«Modern European trends in biomedical higher education: Bionanomaterials.» № 620717-EPP-1-2020-1-UA-EPPJMO-MODULE

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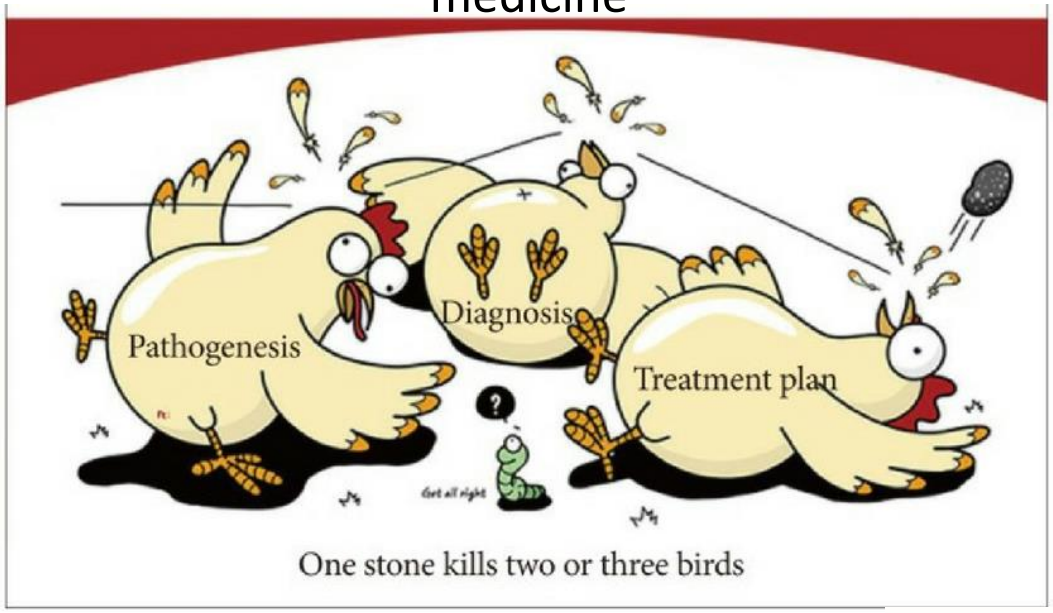
Theranostics:

combination of diagnosis and therapeutics,
focuses on patient-centered care.
Provides a transition from conventional medicine to personalized medicine



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https://www.thno.org/v08p4925.htm

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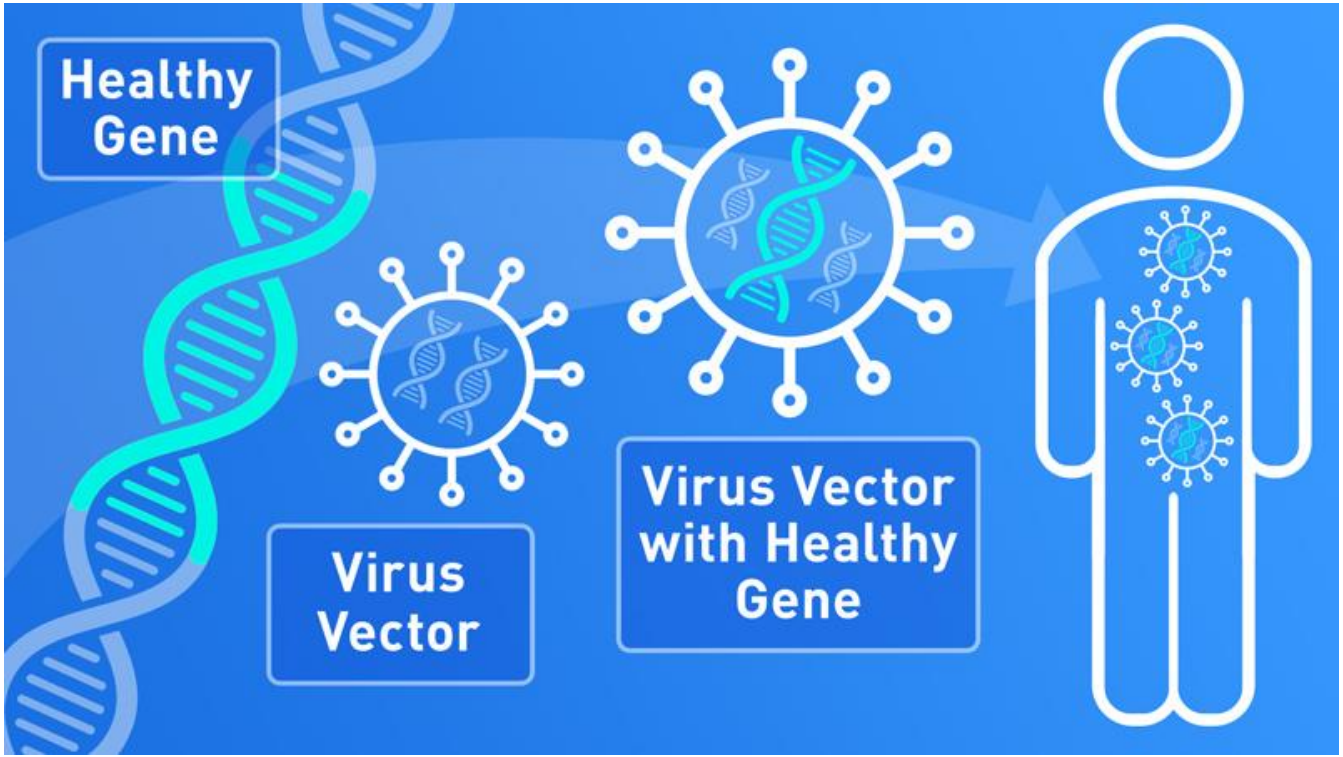
Gene therapy



https://www.fda.gov/media/109812/download

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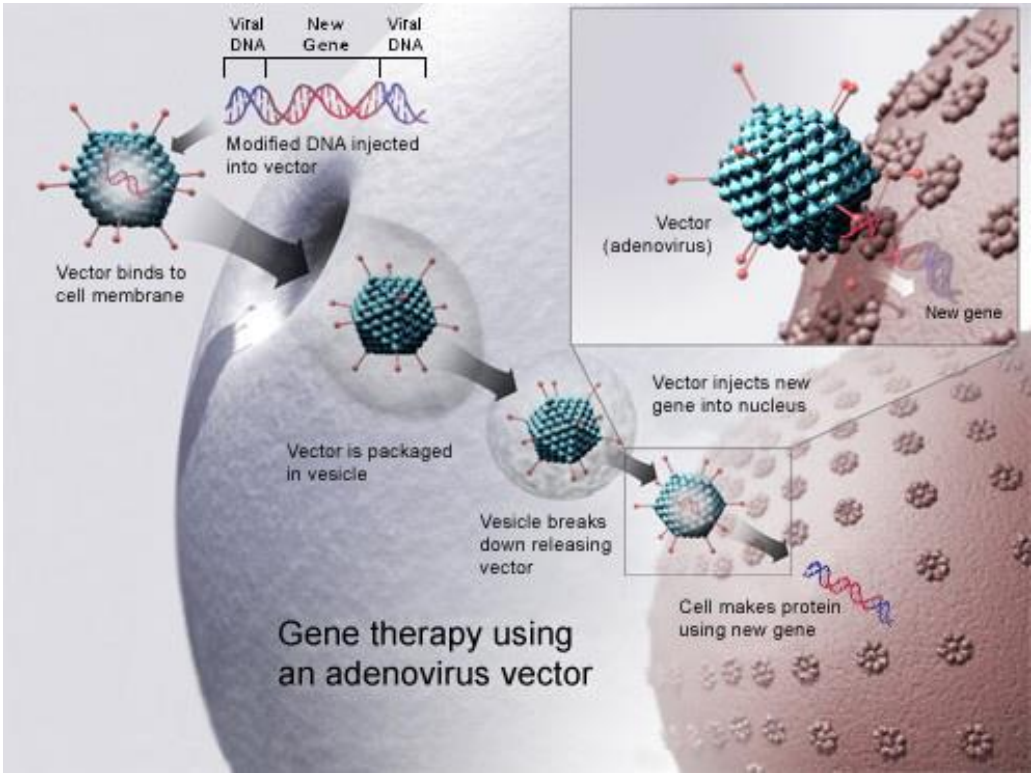
The concept of gene therapy is to fix a genetic problem at its source



https://en.wikipedia.org/wiki/Gene_therapy

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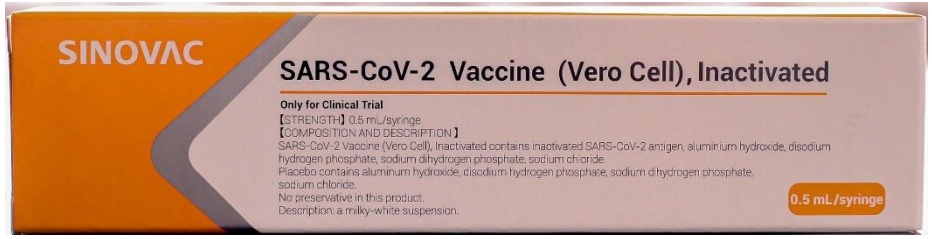

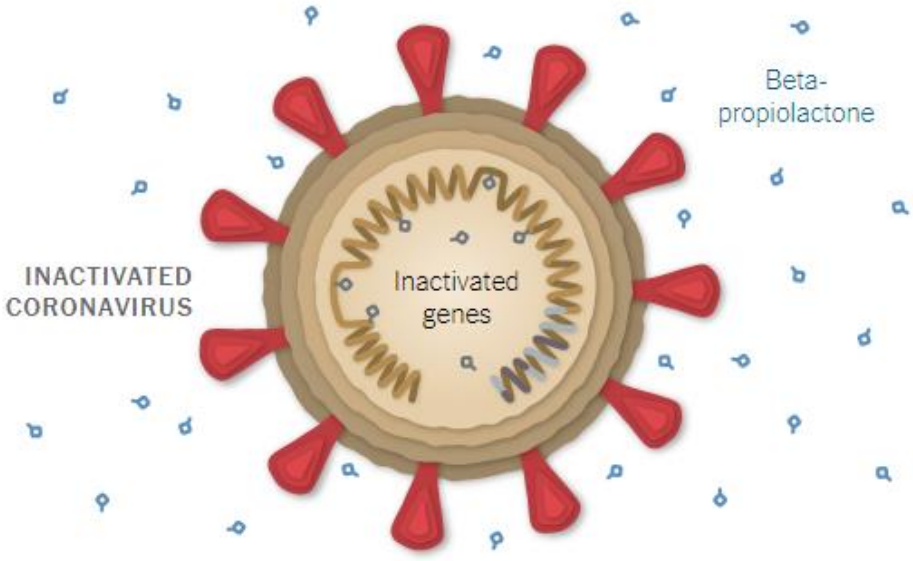

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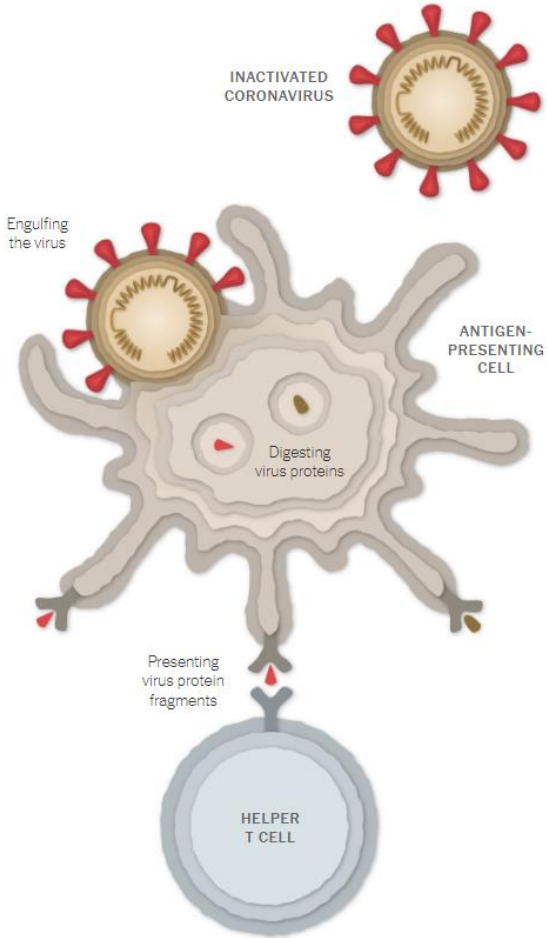

https://www.nytimes.com/interactive/2020/health/sinovac-covid-19-vaccine.html

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Curr Med Chem. 2011;18(17):2630-7. doi: 10.2174/092986711795933740.

Aluminum vaccine adjuvants: are they safe?

L Tomljenovic [1], C A Shaw

Affiliations + expand

PMID: 21568886 DOI: 10.2174/092986711795933740

Abstract

Aluminum is an experimentally demonstrated neurotoxin and the most commonly used vaccine adjuvant. Despite almost 90 years of widespread use of aluminum adjuvants, medical science's understanding about their mechanisms of action is still remarkably poor. There is also a concerning scarcity of data on toxicology and pharmacokinetics of these compounds. In spite of this, the notion that aluminum in vaccines is safe appears to be widely accepted. Experimental research, however, clearly shows that aluminum adjuvants have a potential to induce serious immunological disorders in humans. In particular, aluminum in adjuvant form carries a risk for autoimmunity, long-term brain inflammation and associated neurological complications and may thus have profound and widespread adverse health consequences. In our opinion, the possibility that vaccine benefits may have been overrated and the risk of potential adverse effects underestimated, has not been rigorously evaluated in the medical and scientific community. We hope that the present paper will provide a framework for a much needed and long overdue assessment of this highly contentious medical issue

https://pubmed.ncbi.nlm.nih.gov/21568886/

https://upload.wikimedia.org/wikipedia/commons/thumb/a/a2/Oxid_hlinit%C3%BD.PNG/440px-Oxid_hlinit%C3%BD.PNG

Ark Therapeutics Oy

https://nordicpropertynews.com/uploads/article_images/3259/2109_0_top_thumb.jpg

doi:10.1016/j.ymthe.2005.07.357

REVIEW

Gene Therapy for Malignant Glioma: Current Clinical Status

Kalevi J. Pulkkanen[1,2] and Seppo Yla-Herttuala[1,3,4,*]

[1]Department of Molecular Medicine, A. I. Virtanen Institute, University of Kuopio, P.O. Box 1627, FIN-70211 Kuopio, Finland
[2]Department of Oncology, [3]Department of Medicine, and [4]Gene Therapy Unit, Kuopio University Hospital, Kuopio, Finland

*To whom correspondence and reprint requests should be addressed. Fax: +358 17 163030. E-mail: Seppo.YlaHerttuala@uku.fi.

Available online 10 August 2005

Glioblastoma is an aggressive brain tumor with a dismal prognosis. Gene therapy may offer a new option for the treatment of these patients. Several gene therapy approaches have shown anti-tumor efficiency in experimental studies, and the first clinical trials for the treatment of malignant glioma were conducted in the 1990s. HSV-tk gene therapy has been the pioneering and most commonly used approach, but oncolytic conditionally replicating adenoviruses and herpes simplex virus mutant vectors, p53, interleukins, interferons, and antisense oligonucleotides have also been used. During the past few years, adenoviruses have become the most popular gene transfer vectors, and some recent randomized, controlled trials have shown significant anti-tumor efficacy in clinical use. However, efficient gene delivery into the brain still presents a major problem, and there is a lack of definitive phase III trials, which would avoid potential problems associated with a small number of patients, inadvertent patient selection, and overinterpretation of results based on a few long-time survivors. For clinical efficacy, median survival is one of the most rigorous endpoints. It is used here to evaluate the usefulness of various treatment approaches and current clinical status of gene therapy for malignant glioma.

https://antiworldnews.files.wordpress.com/2012/04/thefuture.jpg

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Published: 12 January 2018

mRNA vaccines — a new era in vaccinology

Norbert Pardi, Michael J. Hogan, Frederick W. Porter & Drew Weissman

Nature Reviews Drug Discovery **17**, 261–279(2018) | Cite this article

1.64m Accesses | **524** Citations | **4714** Altmetric | Metrics

Key Points

- Recent improvements in mRNA vaccines act to increase protein translation, modulate innate and adaptive immunogenicity and improve delivery.
- mRNA vaccines have elicited potent immunity against infectious disease targets in animal models of influenza virus, Zika virus, rabies virus and others, especially in recent years, using lipid-encapsulated or naked forms of sequence-optimized mRNA.
- Diverse approaches to mRNA cancer vaccines, including dendritic cell vaccines and various types of directly injectable mRNA, have been employed in numerous cancer clinical trials, with some promising results showing antigen-specific T cell responses and prolonged disease-free survival in some cases.
- Therapeutic considerations and challenges include scaling up good manufacturing practice (GMP) production, establishing regulations, further documenting safety and increasing efficacy.
- Important future directions of research will be to compare and elucidate the immune pathways activated by various mRNA vaccine platforms, to improve current approaches based on these mechanisms and to initiate new clinical trials against additional disease targets.

https://cdn.aarp.net/content/dam/aarp/health/drugs_supplements/2020/12/1140-mnra-covid-vaccine.imgcache.rev.web.900.513.jpg

https://www.nature.com/articles/nrd.2017.243

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Katalin Karikó, a senior vice president at BioNTech overseeing its mRNA work, in her home office in Rydal, Penn.
JESSICA KOURKOUNIS FOR THE BOSTON GLOBE

https://www.statnews.com/2020/11/10/the-story-of-mrna-how-a-once-dismissed-idea-became-a-leading-technology-in-the-covid-vaccine-race/
https://european-biotechnology.com/up-to-date/latest-news/news/biontech-and-fosun-pharma-kick-off-chinese-covid-19-trials.html

J Biol Chem. 2004 Mar 26;279(13):12542-50. doi: 10.1074/jbc.M310175200. Epub 2004 Jan 16.

mRNA is an endogenous ligand for Toll-like receptor 3

Katalin Karikó [1], Houping Ni, John Capodici, Marc Lamphier, Drew Weissman

Affiliations + expand

PMID: 14729660 DOI: 10.1074/jbc.M310175200

Free article

Abstract

Toll-like receptors (TLRs) are the basic signaling receptors of the innate immune system. They are activated by molecules associated with pathogens or injured host cells and tissue. TLR3 has been shown to respond to double stranded (ds) RNA, a replication intermediary for many viruses. Here we present evidence that heterologous RNA released from or associated with necrotic cells or generated by in vitro transcription also stimulates TLR3 and induces immune activation. To assess RNA-mediated TLR3 activation, human embryonic kidney 293 cells stably expressing TLR3 and containing a nuclear factor-kappaB-dependent luciferase reporter were generated. Exposing these cells to in vitro transcribed RNA resulted in a TLR3-dependent induction of luciferase activity and interleukin-8 secretion. Treatment with in vitro transcribed mRNA activated nuclear factor-kappaB via TLR3 through a process that was dose-dependent and involved tyrosine phosphorylation. Furthermore, in vitro

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Hum Gene Ther. 2019 Feb;30(2):168-178. doi: 10.1089/hum.2018.145. Epub 2018 Oct 2.

Purification of mRNA Encoding Chimeric Antigen Receptor Is Critical for Generation of a Robust T-Cell Response

Jessica B Foster [1 2], Namrata Choudhari [3 4], Jessica Perazzelli [1], Julie Storm [1], Ted J Hofmann [1], Payal Jain [3 4], Phillip B Storm [2 3 4 5], Norbert Pardi [6], Drew Weissman [6], Angela J Waanders [1 2 4], Stephan A Grupp [1 2], Katalin Karikó [7], Adam C Resnick [2 3 4 8], David M Barrett [1 2]

Affiliations + expand

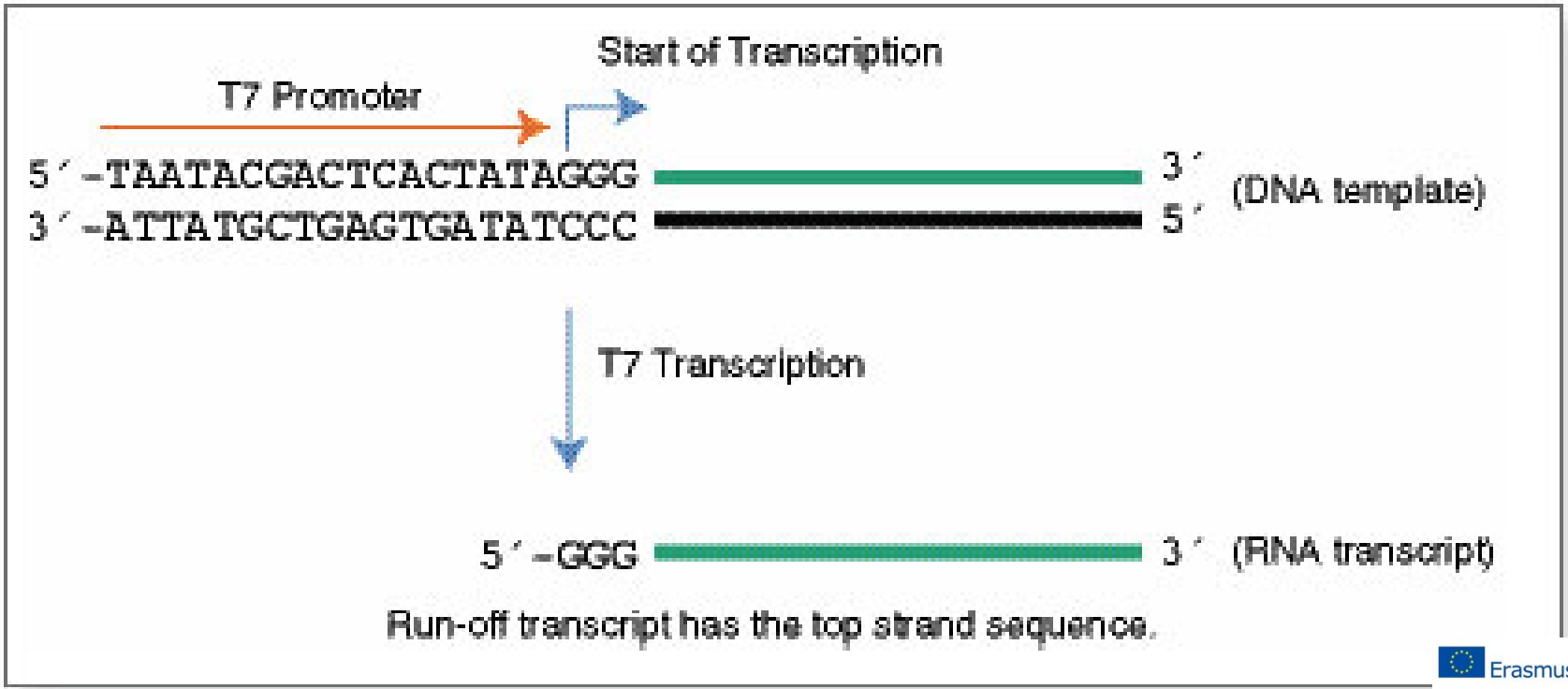
PMID: 30024272 PMCID: PMC6383579 DOI: 10.1089/hum.2018.145

Free PMC article

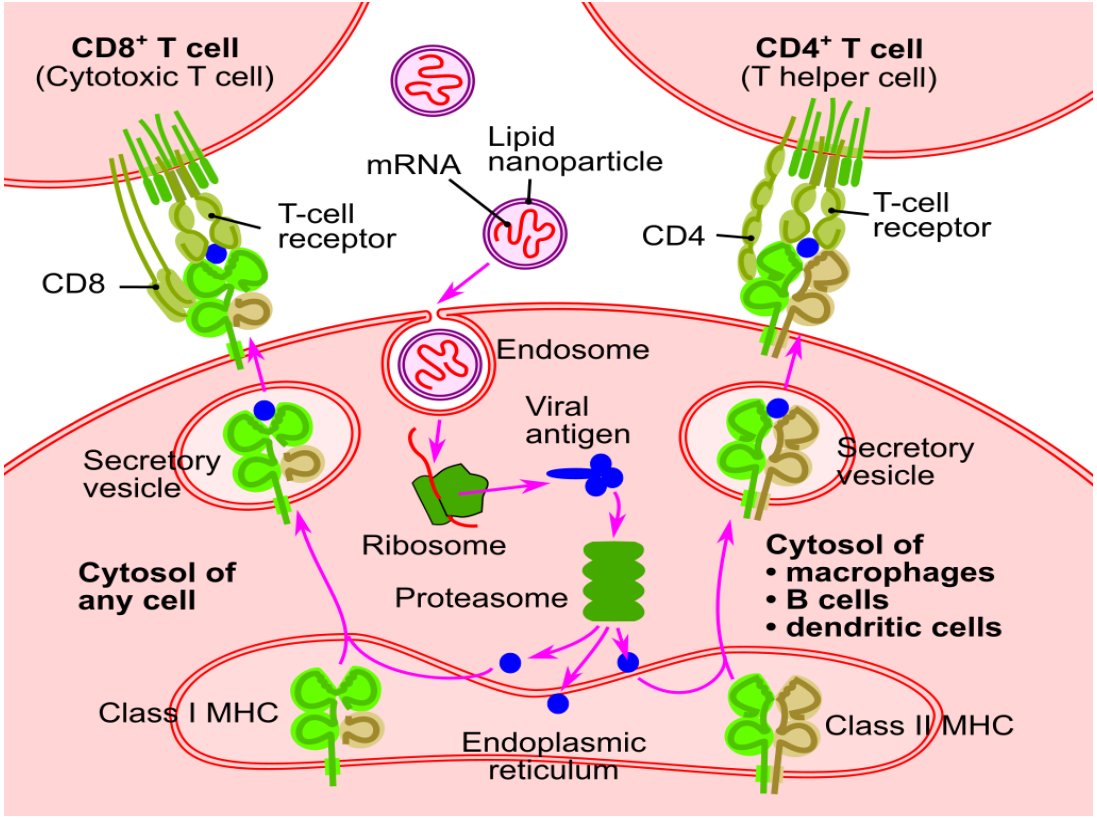
https://pubmed.ncbi.nlm.nih.gov/30024272/

Abstract

T cells made with messenger RNA (mRNA) encoding chimeric antigen receptor (CAR) offer a safe alternative to those transduced with viral CARs by mitigating the side effects of constitutively active T cells. Previous studies have shown that mRNA CAR T cells are transiently effective but lack persistence and potency across tumor types. It was hypothesized that the efficacy of mRNA CARs could be



https://www.neb.com/products/e2040-hiscribe-t7-high-yield-rna-synthesis-kit#Product%20Information



https://en.wikipedia.org/wiki/RNA_vaccine#cite_note-21

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Research Highlight | Published: 12 January 2021

AUTOIMMUNITY

mRNA vaccine shows promise in autoimmunity

Alexandra Flemming

Nature Reviews Immunology **21**, 72(2021) | Cite this article

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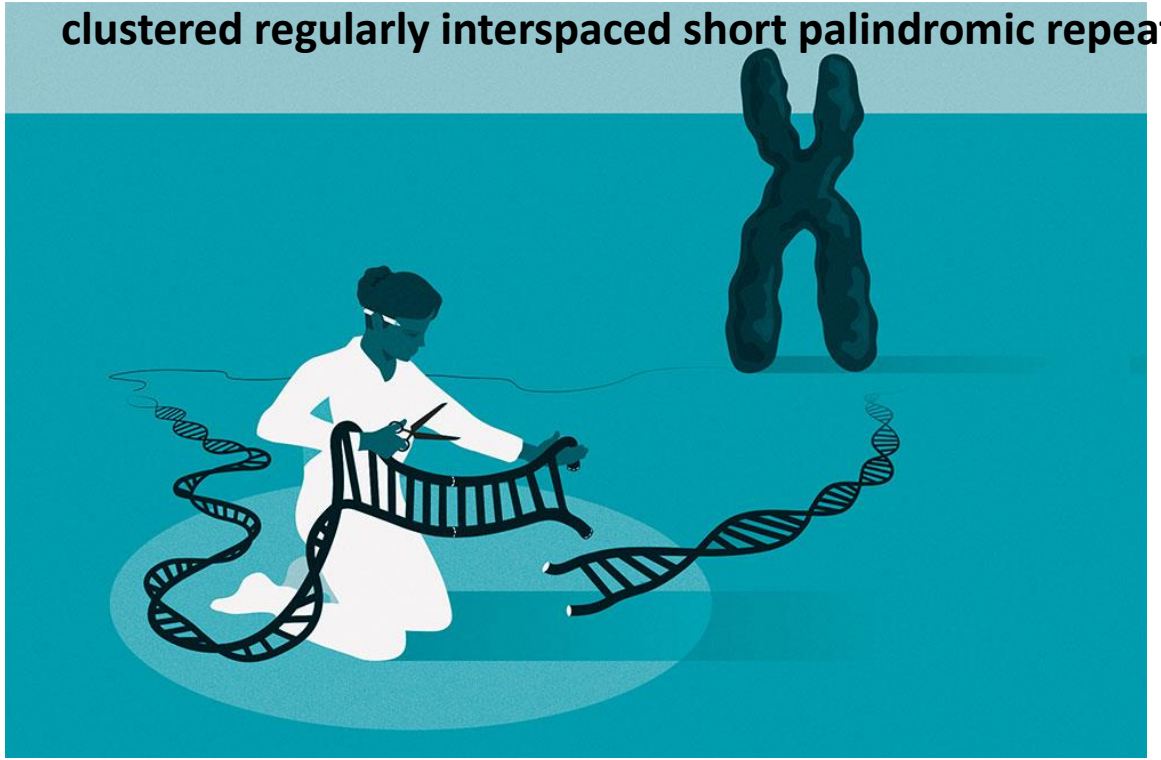
Gene editing: CRISPR/Cas9

clustered regularly interspaced short palindromic repeats



https://www.nobelprize.org/uploads/2020/10/che-carrier.jpg

With the support of the Erasmus+ Programme of the European Union

A programmable dual-RNA-guided DNA endonuclease in adaptive bacterial immunity.

Jinek M, Chylinski K, Fonfara I, Hauer M, Doudna JA, Charpentier E.

Science. 2012 Aug 17;337(6096):816-21. doi: 10.1126/science.1225829. Epub 2012 Jun 28.

PMID: 22745249 Free PMC article.

https://pubmed.ncbi.nlm.nih.gov/22745249/

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https://img2.chinadaily.com.cn/images/202010/08/5f7e7bd4a31024adbd985bf9.jpeg

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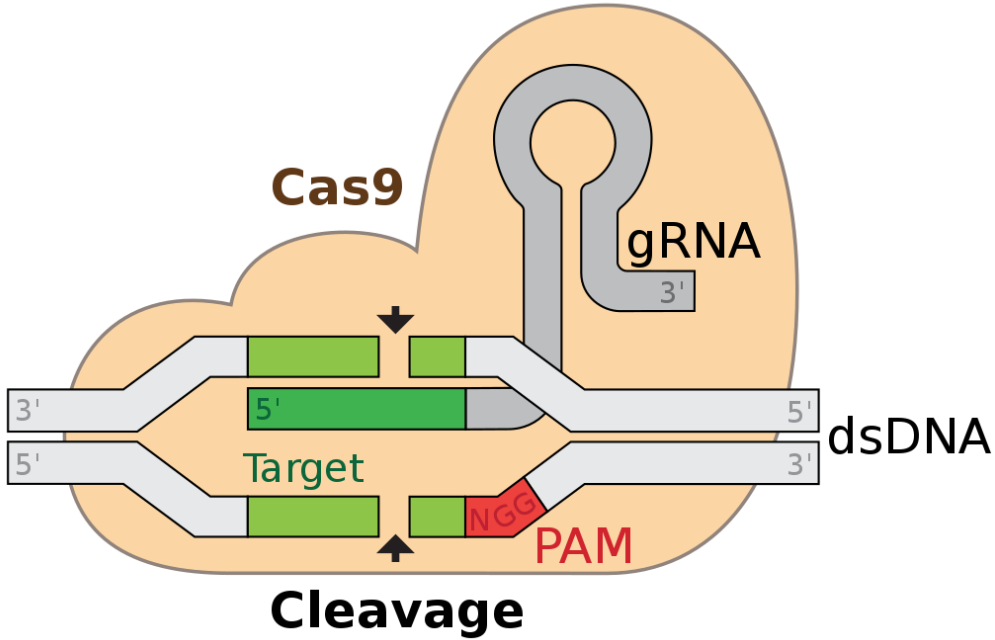
Gene editing: CRISPR/Cas9



https://upload.wikimedia.org/wikipedia/commons/thumb/5/57/GRNA-Cas9.svg/1024px-GRNA-Cas9.svg.png

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He Jiankui affair 2018

CRISPR/Cas9 mediatged knockout of CD195 gene

https://en.wikipedia.org/wiki/He_Jiankui_affair

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Nanosystems

THERAPY

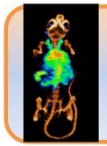

Chemotherapeutic drugs

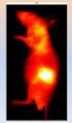

Nucleic acids


Peptides/proteins

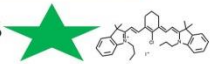

Antibodies

IMAGING

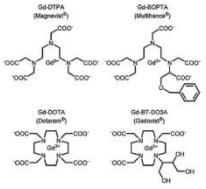




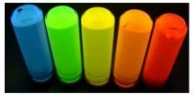
Florescent probes



Contrast agents



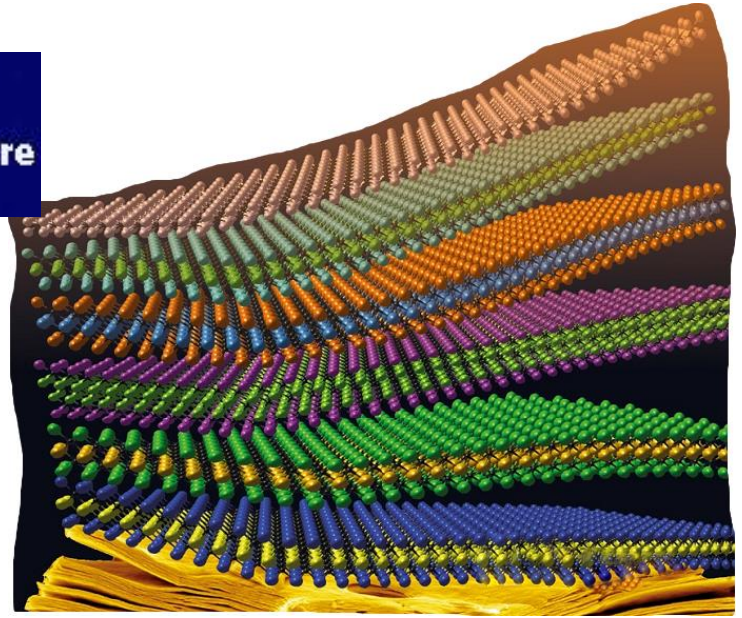
Quantum dots



Cancer Theranostics

With the support of the Erasmus+ Programme of the European Union

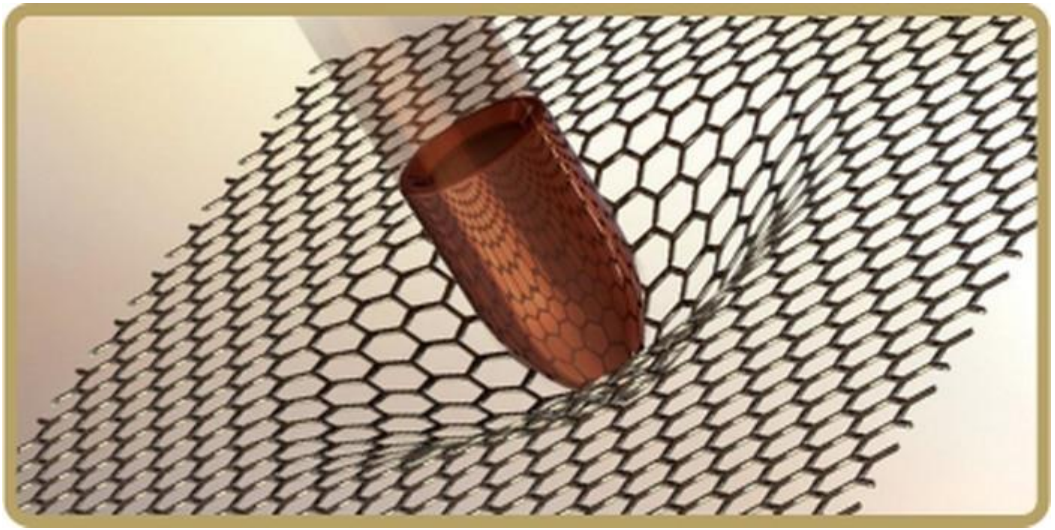
Photothermal effects of $Ti_3C_2T_x$ MXenes in cell cultures

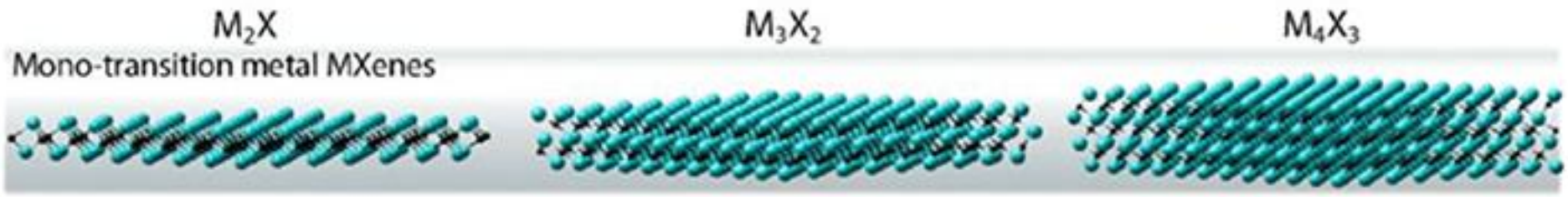


MXene picture courtesy of **B. Anasori & Y. Gogotsi** (Ed.), 2D Metal Carbides and Nitrides (MXenes), Springer 2019

With the support of the Erasmus+ Programme of the European Union

MXenes ≠ graphene





https://nanografi.com/blog/military-applications-of-graphene/
https://www.mdpi.com/2079-4991/10/4/702

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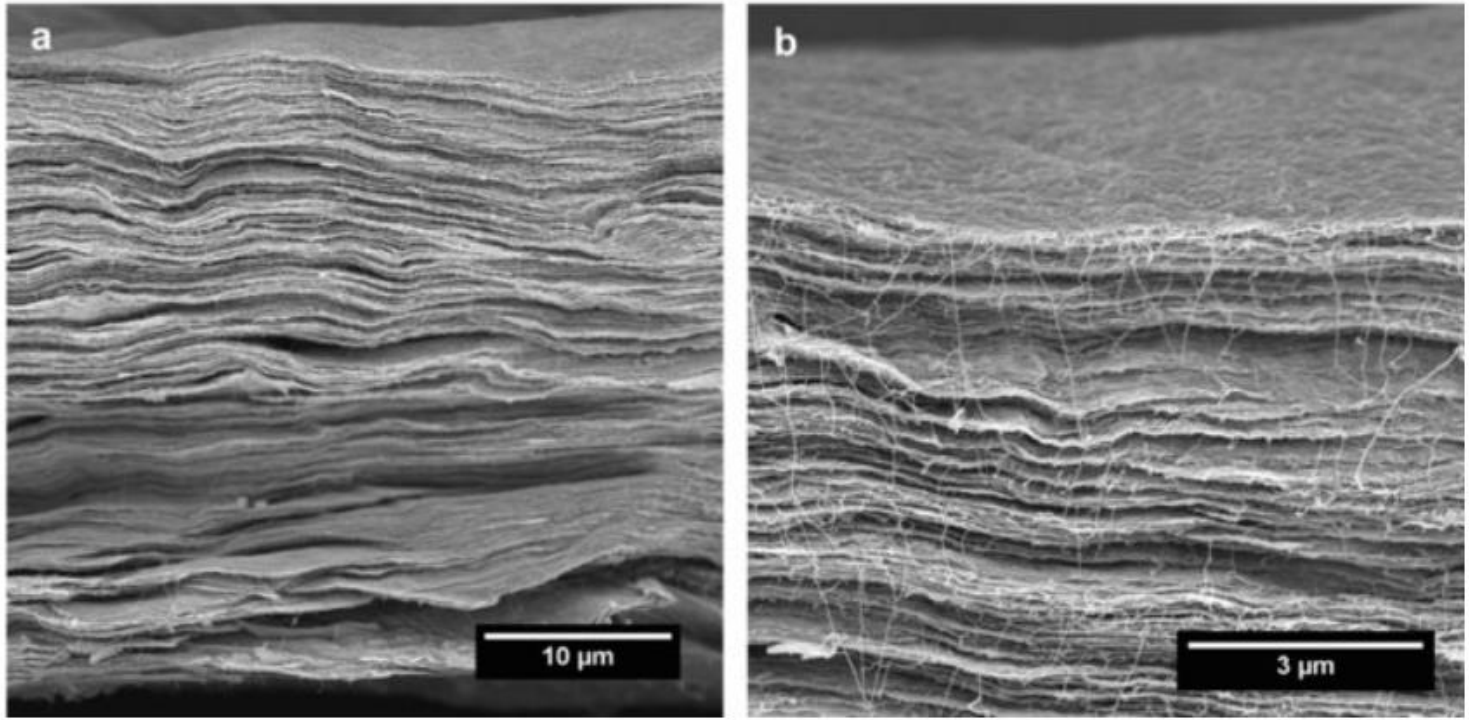


Thickness-independent capacitance of vertically aligned liquid-crystalline MXenes
May 2018 Nature 557(7705) DOI: 10.1038/s41586-018-0109-z

With the support of the Erasmus+ Programme of the European Union

Treatment parameters from the literature:

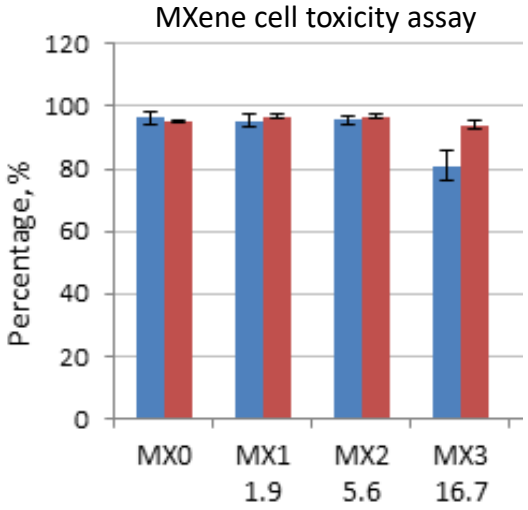
1.5 W/см2 10 min

https://dx.doi.org/10.1021/acsami.0c14752

1.0 W/см2 300 sec (5 min)

10.1021/acsami.8b08314

Background info: for depilation the following parameters in the laser machine are used:
755 nm laser – 7 msec, 8-15 J/cm2, 1 impuls
1064 nm laser – 7 msec, 25-45 J/cm2, 1 impuls



Conc. of MXenes, final:	
MX0	0
MXA	0.4 ug/ml
MXB	0.8 ug/ml
MXC	1.6 ug/ml
MXD	3.2 ug/ml

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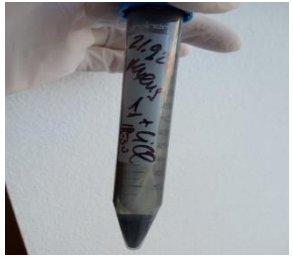
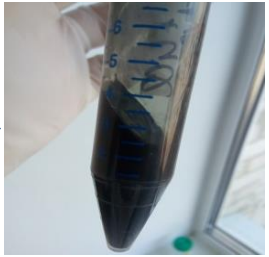
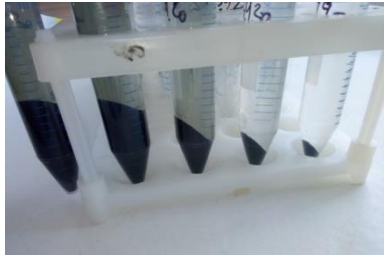
Delamination: segregation of multilayered MXenes into single layer flakes







Increased layer spacing is clearly observable

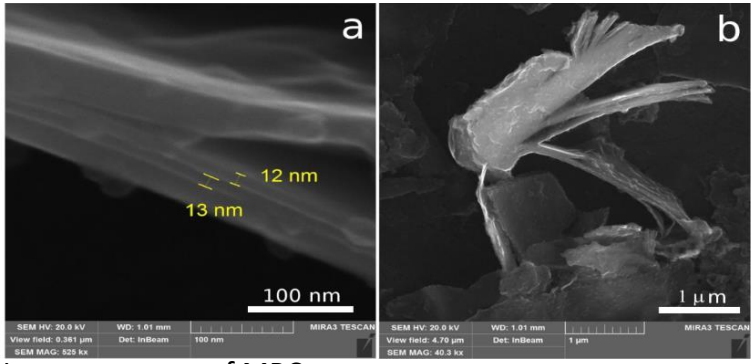
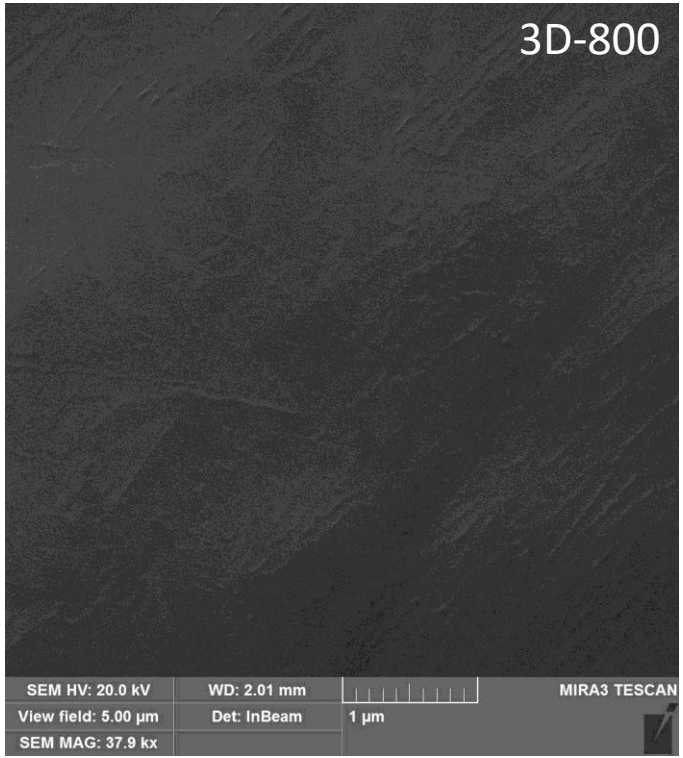


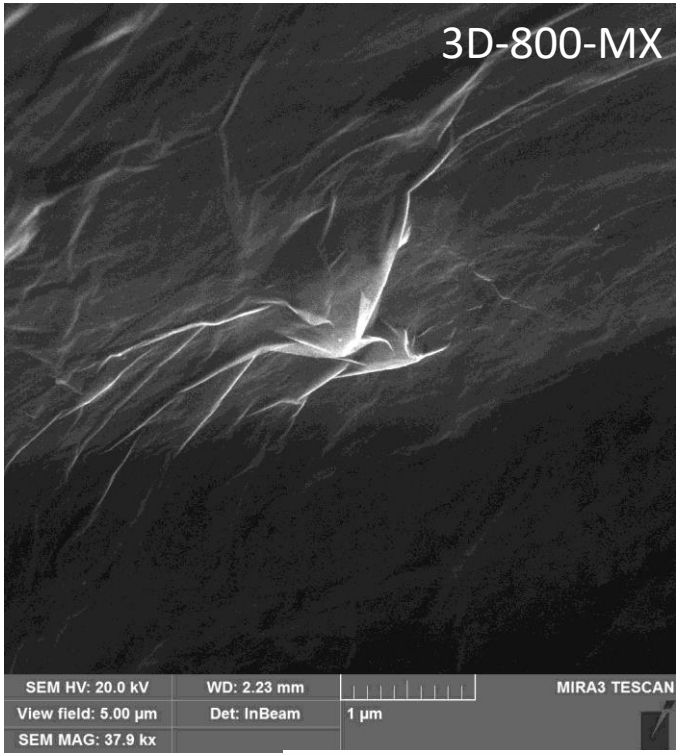
Image courtesy of MRC

Electrospun nanofiber mats

3D porous Ti scaffolds

Like a gold leaf in gilding?





Courtesy for images: MRC

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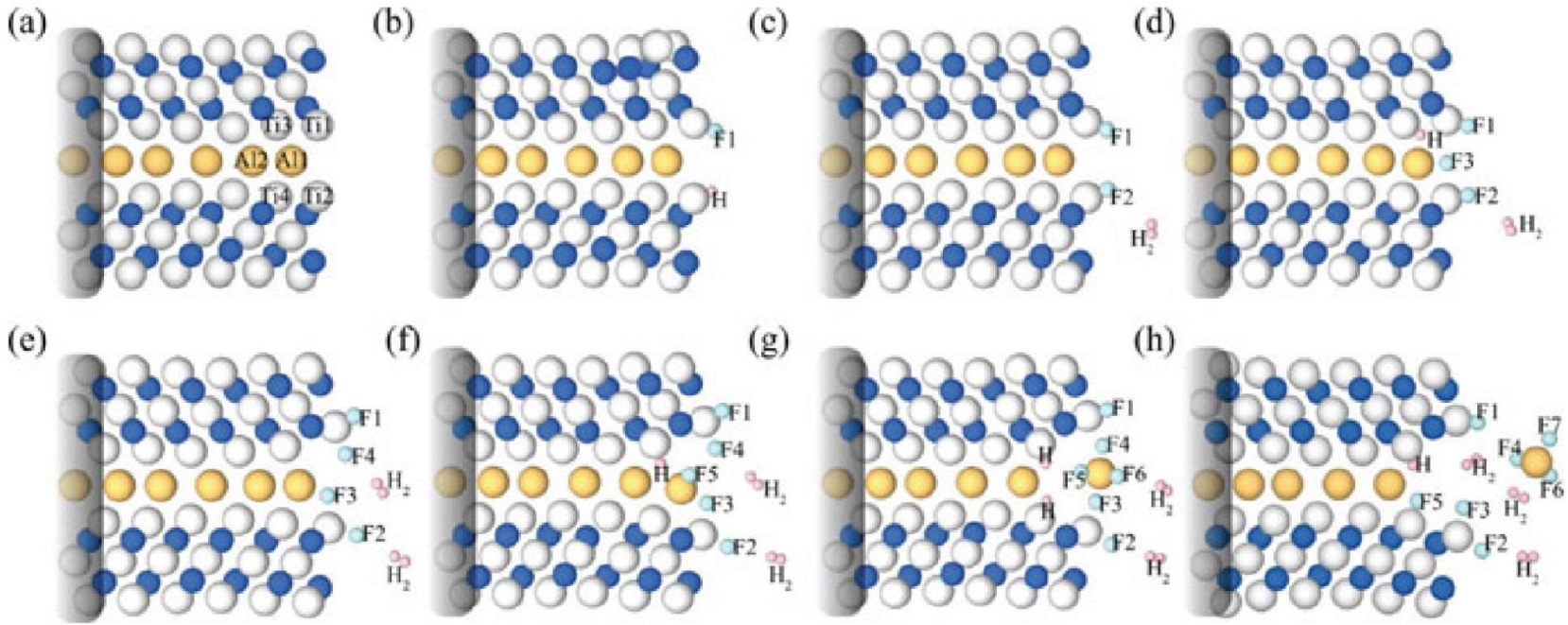
Possibilities for covalent functionalization of MXenes



2D Metal Carbides and Nitrides (MXenes). Edited by **B. Anasori & Y. Gogotsi,** Springer 2019.

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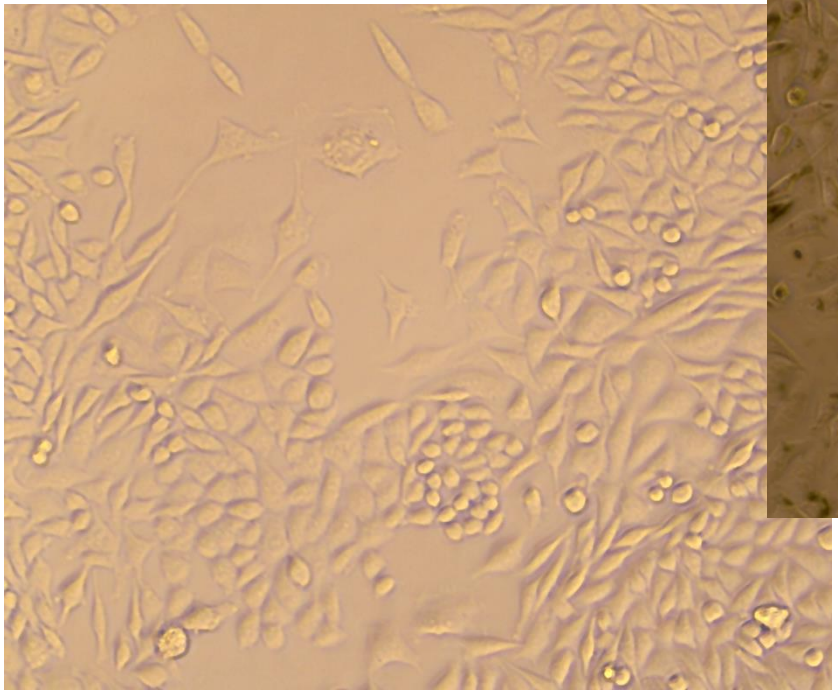

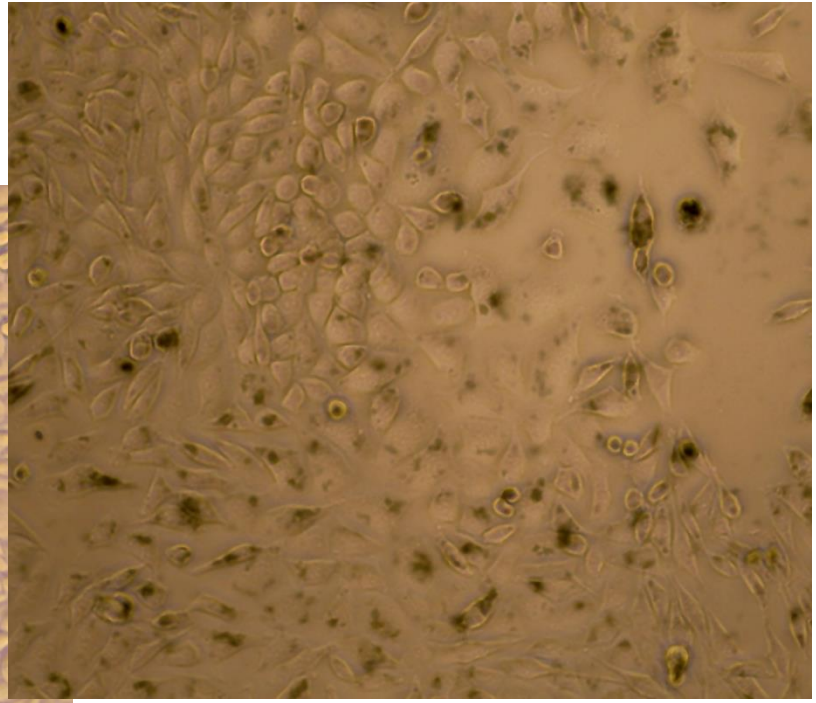

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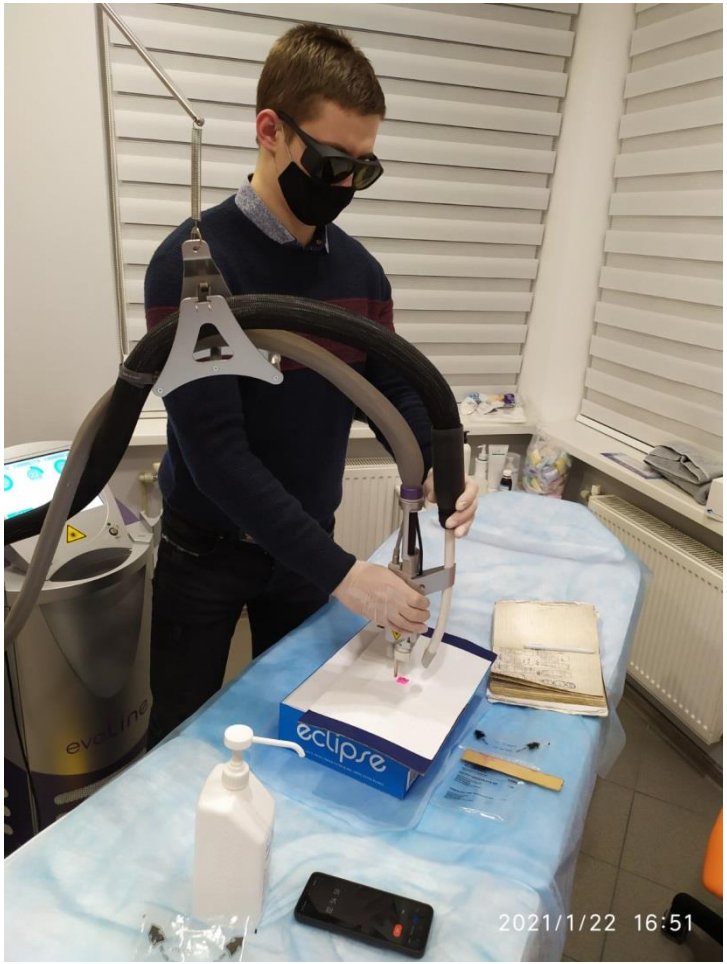

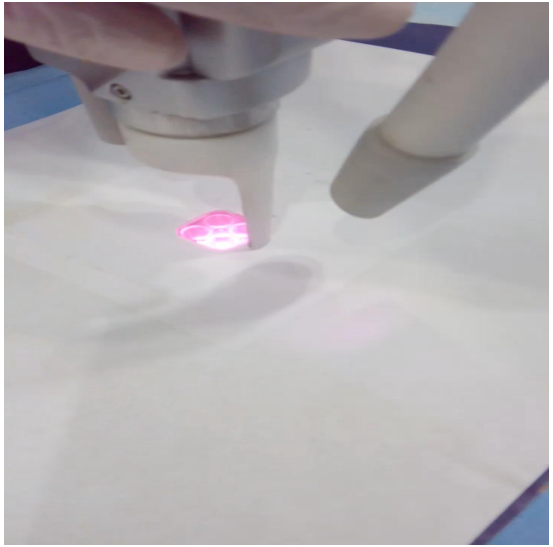

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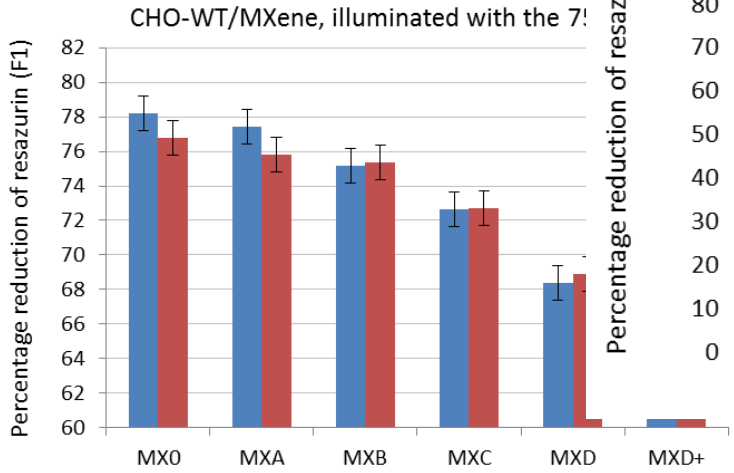

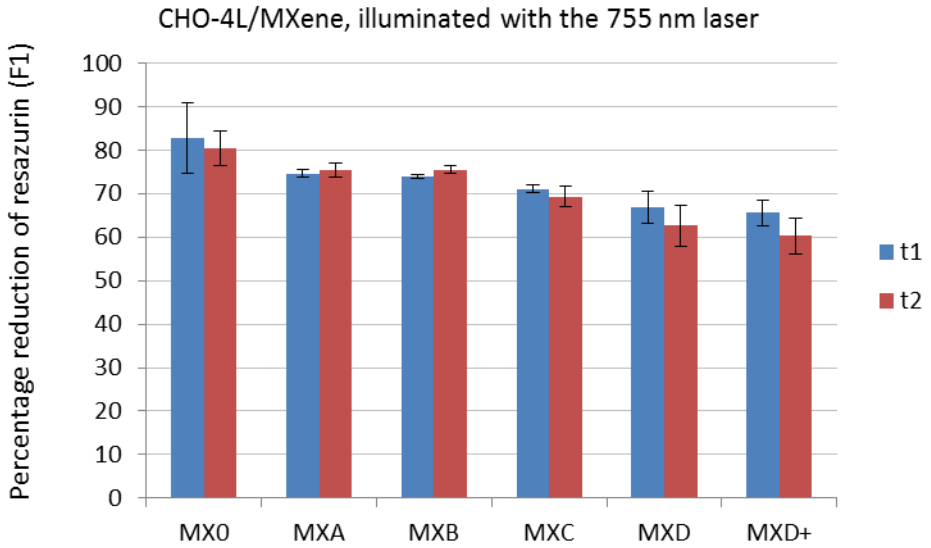

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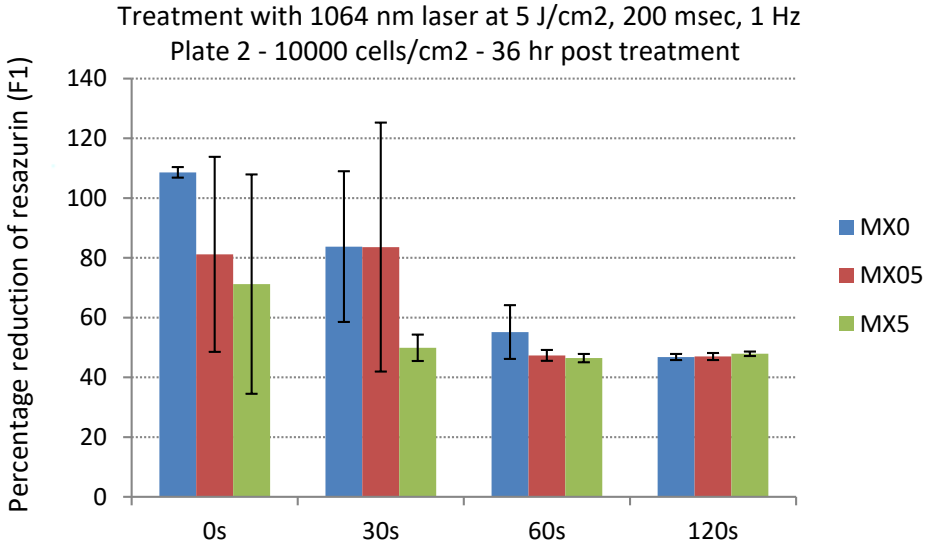

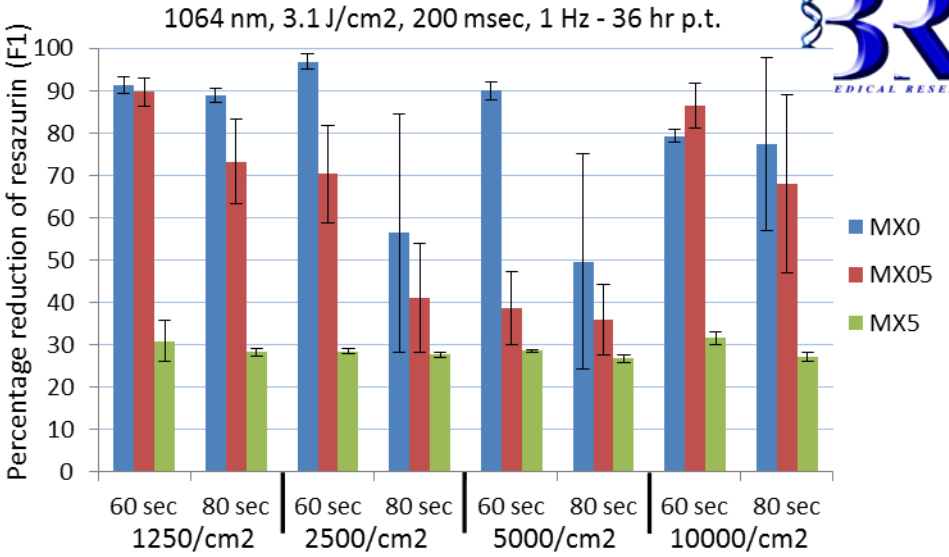

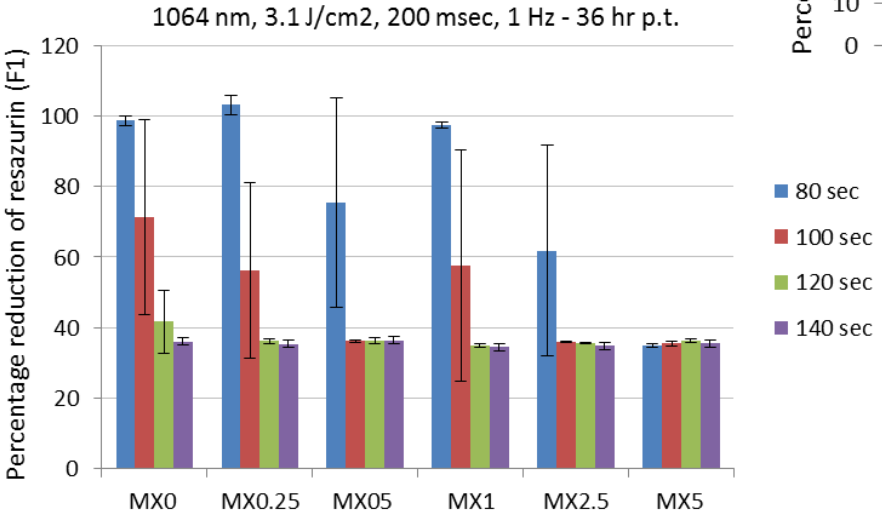

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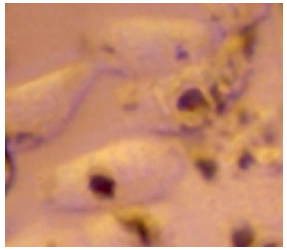
● Selective affinity of MXenes to tumor cells: covalent modification of MXenes and immobilization of antibodies



MXenes in cells: histochemistry, immunocytochemistry, SEM, TEM etc,

●

● Refining parameters for PTT (in vitro, in vivo)

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