2*}, and Gregory A. Wellenius ¹

Does night-time aircraft noise trigger mortality? A case-crossover study on 24 886 cardiovascular deaths

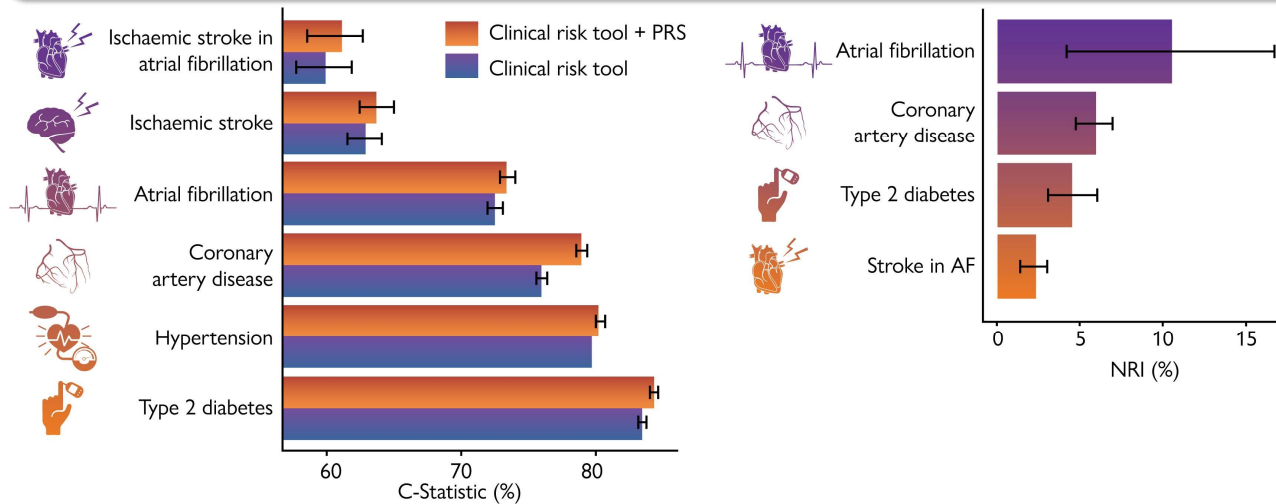
Apolline Saucy ^{1,2}, **Beat Schäffer** ³, **Louise Tangermann** ^{1,2},
Danielle Vienneau ^{1,2}, **Jean-Marc Wunderli** ³, and **Martin Röösli** ^{1,2*}

Main topics

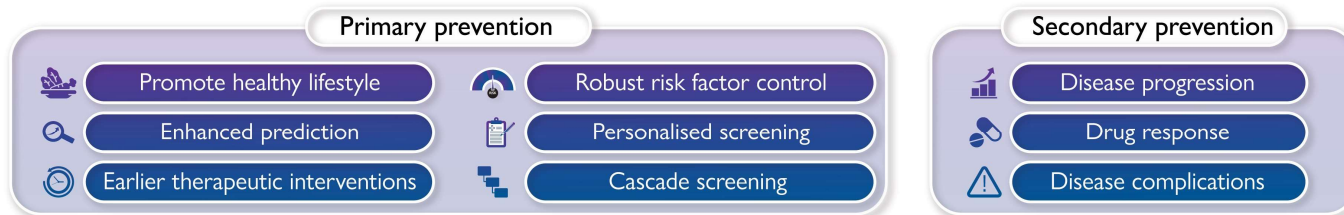
- Environmental pollution
- Polygenic risk scores
- Artificial intelligence
- Nucleic acid-based therapies
- Personalized/stratified cardiology

Polygenic risk score for the prediction of cardiometabolic disease

Predictive accuracy of clinical risk tools with the addition of PRS



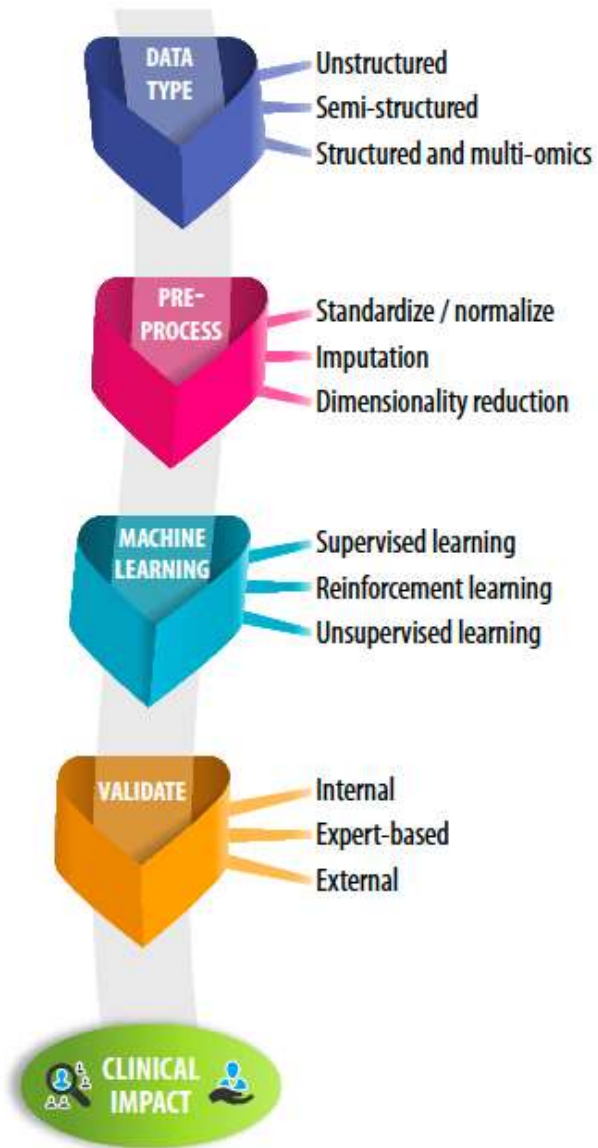
Potential clinical uses of PRS



(O'Sullivan et al, EHJ 2023)

Main topics

- Environmental pollution
- Polygenic risk scores
- **Artificial intelligence**
- Nucleic acid-based therapies
- Personalized/stratified management



AI across the spectrum of cardiovascular healthcare: the four key steps

(Gill et al, EHJ 2023)



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doi:10.1093/eurheartj/ehaa640

CLINICAL RESEARCH

Feasibility of using deep learning to detect coronary artery disease based on facial photo

Shen Lin^{1†}, Zhigang Li ^{2†}, Bowen Fu^{2†}, Sipeng Chen³, Xi Li¹, Yang Wang⁴, Xiaoyi Wang¹, Bin Lv^{1,5}, Bo Xu ^{1,6}, Xiantao Song⁷, Yao-Jun Zhang ⁸, Xiang Cheng ⁹, Weijian Huang¹⁰, Jun Pu¹¹, Qi Zhang¹², Yunlong Xia ¹³, Bai Du¹⁴, Xiangyang Ji^{2*}, and Zhe Zheng ^{1,15,16*}



Patients Underwent Coronary Angiography or Coronary Computed Tomography Angiography

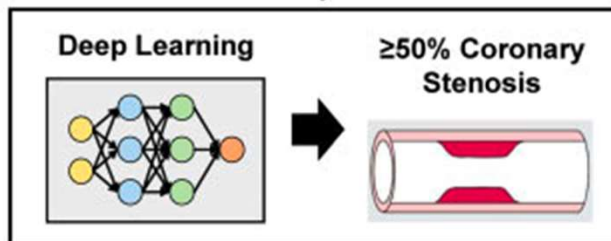
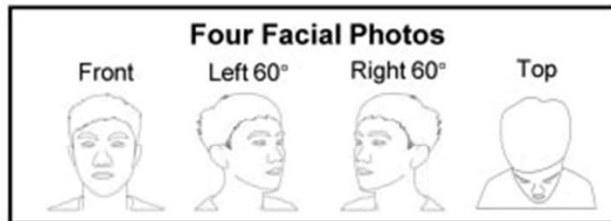
Algorithm Development (7/2017-3/2019)
8 Centers, n=5796

Algorithm Test (4/2019-7/2019)
9 Centers, n=1013

Training Group
(Random 90%)

Validation Group
(Random 10%)

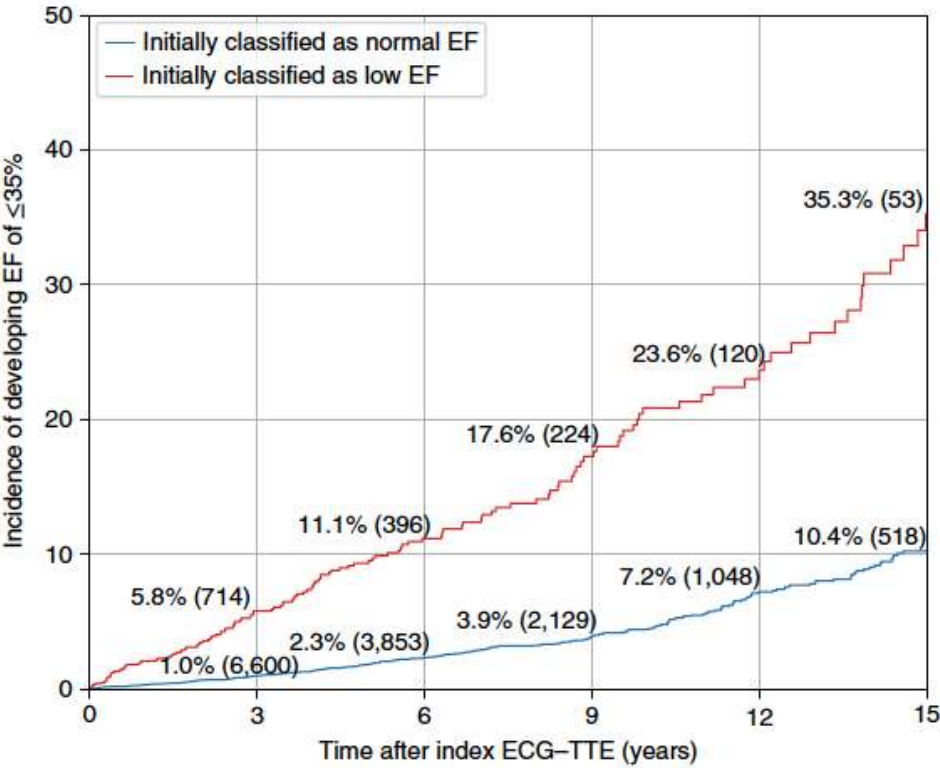
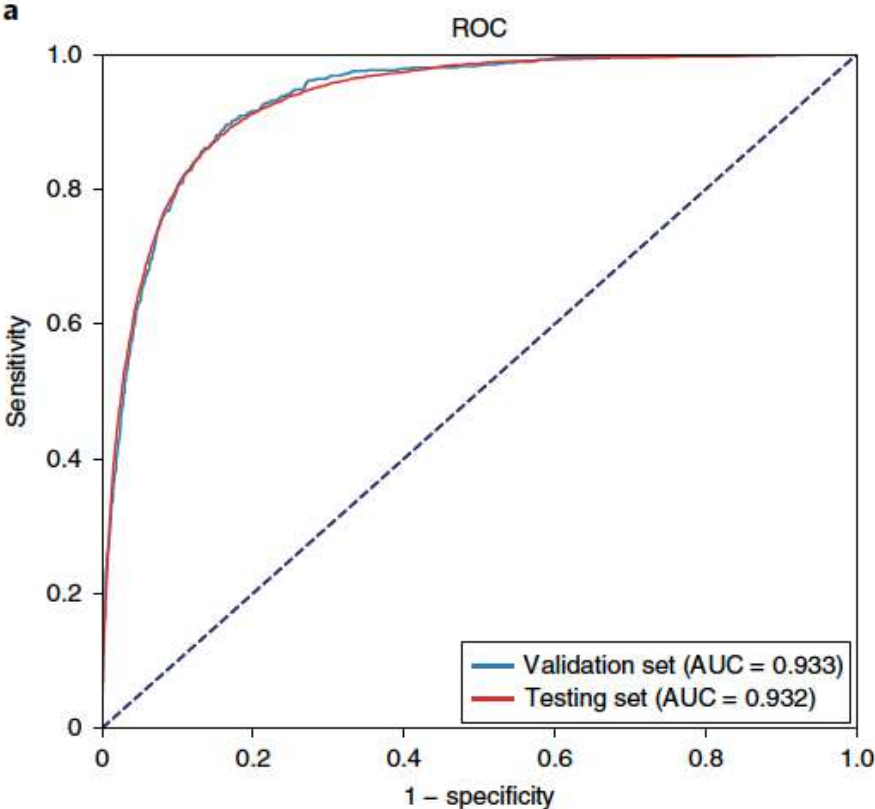
Test Group



AI vs. Tradition	AUC	P value
Algorithm	0.757	Ref
Diamond-Forrester	0.631	<0.001
CAD Consortium Clinical Score	0.694	0.03

AI vs. Tradition	AUC	P value
Algorithm	0.730	Ref
Diamond-Forrester	0.623	<0.001
CAD Consortium Clinical Score	0.652	<0.001

Screening for cardiac contractile dysfunction using an artificial intelligence-enabled ECG



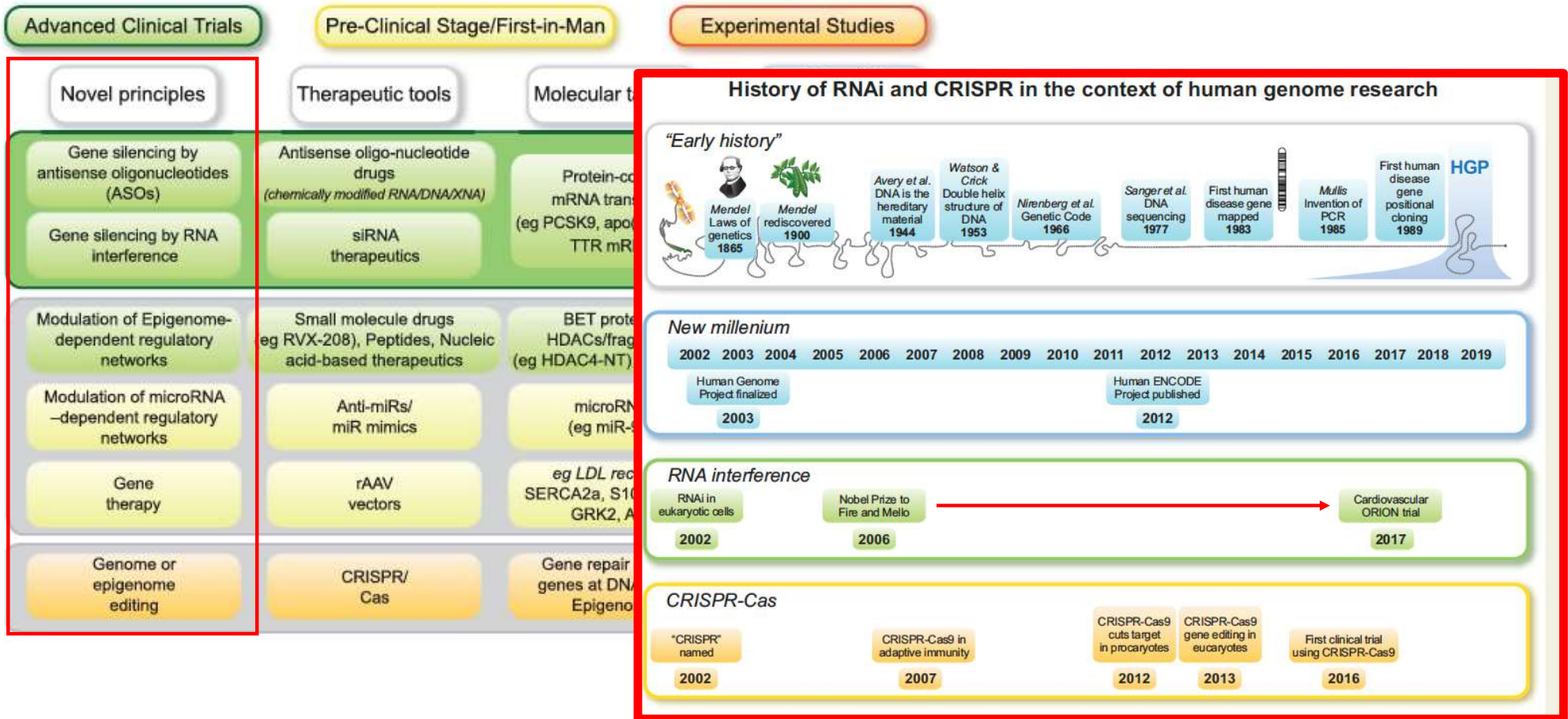
(Attia et al, Nature Medicine 2019)

Main topics

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- Polygenic risk scores
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- Nucleic acid-based therapies
- Personalized/stratified management

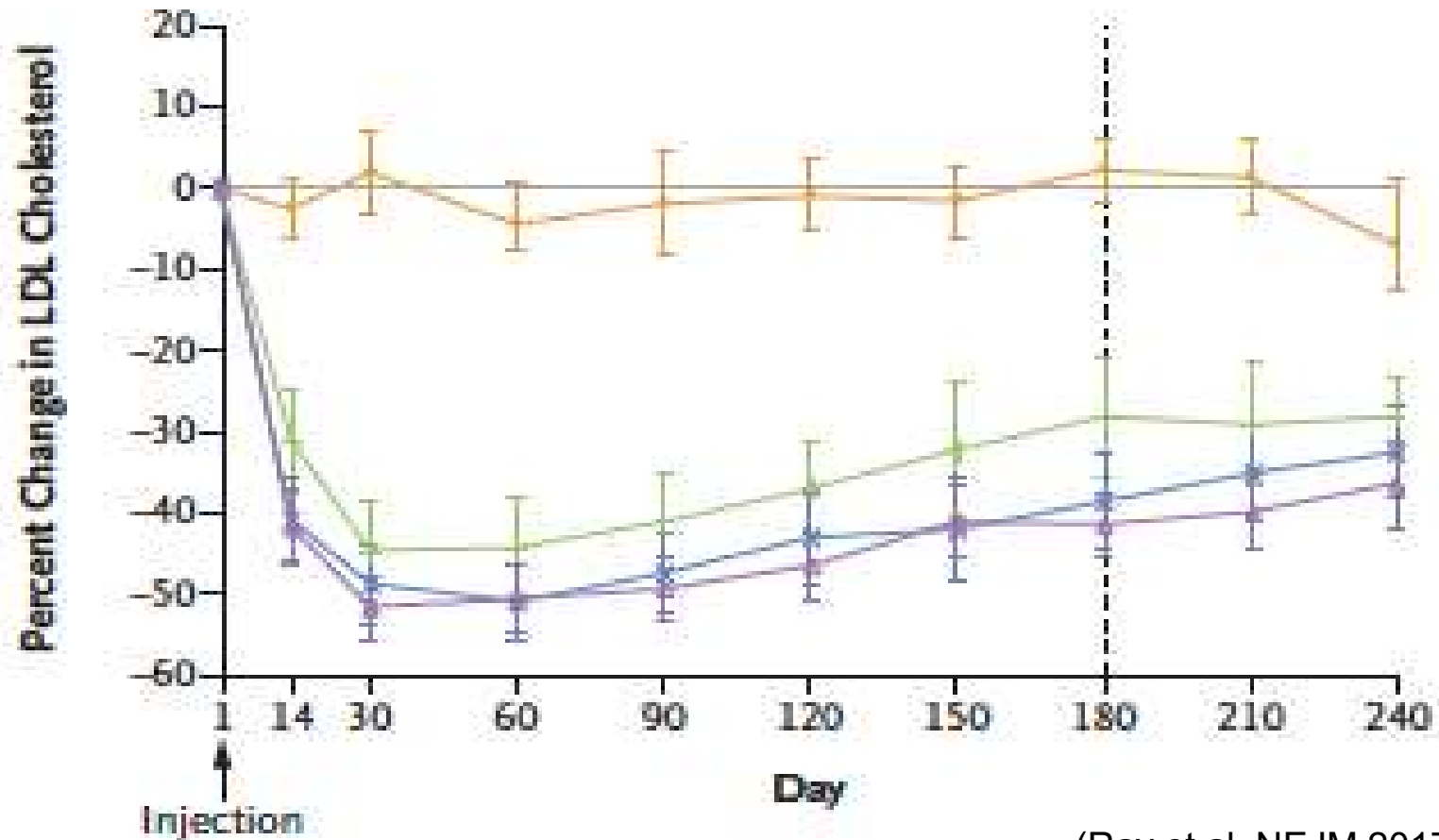
Nucleic acid-based therapies

Translational status of novel therapeutic strategies in cardiovascular diseases



(Landmesser et al, EHJ 2020)

Inclisiran in patients at high CV risk with elevated LDL cholesterol



(Ray et al, NEJM 2017)



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doi:10.1093/eurheartj/ehaa791

BASIC SCIENCE

Heart failure and cardiomyopathies

CDR132L improves systolic and diastolic function in a large animal model of chronic heart failure

**Sandor Batkai^{1†}, Celina Genschel^{1†}, Janika Viereck^{1†}, Steffen Rump¹,
Christian Bär^{2,3}, Tobias Borchert¹, Denise Traxler ⁴, Martin Riesenhuber ⁴,
Andreas Spannbauer ⁴, Dominika Lukovic⁴, Katrin Zlabinger ⁴,
Ena Hašimbegović⁴, Johannes Winkler⁴, Rita Garamvölgyi⁵, Sonja Neitzel ⁶,
Mariann Gyöngyösi⁴, and Thomas Thum ^{1,2,3*}**

Cardiac stress or injury

miR-132

CDR132L
(ASO miR-132 inhibitor)

Maladaptive
Hypertrophy

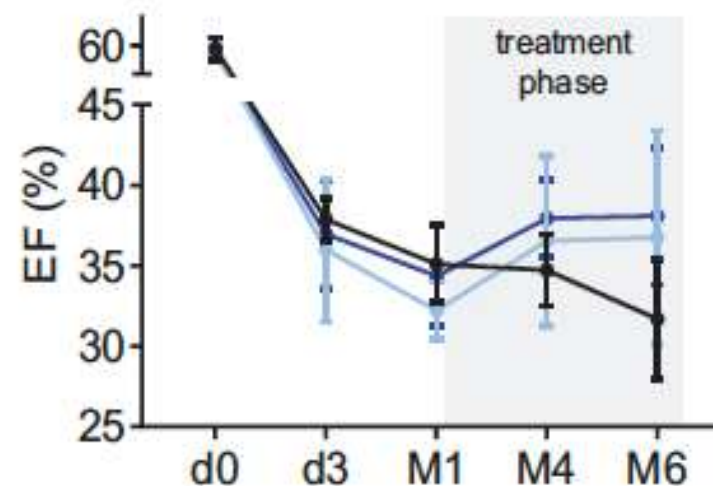
Impaired
contractility /
Ca²⁺ handling

Derailed
autophagy

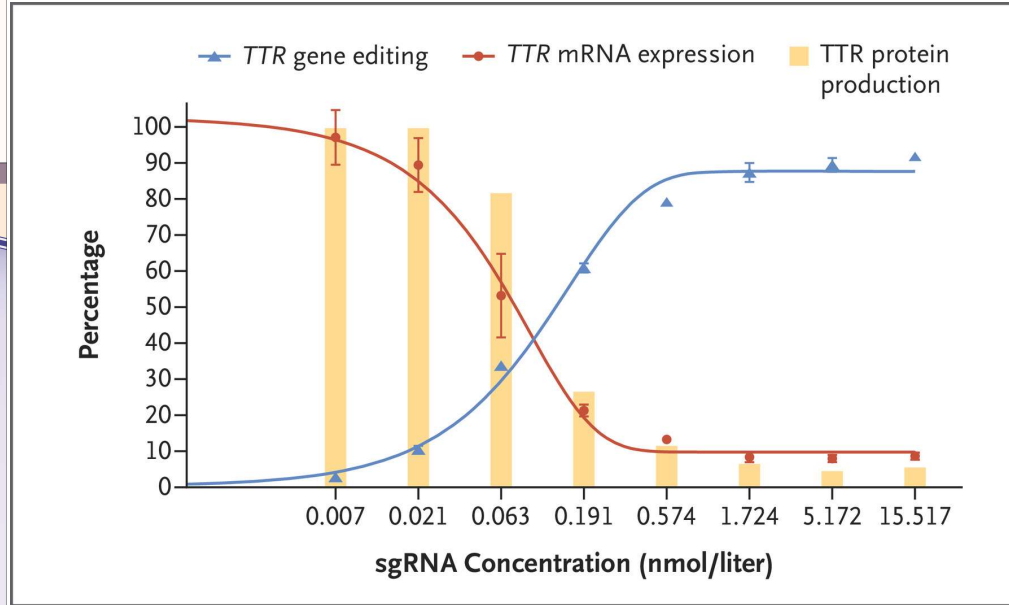
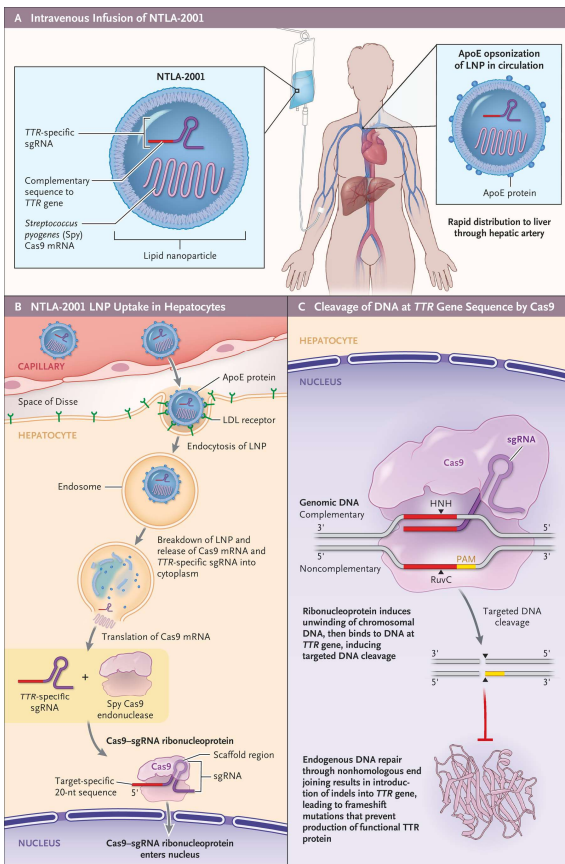
Failing Cardiomyocyte

Failing Heart and Death

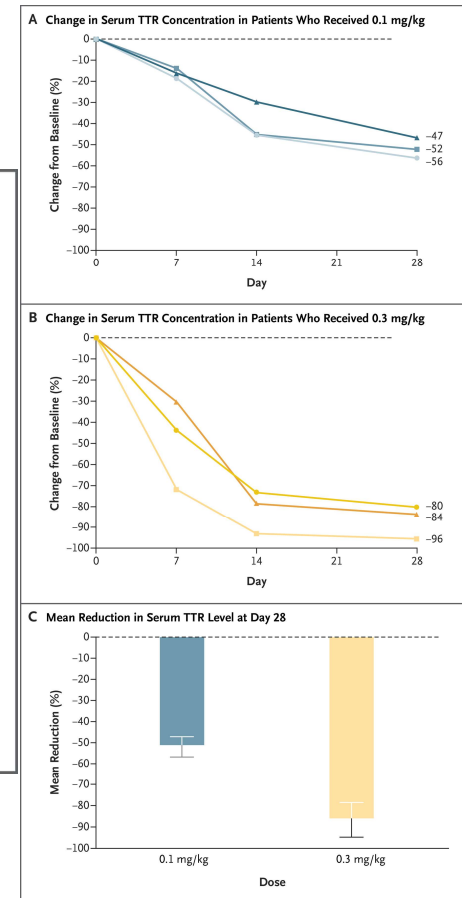
■ Placebo ■ 3x CDR132L ■ 5x CDR132L



Crispr-cas9 in vivo gene editing for transthyretin amyloidosis



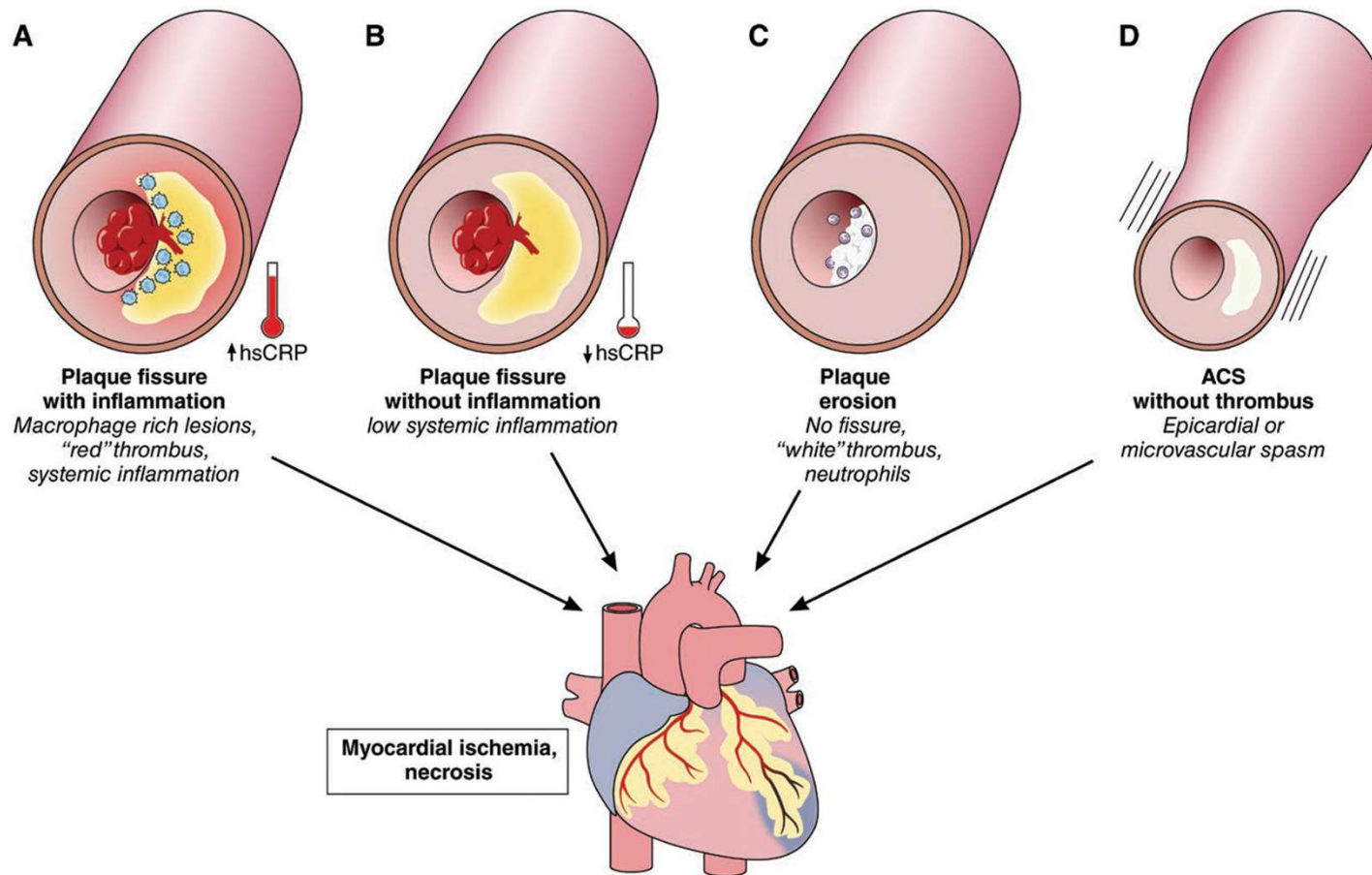
(Gillmore et al, NEJM 2021)



Main topics

- **Environmental pollution**
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- **Nucleic acid-based therapies**
- **Personalized/stratified management**

ACS: the way forward from mechanisms to precision treatment



(Crea and Libby, Circulation 2017)

Stratified treatment of ACS

Fissure with inflammation

- **Modulation of adaptive immunity**

Fissure without inflammation

- **Cyclodextrin**

Erosion

- **Potent antithrombotic drugs**
- **Drugs targeting hyaluronan**

Spasm

- **Rho Kinase inhibitors**

Causes of MINOCA

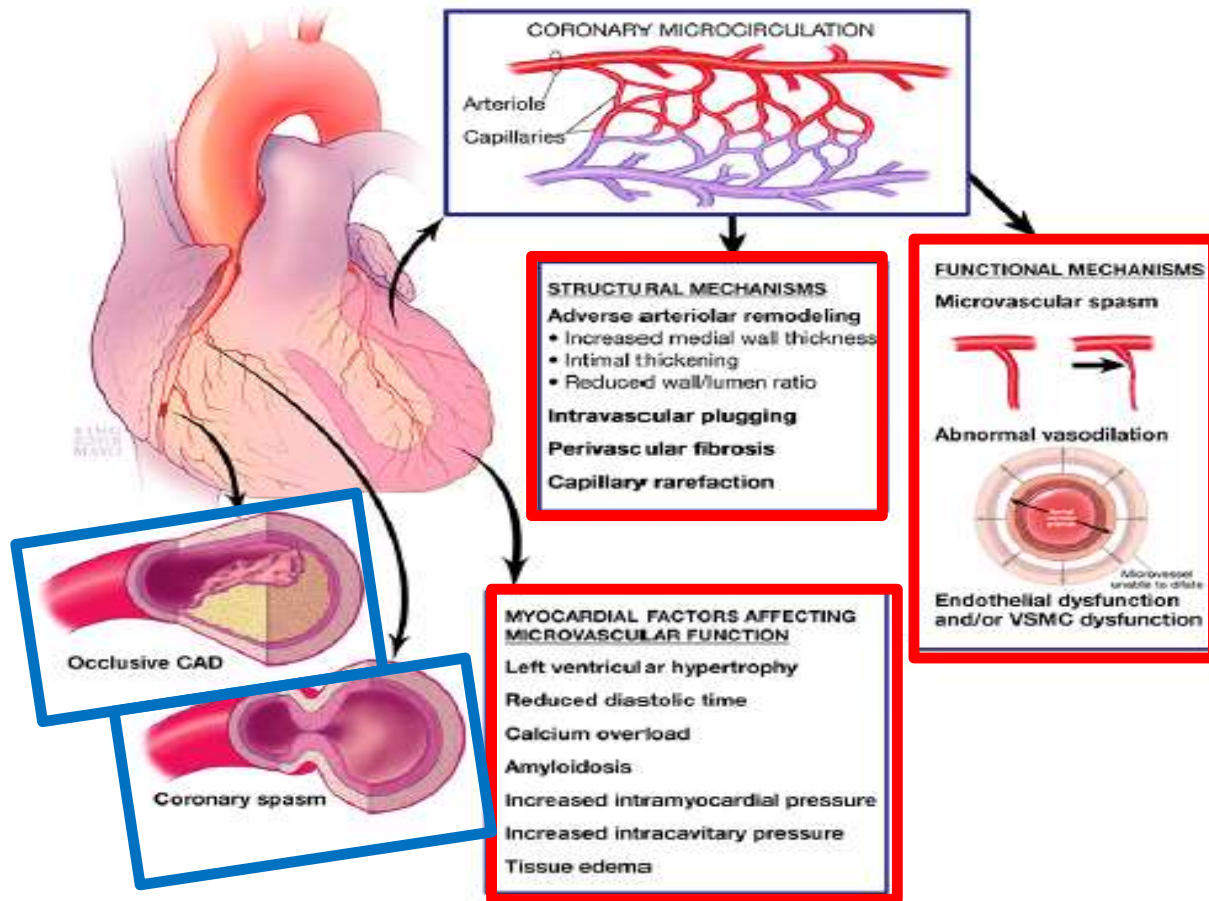
- **Epicardial causes**
 - **Coronary spasm**
 - **Plaque fissure with positive remodeling**
 - **Coronary dissection**
- **Microvascular causes**
 - **Unstable microvascular angina**
 - **Takotsubo syndrome**
 - **Myocarditis**
 - **Coronary thromboembolism**

Stratified treatment of MINOCA

Mechanism	Diagnosis	Prognosis	Therapy
Epicardial causes			
Vasospasm	Ergo or A-Ch	Good if properly treated	CCB, Rho kinase-I?
Culprit plaque	IVUS or OCT	Good if properly treated	RFs control, DAPT
Spontaneous dissection	OCT	Good if properly treated	DAPT
Microvascular causes			
TTS	LVgram	Similar to that of ACS	ACE-I?
Microvascular spasm	A-Ch	Good if properly treated	CCB, Rho kinase-I?
PVB19 myocarditis	CMR/EMB	Good in the absence of LVD	Rx of HF if needed
Coronary embolism	TEE	Depends on the cause	Anticoagulants

(Niccoli G et al, EHJ, 2015)

Reappraisal of ischemic heart disease



(Kaski, Crea, Gersh, Camici, Circulation 2018)

Stratified treatment of CCS

- **Epicardial or microvascular spasm**
 - Calcium channel blockers
 - ACE-I
 - Nicorandil
 - Rho kinase antagonists
 - Endothelin antagonists
 - NPY antagonists
- **Epicardial stenoses or impaired microvascular dilation**
 - Beta-blockers
 - Ivabradine
 - Ranolazine
 - Trimetazidine
- **Enhanced pain perception**
 - Tricyclics
 - Adenosine-antagonists

Grazie per la vostra attenzione!