



FLAG-ERA

Joint Transnational Call 2019

# MARGO: MAXillofacial bone Regeneration by 3D-printed laser-activated Graphene Oxide scaffolds

**Main area:** Soft graphene-based materials for tissue engineering

**Keywords:** Bone regeneration, 3D printing, antibacterial, graphene oxid

**Duration:** 36 months

**Total project funding:** € 450.000

# MARGO

*A project based on graphene and 3D printing*

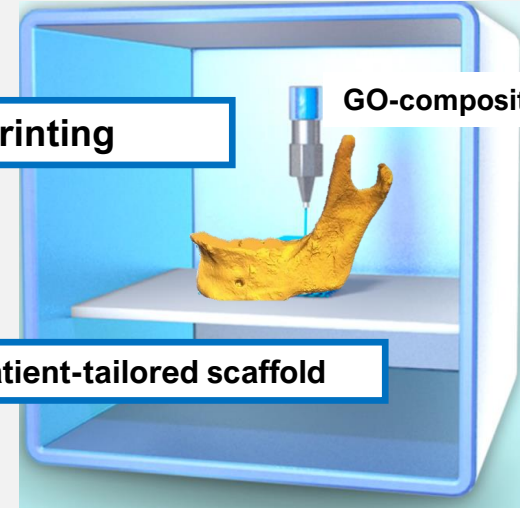
**Maxillofacial defect modelling**



**3D printing**

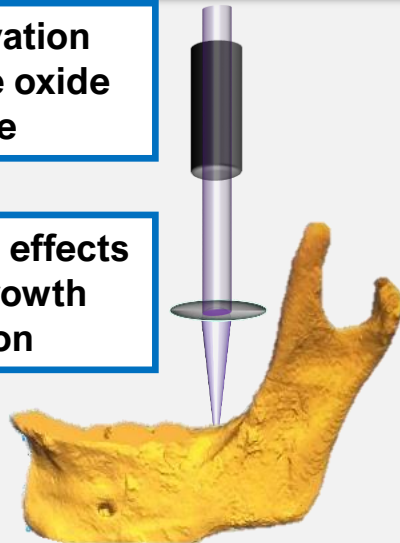
**GO-composites**

**Patient-tailored scaffold**

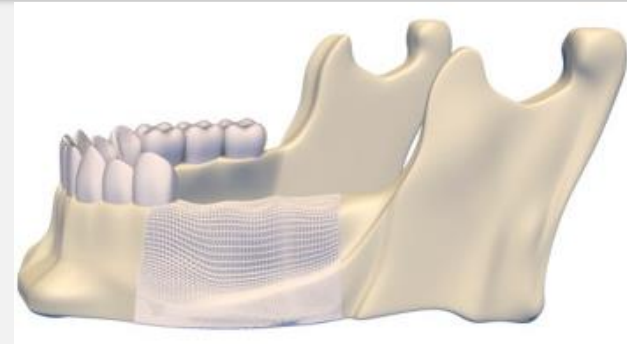


**Laser activation  
of graphene oxide  
surface**

**Antibacterial effects  
and cell growth  
induction**



**Patient-driven  
reconstruction**



# MARGO PILLARS



Scalable and patient-tailored designs by 3D printing



Exploitation of reparative capacity of mesenchymal stromal cells grown on laser reduced GO



Direct control of bone formation, antibacterial action, and vascularization via laser activation.



# MARGO Partners Expertise

DHAL



DHAL Software (SME)  
**GREECE**



2D and 3D morphometric analysis  
software

CSIC



Consejo Superior de  
Investigaciones Cientificas (CSIC)  
**SPAIN**



photonic materials and in  
biomaterials and tissue engineering

Sapienza



Complex Photonics group  
Sapienza University of Rome  
**ITALY**



photonics of complex media

UCSC



University  
Catholic of Sacred Heart (UCSC)  
**ITALY**



graphene-functionalized  
biomaterials applied to  
healthcare and life science

# MARGO workflow

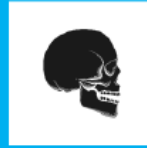
## WPO Coordination and Management

P 1,2,3,4

### WP1

3D CAD Modelling  
and Bone Atlas

P1,4



### WP2

3D printing

P 1, 2, 3

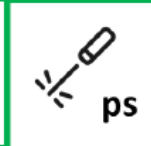


### WP3

Laser patterning

P 1,2,3

Feedback



### WP4

Biofunctionality test

P 2, 3



### WP5

3D printer prototype

P 1, 2, 3, 4



# MARGO timeline

		Tasks	Deliverables	Partner responsible	Partners involved	M1-M6	M7-M12	M13-M18	M19-M24	M25-M30	M31-M36
WP0	Management	T0.1	D0.1	1	2,3,4	D0.1					
		T0.2	D0.2	1	2,3,4						
		T0.3	D0.3	1	2,3,4				D0.2/D0.3		
		T0.4	D0.4	1	2,3,4						D0.4
WP1	3D CAD	T1.1	D1.1	4			D1.1				
		T1.2	D1.2	4	1					D1.2	
		T1.3	D1.3	4							D1.3
WP2	3D print	T2.1	D2.1	2	1	D2.1					
		T2.2	D2.2	1	3	D2.2					
		T2.3	D2.3	1	2,3		D2.3				
		T2.4	D2.4	2	1			D2.4			
WP3	Laser activate	T3.1	D3.1	3	1		D3.1				
		T3.2	D3.2	3	1			D3.2			
		T3.3	D3.3	3	1					D3.3	
		T3.4	D3.4	2	1,3			D3.4			
WP4	Bio-function	T4.1	D4.1	3	2				D4.1		
		T4.2	D4.2	2	3				D4.2		
		T4.3	D4.3	2	3						D4.3
		T4.4	D4.3	3	2						D4.3
WP5	Proto-type	T5.1	D5.1	1	3,4					D5.1	
		T5.2	D5.2	1	2,3						D5.2
		T5.3	D5.3	1	2,3						D5.3



Starting date: 1st May 2020  
End date: 31st January 2024

# MARGO progress\*

\* The progress of the project has suffered the pandemic situation and the funding delay of the Italian and Greek partners.

**D0.1** Consortium agreement establishment and Kick-off Meeting

**D2.1** Report on polymer/GO composites synthesis in various concentrations of GO

## Tested Polymers



GO-poly(lactide-co-glycolide) (PLGA)

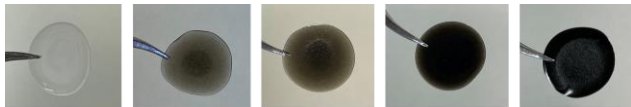
GO-poly(vinyl alcohol) (PVA)

GO/alginate

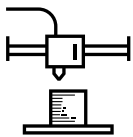


## GO concentration

0-30% powder

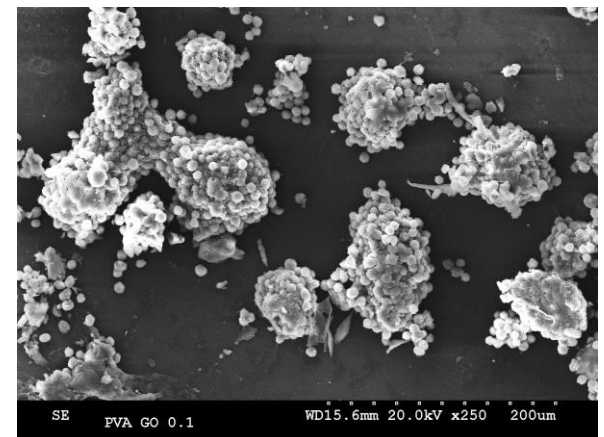


## Techniques



Bioprinting/Fused deposition modelling

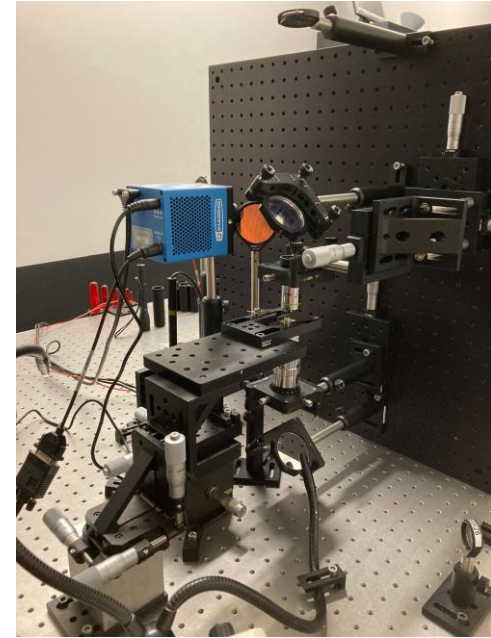
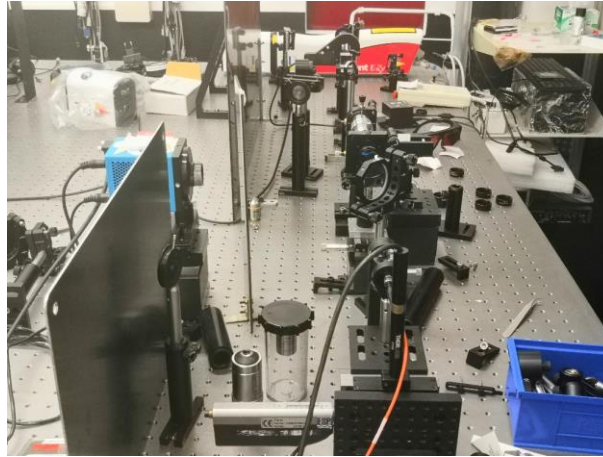
The CSIC group selected the suitable samples to perform the first test of cellular growth and adhesion after laser activation (Libra laser at 800 nm, 1 kHz repetition rate, fs pulse duration).



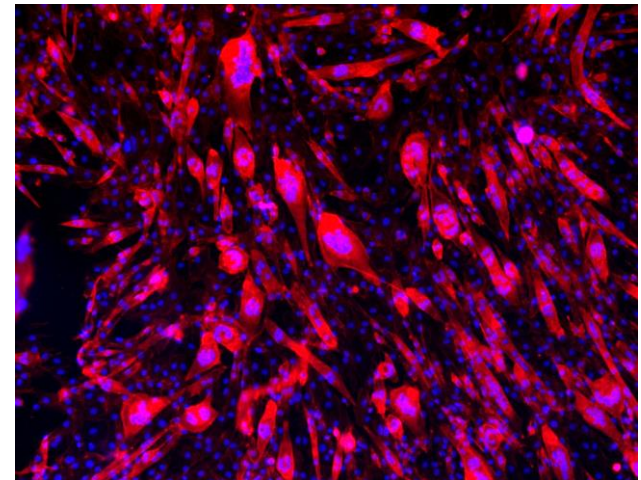
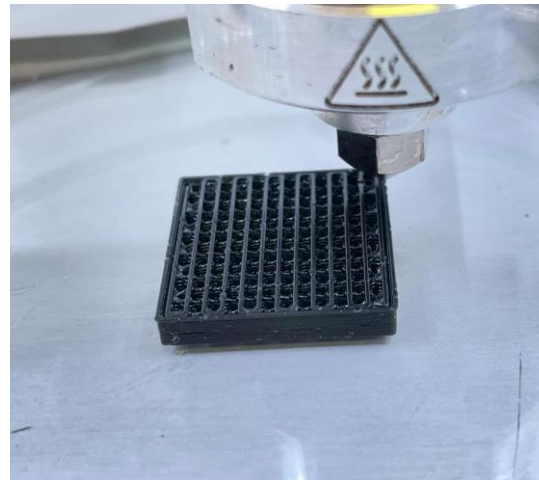


# MARGO ongoing steps

WP3: the ns setup for the laser activation (Sapienza University)



WP2: 3D printing of GO mixtures and cell growth in 3D



# Responsible Research Innovation



High interdisciplinarity of the team  
Including biologists, physics, physician, dentists



Public health oriented objectives



Sharing of the main results on the  
project website

<https://sites.google.com/view/margoflagera/>

# Follow MARGO progress



JTC 2019  
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Updates



**MARGO**

MAXillofacial bone Regeneration by 3D-printed  
laser-activated Graphene Oxide Scaffolds

aker

Our mission

<https://sites.google.com/view/margoflagera/>