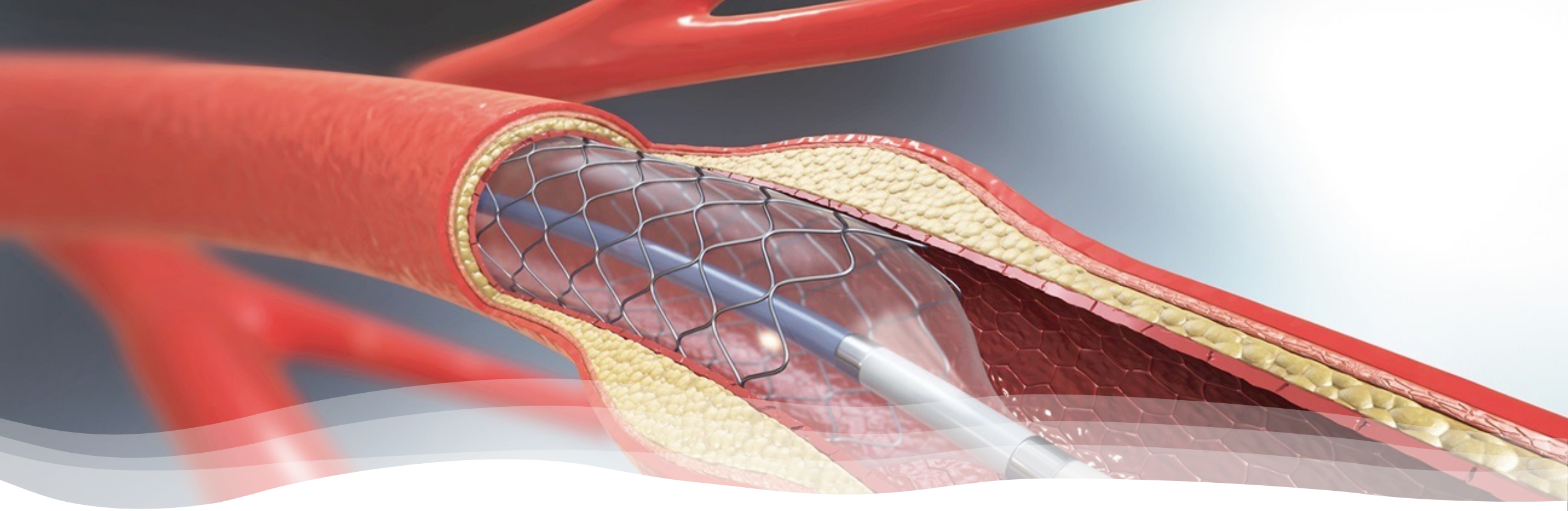

Nanodiamond - decorated PEO – coating: biocompatibility studies

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Fraunhofer IKTS

POLITECHNIKA ŚLĄSKA

Relevance

WORLD HEART FEDERATION

CARDIOVASCULAR DISEASE

THE WORLD'S NUMBER 1 KILLER

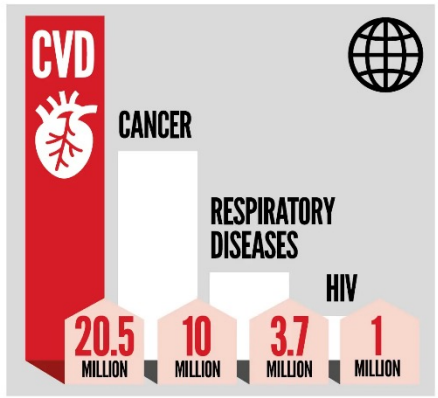
Cardiovascular diseases are a group of disorders of the heart and blood vessels, commonly referred to as **heart disease** and **stroke**.

20.5 MILLION deaths every year from CVD

33% of all global deaths

>75% of CVD deaths take place in low- and middle-income countries

GLOBAL CAUSES OF DEATH



RISK FACTORS FOR CVD

- High Blood Pressure
- Unhealthy Diet
- High Cholesterol
- Diabetes
- Overweight & Obesity
- Tobacco
- Air Pollution
- Kidney Disease
- Physical Inactivity
- Harmful use of alcohol

Sources: World Health Organization; IHME, Global Burden of Disease

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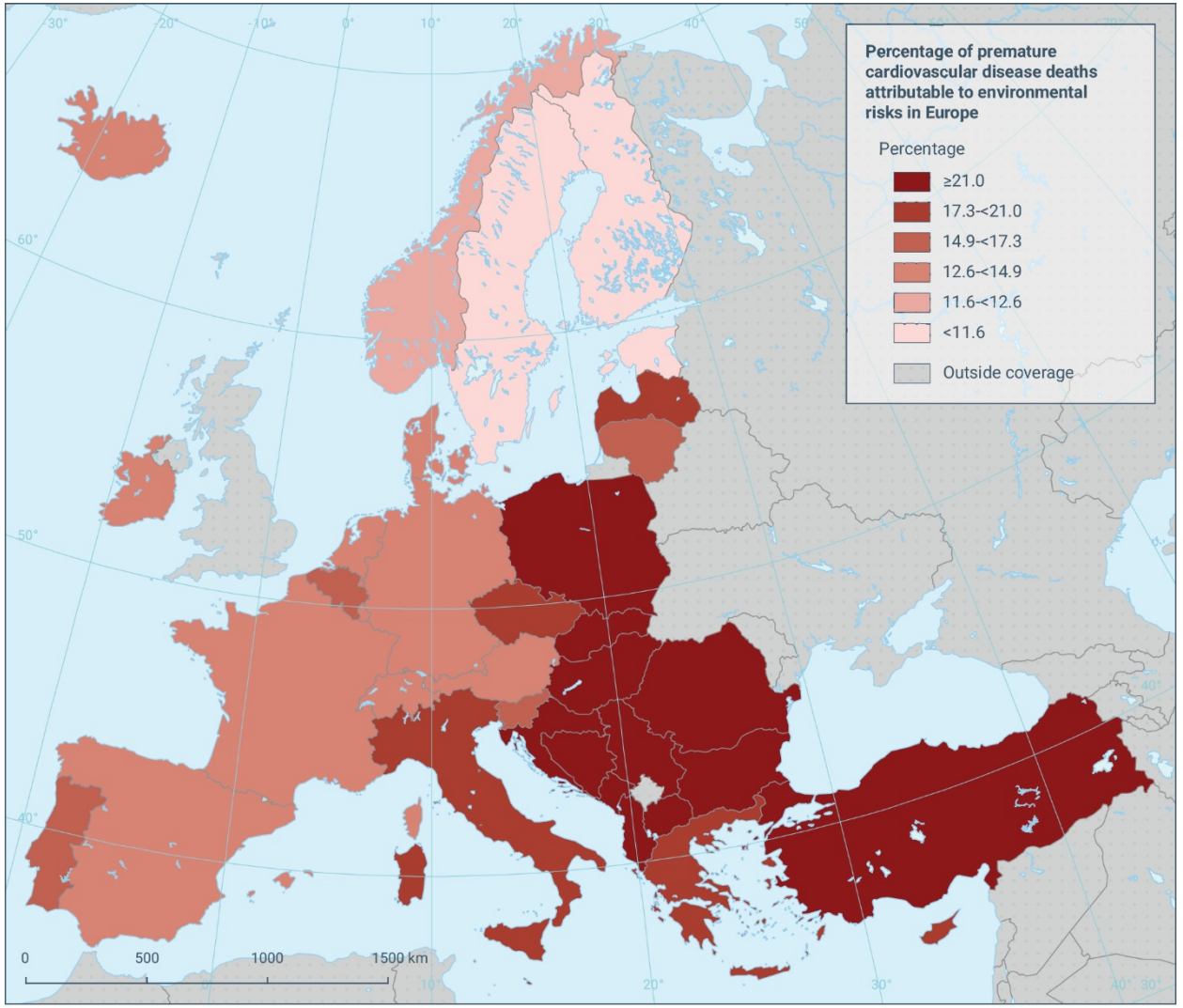
www.worldheart.org

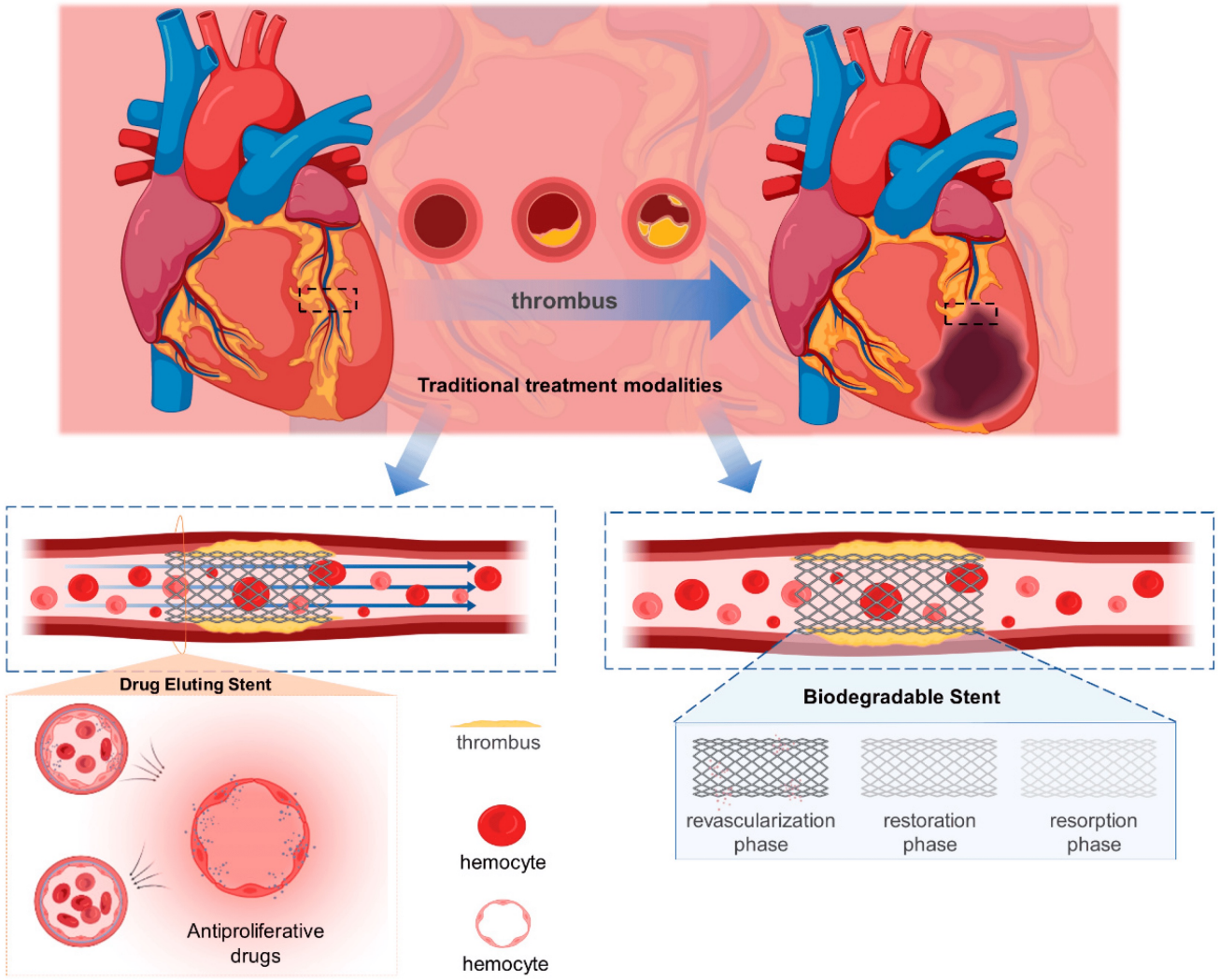
worldheartfederation
worldheartfed
worldheartfederation



Reference data: © EuroGeographics, © FAO (UN), © TurkStat Source: European Commission - Eurostat/GISCO

https://www.eea.europa.eu/publications/beating-cardiovascular-disease

What is the treatment of myocardial infarction?



Disadvantages of traditional treatment:

01 Delayed healing and endothelialization;

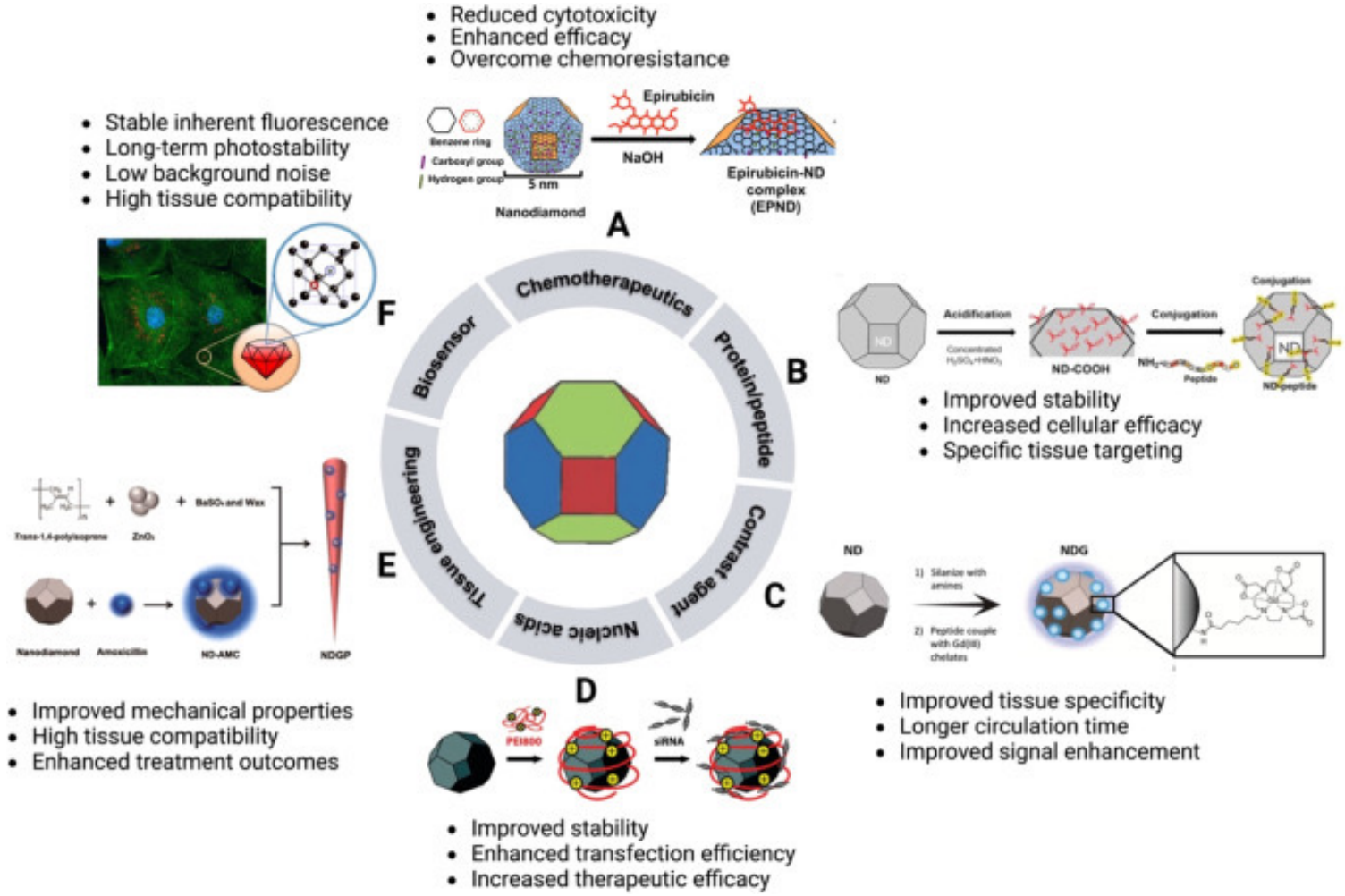
02 Risk of late stent thrombosis;

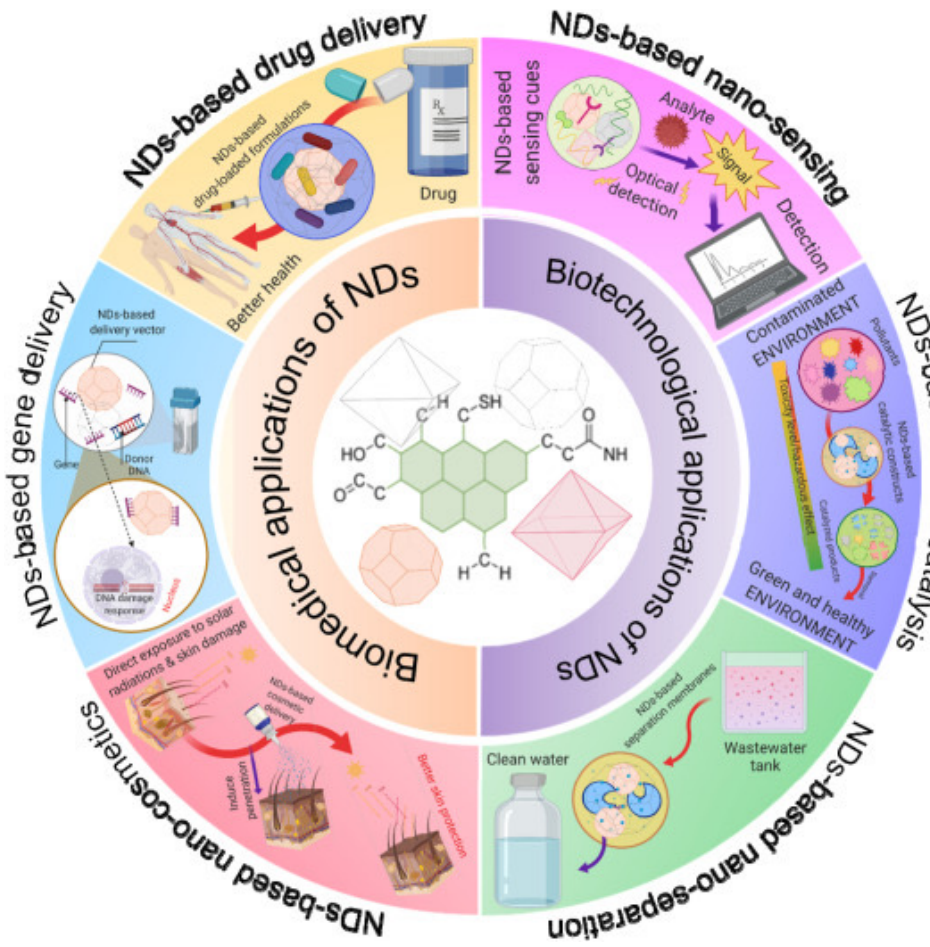
03 Taking long-term dual antiplatelet therapy;

04 **Restenosis**

https://doi.org/10.3390/bios13080795

WHAT & WHY Nanodiamonds?





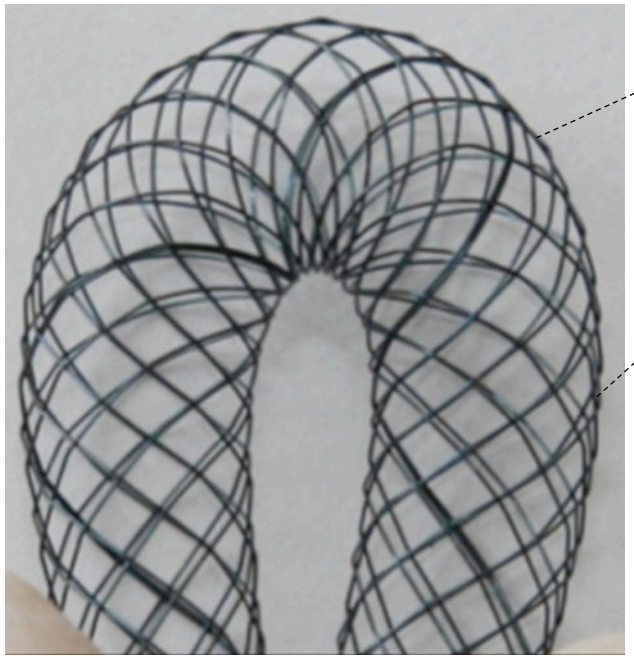
https://doi.org/10.1016/j.slast.2023.03.007

https://doi.org/10.1016/j.jmrt.2021.11.037

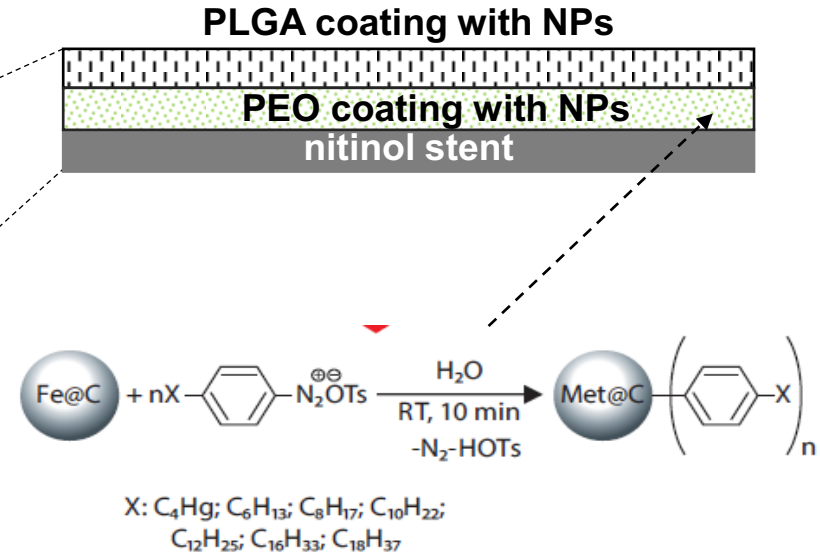
The aims of research

To improve the surface characteristics of NiTi stents by incorporating detonated nanodiamonds (NDs) into plasma electrolytic oxidation (PEO) coatings to protect against atherosclerosis reversal.

General concept of the research

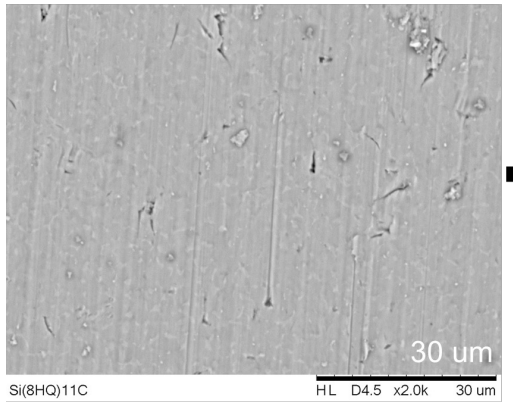


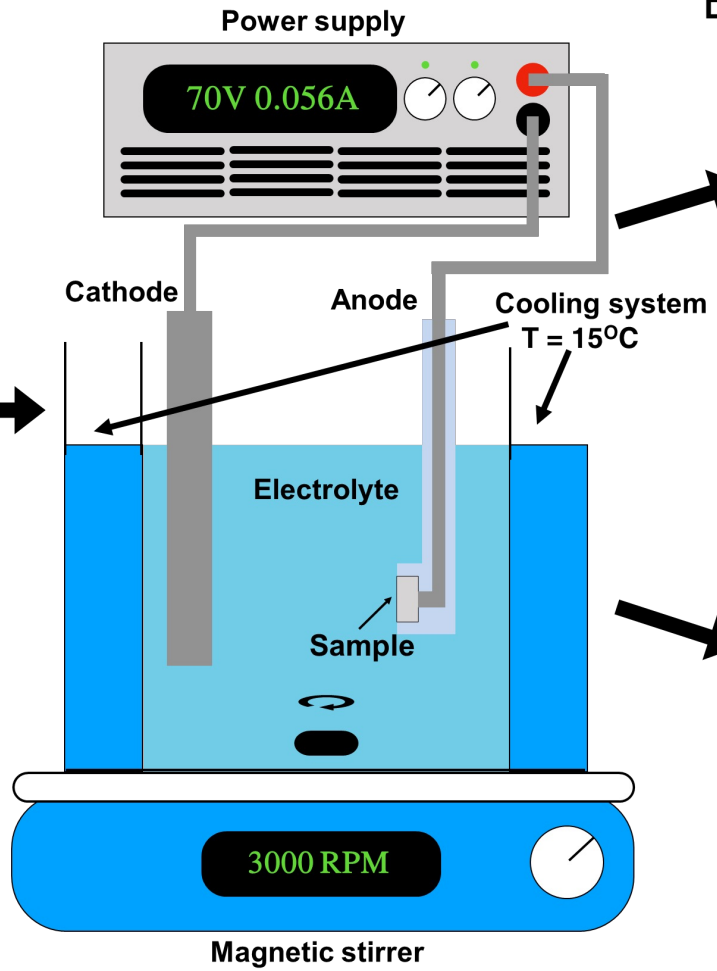
One-wire peripheral nitinol stent



Experimental protocol

Blank NiTi sample

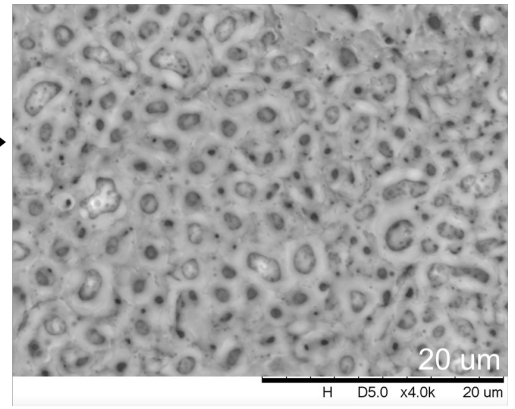




Electrolyte

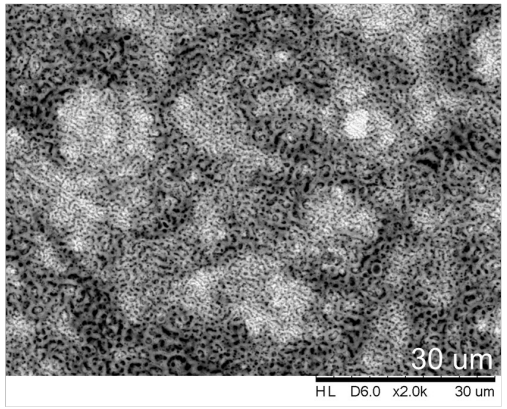
H_3PO_4

PEO treated sample

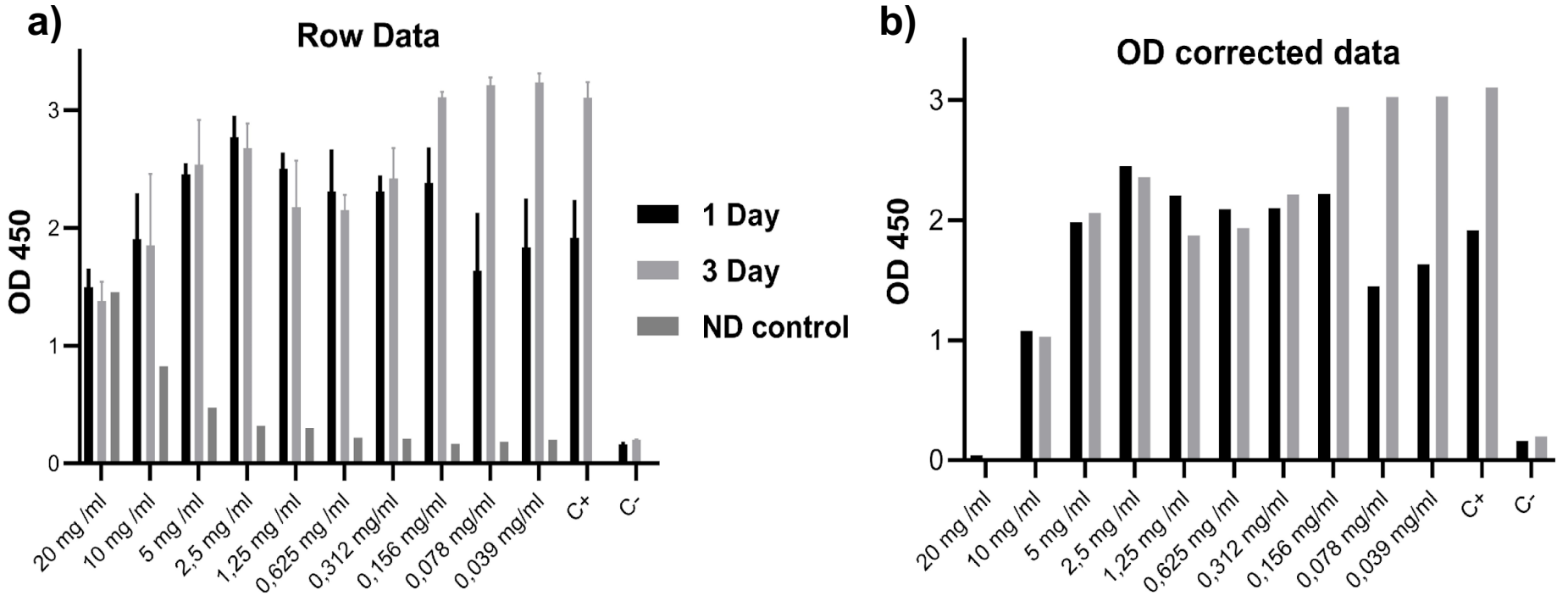


Drop casting

H_3PO_4 + ND

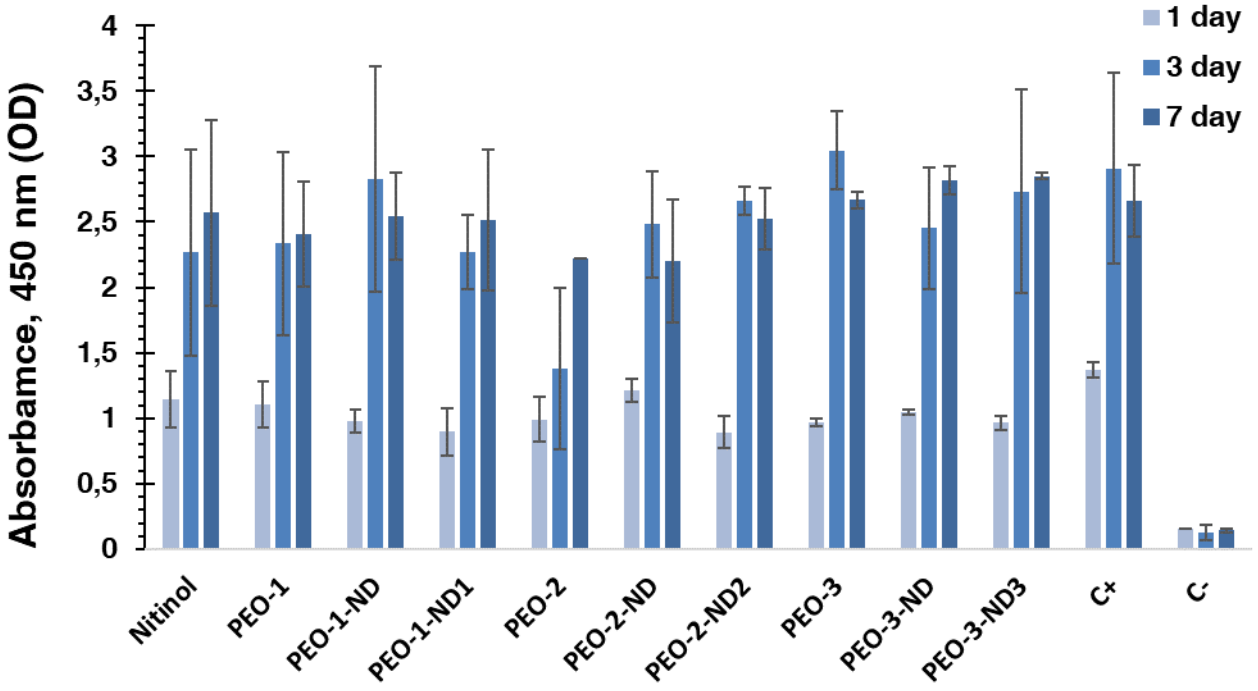


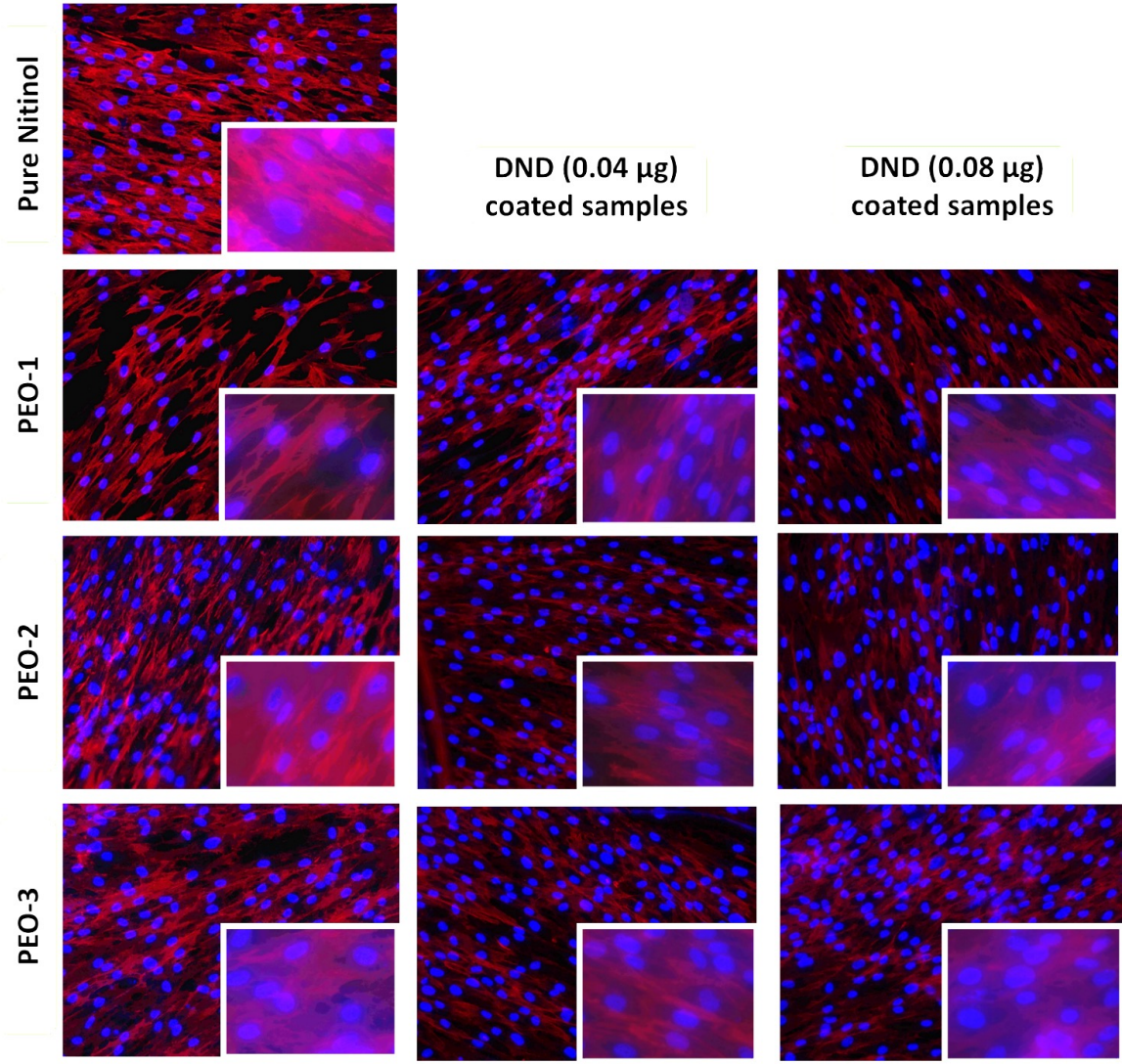
Results of biocompatibility studies



Cytotoxicity of ND examined by CCK-8 assay with human dermal fibroblasts during 3-days of co-cultivation. a) – row data with ND cell-free control and b) – data after the ND optical density correction. “OD 450” – optical density measured with 450 nm; “C+” - positive control (without ND), “C-“ – cell-free control with cell media only

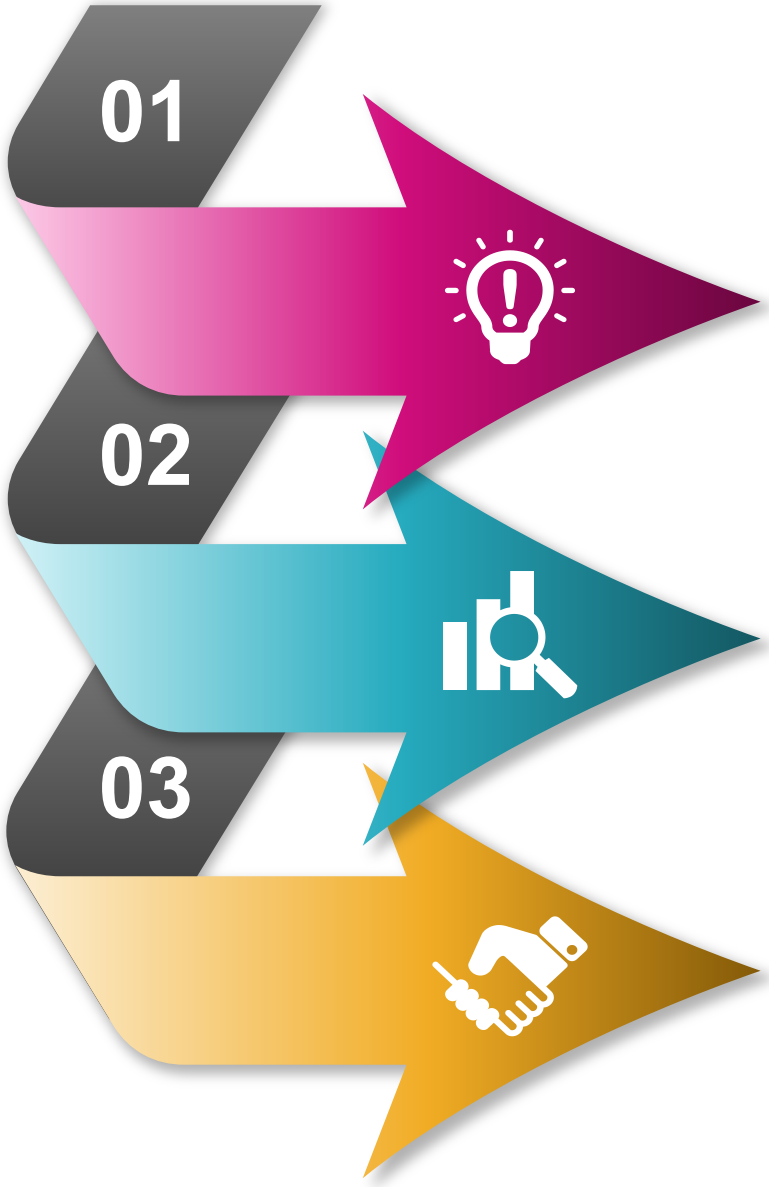
Results of biocompatibility studies





CCK-8 assay data on proliferation of human dermal fibroblast during the 7-day experiment (diagram) with fluorescent images of nuclei (blue) and cytoskeleton staining (red) on day 7 of cultures on metal NiTi samples.
Where: **PEO-1 – 50 V, PEO-2 – 60 V, PEO-3 – 70 V, ND1= 0,04 mg and ND2= 0,08 mg**

Conclusions



The modified NiTi surface demonstrated high biocompatibility, adhesion and proliferation of human dermal fibroblasts.

The obtained results offer a novel and promising approach to significantly improving the performance and long-term outcomes of nitinol stents in the treatment of CVD.

These advances have the potential to greatly impact cardiovascular care and contribute to improved patient outcomes in the future.

Acknowledgments

HybbiStent
(Hybrid Biodegradable Coating for One-Wire Peripheral Nitinol Stent for Prevention of Restenosis and Plaque Formation)


Dziękujemy za uwagę!
Thank you for your attention!
Paldies par jūsu uzmanību!