



Allegato 1

**Scheda di partecipazione per l'assegnazione di fondi per Progetti di Ricerca  
sviluppati da singoli Ricercatori – Anno 2023**

TITOLO DELLA RICERCA	DEVELOPMENT OF KEFIRAN-BASED BIOINK FOR CUSTOM 3D PRINTING OF SKIN TISSUE		
PAROLE CHIAVE	1	Kefiran Bioink	
	2	3D Bioprinting	
	3	Scaffold Characterization	
	4	Skin Tissue Engineering	
PROPONENTE	CAPUANA ELISA		
	COGNOME E NOME		
	RUOLO	RTDA	
	E-MAIL	elisa.capuana@unipa.it	
	SSD	ING-IND/34 BIOINGEGNERIA INDUSTRIALE	

**EVENTUALI COLLABORAZIONI**

N.	COGNOME E NOME	RUOLO	UNIVERSITA'/ORGANIZZ. ESTERNA
1	D'AMORA UGO	RICERCATORE	IPCB-CNR NAPOLI
2	ALFREDO RONCA	RICERCATORE	IPCB-CNR NAPOLI
3	PATTAPPA GIRISH	ADVISOR	UNIVERSITY REGENSBURG MEDICAL CENTRE



**Università  
degli Studi  
di Palermo**

**Dipartimento di Ingegneria**  
Direttore: prof. Antonino Valenza



## SCOPO, DESCRIZIONE E RISULTATI ATTESI DELLA RICERCA

### **Stato dell'arte** (max 10 righe):

Kefiran, a natural biopolymer derived from kefir fermentation, offers remarkable advantages such as biocompatibility, ease of modification, and potential therapeutic properties. Recently, kefir-based bioinks have attracted research attention for the development of complex, customizable three-dimensional (3D) scaffolds for tissue. Despite their potential, rheological properties, printability, and gelation kinetics present a significant challenge. Studies have also explored the growth of essential skin cells and demonstrated their bioactive properties and enhanced bioprinted tissue functionality. Moreover, characterizing mechanical properties, biocompatibility, and long-term cell viability within these scaffolds is crucial. The ongoing efforts in this field aim to bridge the gap between bioink development and practical applications, bringing us closer to bioprinted tissues and organs for skin substitution.

### **Obiettivi, ipotesi e metodologia** (max 12 righe):

The primary objective of this study is to develop and evaluate a kefir-based bioink for 3D bioprinting in skin tissue engineering. This bioink aims to enable the creation of customizable and functional skin tissue constructs/patches that closely resemble native skin. We seek to optimize the rheological properties of the bioink, assess its biocompatibility, and determine its capacity to support the proliferation of skin-specific cells. We hypothesize that a kefir-based bioink will be a suitable and innovative material for 3D bioprinting of skin tissue. The research will first optimize and select the best formulation of the kefir-based bioink, adjusting its viscosity and shear-thinning behavior for precise 3D printing. Characterization of the printed skin constructs/patches will involve mechanical testing and morphological analysis to validate their structural and functional similarity to native skin. Subsequently, we will perform in vitro experiments to assess the bioink's biocompatibility, cell viability, and ability to promote skinspecific cell growth and differentiation.

### **Risultati attesi** (max 5 righe):

The expected outcomes encompass the successful development of an optimized kefir-based bioink. The scaffold/patch will exhibit mechanical properties akin to native skin. The work will demonstrate high biocompatibility, supporting skin cell proliferation, confirmed through cell viability assays. Additionally, morphological analysis, including scanning electron microscopy, will validate the structural resemblance of 3D-printed skin constructs to native skin.

### **Caratteristiche di interdisciplinarietà del progetto** (max 5 righe):

The project exhibits strong interdisciplinary characteristics by combining expertise in biology, materials science, and engineering. Specialists in cell biology, rheology, and biomaterials collaborate to develop a kefir-based bioink for 3D skin tissue printing, optimizing its mechanical and biological properties. This interdisciplinary approach ensures a comprehensive and technical exploration of skin tissue regeneration solutions.



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DESCRIZIONE DEL PRODOTTO DELLA RICERCA (tipologia, collocazione editoriale, co-autore straniero eventualmente previsto, tempi attesi)

The research aims to develop kefir-based bioink optimized for 3D printing of skin tissue. The expected outcome is a scientific article to be published in a specialized journal in the field of tissue engineering or biotechnology. Collaboration with a foreign co-author (Girish Pattappa) is anticipated to enhance international perspectives and research quality. The expected timeline for article publication will depend on the complexity of the work, but the goal is to complete the research within 10-12 months.

FINANZIAMENTO RICHIESTO (max 1.500,00 €)

1.500,00 €

DESCRIZIONE DELLE SPESE PREVISTE

The anticipated expenses for this research project will include the following categories:

**Materials and Reagents:** Funds will be allocated for the purchase of kefir, cell culture media, growth factors, and other necessary materials for bioink development and cell culture experiments (700 €).

**Laboratory Equipment:** Expenses may arise for renting of specialized equipment such as bioprinters and analytical instruments for testing and characterization (400 €).

**Publication Fees:** Costs related to publishing research findings in scientific journals, which may include article processing charges (APCs) or page fees (300 €).

**Collaboration Costs:** expenses for shipping may be necessary (100 €).

Il sottoscritto, proponente del progetto, dichiara:

- di non avere disponibilità di fondi di ricerca per un importo superiore a 5.000 €;

Luogo e data  PALERMO, 02/11/2023

Firma F.to Elisa Capuana