FUNDING PROGRAMME: PNIII-Program 3 - European and International Cooperation.
SUBPROGRAM: 3.5 - Other European and international initiatives and programs – EUREKA Traditional, EUREKA-Cluster, Eurostars Projects.

PROJECT TITLE/ACRONYM: Technology for obtaining innovative non-active antimicrobial medical dressings by capitalizing on indigenous bioresources, NonActivPans, E!13429.

CONTRACT NO.: 219/2020

TOTAL PROJECT BUDGET: 1 784 000 lei/ 232 000 euro **BUGET INCDTP:** 570 000 lei/120 000 euro

PROJECT STARTING DATA: 23/12/2020 **PROJECT ENDING DATA:** 570000 lei/120000 euro

PAGINA WEB: https://spdgroup.ro/non-active-pans-2-2/

PARTNERS:

SC SPD STAR SRL-Coordinator
Universitatea Politehnica Bucuresti- Partener 1
INCDTP-Division ICPI, Partener 2
MB BIOFITA, Kaunas, Lithuania, Partner 3
Kaunas University of Technology (KTU), Kaunas, Lithuania, Partner 4

GENERAL OBJECTIVES:

The objective of the NonActivPans project is the development of new medical dressings based on protein extracts and non-active antimicrobial agents (without antibiotics) with advanced regenerative properties for the healing of acute and chronic wounds, as a result of the collaboration between SPD STAR SRL, UPB and ICPI, with a view to commercial exploitation.

SPECIFIC OBJECTIVES/ EXECUTION PHASES:

•Transfer of R&D results on obtaining protein extracts (collagen, keratin) from waste generated from the leather industry (cattle hides, rabbit skins, etc.) and from sheep wool processing, from ICPI to SPD STAR SRL;
•Transfer of R&D results on obtaining antimicrobial nanowires through electrospinning technology from UPB to SPD STAR SRL;
•Consolidation of the scientific and technological base of SPD STAR SRL in order to introduce new antimicrobial medical dressings with significant added value on the European and international market;
•Elaboration of documentation for obtaining the CE certificate for the marketing of NonActivPans products on the European and international market, according to the essential requirements imposed by Directive 93/42/EEC on medical devices;
•Promoting rapid healing of patients' wounds without the risk of cross-contamination;
•Sustainability and environmental protection by capitalizing on existing protein resources that have high wound healing potential and spinnable properties, reducing energy consumption and using natural biopolymers;
•Increasing the national and international visibility of SPD STAR, UPB and ICPI.

NOVELTY ELEMENTS/ SCIENTIFIC CONCEPT:

The creation of protein nanostructures additived with antimicrobial agents without antibiotics, with efficient action to restore and regenerate acute and chronic wounds, by capitalizing on natural resources, as an alternative to the use of synthetic products and solvents with unwanted adverse effects.

EXPECTED EXPLOITABLE RESULTS:

• Gelatin extracted from protein by-products, with electrospinning properties, an alternative to the use of native collagen, which is poorly soluble;

• Techniques for encapsulating antimicrobial agents by electrospinning to create bioactive dressings that are effective in healing chronic wounds, without the use of synthetic antibiotics;

• Dressings based on collagen and/or keratin protein nanowires - ecological alternatives to the use of antibiotic dressings, which generate resistance to pathogens.

OBTAINED RESULTS:

Study on biopolymers and bioactive agents used in electrospinning;

• Characterization reports for biopolymers and bioactive compounds;

• Experimentation report on electrospinning technology for protein biomaterials (mono and co-axial electrospinning);

• Test batch of nanowires with high protein content;

• Morphological and structural characterization report on antimicrobial nanowires obtained by electrospinning;

• Report on the efficiency of encapsulation of bioactive compounds in protein matrices;

• Development of the extraction and conditioning strategy for proteins;

• Characterization reports on protein extracts;

• Technologies for the extraction of collagen and keratin;

• Test batches of gelatin from rabbit, donkey or fish scales skin;

• Report on the biological characterization of antimicrobial nanowires;

• Demonstration report on antimicrobial medical dressing packaging;

• Report on the behavior of new dressings during gamma sterilization, optimal sterilization dose;

• Characterization report on the physical-mechanical properties of non-active antimicrobial medical dressings;

• Demonstration report on the production of non-active nanowires by electrospinning (mono, coaxial electrospinning);

• Characterization report on the structure and interactions of the compounds in the composition of antimicrobial dressings;

• Report on the controlled release of bioactive compounds from the obtained medical dressings;

• Technology transfer report on obtaining antimicrobial nanowires based on collagen and keratin and antimicrobial agents;

• Technical product specifications;

• Demonstration report on technologies for the production of spinnable collagen and keratin;

• Demonstration batches of collagen and keratin with electrospinning, bioactive properties;

• Report on the characterization of the bioactive properties of protein extracts;

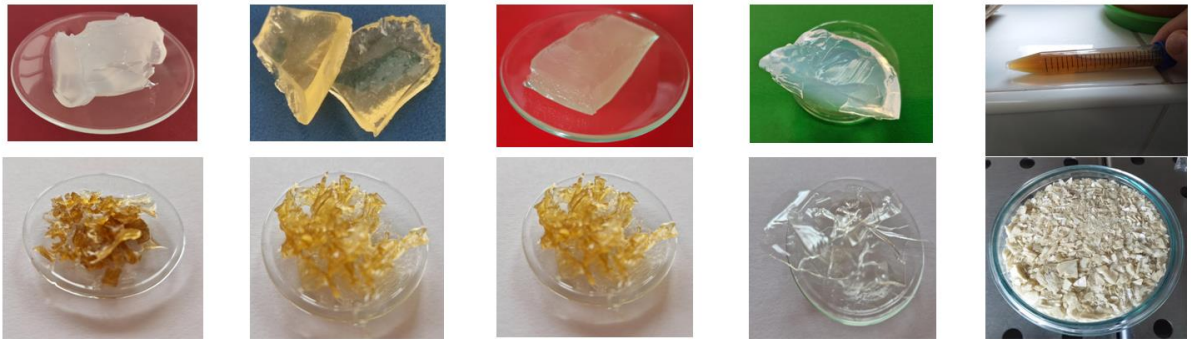
• Report on the transfer of technology for obtaining biomaterials based on collagen and keratin;

• Market analysis;

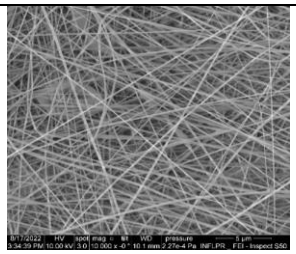
• Report on in vitro and in vivo biocompatibility and regeneration tests;

• Report on risk management;

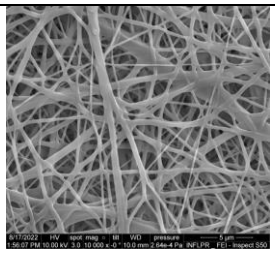
• Technical documentation for the medical dressings produced.



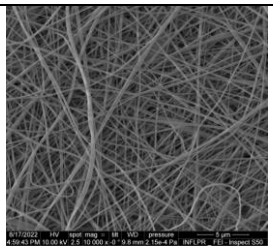
Bovine hide collagen | Donkey hide collagen | Rabbit skin collagen | Fish scale collagen | Wool keratin



Nanowires made of gelatin from donkey leather



Gelatin nanowires from rabbit skin



Gelatin nanowires from fish scales

Dressings based on protein nanowires added with antimicrobial agents

DISSEMINATION, PATENT APPLICATIONS, AWARDS:

- **Lucrari publicate WoS: 8**

♦Maria Râpă, Carmen Gaidau, Liliana Mititelu-Tartau, Mariana-Daniela Berechet, Andrei Constantin Berbecaru , Irina Rosca, Aurica P. Chiriac, Ecaterina Matei, Andra-Mihaela Predescu, Cristian Predescu. **Bioactive Collagen Hydrolysate-Chitosan/Essential Oil Electrospun Nanofibers Designed for Medical Wound Dressings**. *Pharmaceutics* 2021, *13*(11), 1939; https://doi.org/10.3390/pharmaceutics13111939.

♦Maria Râpă, Cătălin Zaharia, Paul Octavian Stănescu, Angela Căşărică, Ecaterina Matei, Andra Mihaela Predescu, Mircea Cristian Pantilimon, Ruxandra Vidu, Cristian Predescu, and Horia Cioflan. **In Vitro Degradation of PHB/Bacterial Cellulose Biocomposite Scaffolds**. *International Journal of Polymer Science* Volume 2021, Article ID 3820364, 8 pages https://doi.org/10.1155/2021/3820364.

♦Matei, E., Gaidau, C., Rapa, M., Stefan, L.M., Ditu, L.M., Predescu, A.M., Stanca, M., Pantilimon, M.C., Berechet, M.D., Predescu, C., Mosutiu, A. **Sustainable Coated Nanostructures Based on Alginate and Electrospun Collagen Loaded with Antimicrobial Agents**. *COATINGS,* Volume: 11, Issue: 2, Article Number: 121, DOI: 10.3390/coatings11020121, Published: FEB 2021.

♦Maria Râpă, Traian Zaharescu, Laura Mihaela Stefan, Carmen Gaidău, Ioana Stănculescu, Rodica Roxana Constantinescu and Maria Stanca. **Bioactivity and Thermal Stability of Collagen–Chitosan Containing Lemongrass Essential Oil for Potential Medical Applications**. *Polymers* 2022, 14, 3884. https:// doi.org/10.3390/polym14183884.

♦ Berechet, M.D.; Gaidau, C.; Nešić, A.; Constantinescu, R.R.;Simion, D.; Niculescu, O.; Stelescu, M.D.; Sandulache, I.; Râpă, M. **Antioxidant and Antimicrobial Properties of Hydrolysed Collagen Nanofibers Loaded with Ginger Essential Oil**. *Materials* **2023**, *16*,1438. https://doi.org/10.3390/ma1604143.

♦Gaidau, C.; Râpa, M.; Stefan, L.M.; Matei, E.; Berbecaru, A.C.; Predescu, C.; Mititelu-Tartau, L. **Conversion of Animal-Derived Protein By-Products into a New Dual-Layer Nanofiber Biomaterial by Electrospinning Process**. Fibers **2023**, 11, 87. https://doi.org/10.3390/fib11100087.

♦Râpă, M.; Gaidau, C.; Stefan, L.M.; Lazea-Stoyanova, A.; Berechet, M.D.; Iosageanu, A.; Matei, E.; Janauskaitė, V.; Predescu, C.; Valeika, V. **Donkey Gelatin and Keratin Nanofibers Loaded with Antioxidant Agents for Wound Healing Dressings**. *Gels* **2024**, *10*, 391. https://doi.org/10.3390/gels10060391.

♦Gaidau, C.; Râpă, M.; Ionita, G.; Stanculescu, I.R.; Zaharescu, T.; Constantinescu, R.-R.; Lazea-Stoyanova, A.; Stanca, M. **The Influence of Gamma Radiation on Different Gelatin Nanofibers and Gelatins**. *Gels* **2024**, *10*, 226.

https://doi.org/10.3390/gels10040226.

- **BDI published papers: 3**

♦Olga Niculescu, Carmen Gaidau, Maria Rapa, Anamaria Mosutiu. **Natural Leather Footwear Protection against Fungi Using Essential Oils**. *Annals of University of Oradea, Fascicle of Textiles, Leatherwork*, Vol. 22, Nr.1, pg. 107-112, 2021**,** ISSN 2457-4880, Editura Universităţii din Oradea.

♦Gaidau Carmen, Rapa Maria, Olariu Laura, Dumitriu Brindusa Georgiana, Mosutiu Anamaria, Stanca Maria, Berechet Daniela, Leather and Wool Byproducts Processing for Bioactive Additives, ANNALS OF THE UNIVERSITY OF ORADEA FASCICLE OF TEXTILES, LEATHERWORK, vol 23, no.1, pp 73-76, https://textile.webhost.uoradea.ro/Annals/AUO-FTL-Vol%2023%20no%201-2022.pdf.

♦Maria Râpă, Mariana Daniela Berechet, Carmen Gaidău, Rodica Roxana Constantinescu, Anamaria Moșuțiu. **Antimicrobial properties of rabbit collagen glue-chitosan biomaterial loaded with *Cymbopogon flexuosus* essential oil**. *TEXTEH Proceedings*, October 2021. DOI: 10.35530/TT.2021.46.

- **Scientific communications: 14**

♦Maria RÂPĂ, Ecaterina MATEI, Andra Mihaela PREDESCU, Traian ZAHARESCU, Andreea Anca ȚURCANU, Mirela Sohaciu, Cristian PREDESCU, Carmen GAIDĂU, Mariana Daniela BERECHET, Anamaria MOȘUȚIU. **Exploring of thermal properties of plant-polymeric films for medical applications**. *CEEC-TAC6 & Medicta2021*, 20-24 July 2021, Split, Croatia (Poster presentation).

♦Maria Râpă, Mariana Daniela Berechet, Carmen Gaidău, Rodica Roxana Constantinescu, Anamaria Moșuțiu. **Antimicrobial properties of rabbit collagen glue-chitosan biomaterial loaded with c*ymbopogon flexuosus* essential oil.** *TEXTEH X International Conference on Textiles and Connected R&D Domains*, October 21-22, 2021, Online (Poster).

♦ Maria Stanca, Carmen Gaidau, Maria Rapa, Daniela Berechet, Anamaria Mosutiu. **Collagen and keratin additives for new nanostructures in tissue engineering**, NanoBioMat2021_P_V5, *International Scientific Conference, Application or Chemistry in nanoscience and Biomaterials Engineering*, 15-12 iunie 2021 (oral presentation).

♦ Maria Râpă, Carmen Gaidau, Roxana Constantinescu, Daniela Berechet, Ecaterina Matei, Simona Savin, Corina Marcela Roșu, Andra Mihaela Predescu, Mircea Cristian Pantilimon, Cristian Predescu, Anamaria Mosutiu. **Valorization of Rabbit Skin Glue to Produce Antimicrobial and Biocompatible Nanofibers**. *Bucharest Polymer Conference 2nd Edition,* University POLITEHNICA of Bucharest, Romania, 10 - 11 June 2021 (Poster online).

♦ Maria RAPA, Ecaterina MATEI, Carmen GAIDAU, Anamaria MOSUTIU, Cristian PREDESCU, Mariana Daniela BERECHET, Andrei Constantin BERBECARU. **Encapsulated essential oils into collagen nanofibers as potential wound dressings**. *International Conference "Agriculture for Life, Life for Agriculture",* University of Agronomic Sciences and Veterinary Medicine of Bucharest, Faculty of Biotechnology, 3 – 5 June 2021 (Poster).

♦Cosmin A. Alexe, Carmen Gaidau, Maria Rapa, Anamaria Mosutiu, Mariana D. Berechet, Maria Stanca and Demetra Simion. **Design of advanced materials from collagen based renewable resources**. *5th European Conference on Green and Sustainable Chemistry*, 26-29 September 2021, virtual Conference - poster presentation.

♦Maria RÂPĂ, Andreea Anca ȚURCANU, Carmen GAIDĂU, Mariana Daniela BERECHET, Anamaria MOȘUȚIU, Andrei Constantin BERBECARU, Mirela SOHACIU, Cristian PREDESCU. **Exploring of hydrolysate keratin and biopolymers spinnable properties to fabricate nanofibers for wound healing management.** The 6th edition of International Conference on Analytical and Nanoanalytical Methods for Biomedical and Environmental Sciences" IC-ANMBES 2022" June 8 - 10, 2022, Brasov, Romania (poster).

♦Maria RÂPĂ, Carmen GAIDĂU, Ecaterina MATEI, Andra Mihaela PREDESCU, Laura Mihaela ȘTEFAN, George COMAN, Mirela SOHACIU, Cristian PREDESCU, Anamaria MOȘUȚIU. **Antimicrobial PLA/Keratin. Composites Fabricated by Coaxial Electrospinning Technology.** MATERIALS, METHODS & TECHNOLOGIES, 24th International Conference, 19-22 August 2022, Burgas, Bulgaria (poster).

♦Maria RÂPĂ, Ecaterina MATEI, Cristian PREDESCU, Carmen GAIDĂU, Anamaria MOȘUȚIU. **Tehnologie de obținere a pansamentelor medicale antimicrobiene non-active, inovative prin valorificarea bioresurselor**

indigene. Salonul Internațional de Invenții și Inovații „TRAIAN VUIA – 2022", 6-10 Octombrie 2022, Timisoara (poster).

♦Maria RÂPĂ, Ecaterina MATEI, Cristian PREDESCU, Carmen GAIDĂU, Anamaria MOȘUȚIU. **Tehnologie de obținere a pansamentelor medicale antimicrobiene non-active, inovative prin valorificarea bioresurselor indigene.** EENVIRO 2022: The 8th Conference of the Sustainable Solutions for Energy and Environment, Bucharest, Romania, October 17-21, 2022 (poster).

♦Carmen Gaidau, Maria Rapa, Maria Stanca, Daniela Berechet, Anamaria Mosiutiu, Laura Olariu, Brandusa Georgiana Dumitriu, **Processing of Protein Byproducts for New Biomaterials Design**, 12th International Conference on Materials & Engineering, BRAMAT 2022 **, Poster 2PO 01, P.54.**

♦ **Carmen Gaidau**; Mihaela Niculescu; Stanca Maria; Cosmin Alexe; Marius Becheritu, Roxana Horoias, Jiri Pecha **Protein By-products Recovery and Reuse for Sustainable Agriculture and Medical Applications,** sips22_7_121,Kolomaznik International Symposium,8th International Symposium on Sustainable Materials Recycling, SIPS 2022, Phuket, Tailanda 27 November-1 December 2022, oral presentation, https://www.flogen.org/sips2022//technical_program.php?a=8f14e45fceea167a5a36dedd4bea2543.

♦C. Gaidau, M. Rapa, M.D. Berechet, M. Stanca, R.R. Constantinescu, A. Lazea-Stoyanova, **Design of Wound Healing Dressings Based on Collgen Nanofibers and Polyphenol Extracts**, 16th World Congress Polyphenol Applications, 27-28 septembrie 2023, Malta, pg 81.

♦ Carmen Gaidau, Maria Stanca, Cosmin Andrei Alexe, Rodica Constantinescu, Adrian Peticila, Dan Tone, **Fast Biodegradation of Organic Tanned Sheepskins Waste**, THE XXXVII IULTCS CONGRESS 2023, Chengdu, China, Poster.

♦ Carmen Gaidau, Maria Rapa, **New Biomaterials Made by Different Origin Gelatins Skin Wound Healing, Science and Technology** / Sustainable Industrial Processing Summit 2023 (SIPS 2023), 27 November-1 December 2023, Panama, Oral presentation.

♦ **EUREKA Newsletter,** December 2024, Success Story: ***Animal skins and essential oils: How SPD STAR is spinning wound dressings***. (https://eurekanetwork.org/news/animal-skins-and-essential-oils-how-spd-star-is-spinning-wound-dressings/).

- **Patent Applications: 2**

OSIM no A/00770/28.11.2022 Gaidau C.C, Rapa. M., Predescu C., Stanca M., Alexe C.A, **"NANOFIRE DIN COLAGEN DIN PIELE DE MĂGAR ȘI PROCEDEU DE OBȚINERE" (COLLAGEN NANOFIBERS FROM DONKEY SKIN AND PROCESS FOR OBTAINING THEM).**

OSIM no A/00782/29.11.2022, Gaidau C.C, Rapa. M., Predescu C., Stanca M., Alexe C.A, "**NANOFIRE DIN COLAGEN DIN SOLZI DE PEȘTE ȘI PROCEDEU DE OBȚINERE**" **(COLLAGEN NANOFIBERS FROM FISH SCALE AND PROCESS FOR OBTAINING THEM).**

- **Patent : 1**

RO137330-B1/30.07.2024. *Procedeu de obținere a nanofirelor din colagen din solzi de peşte (Process for obtaining collagen nanowires from fish scales)*. Authors: Gaidau C.; Râpă M.; Predescu C.; Stanca M.; Alexe C.A.

- **Awards: 4**

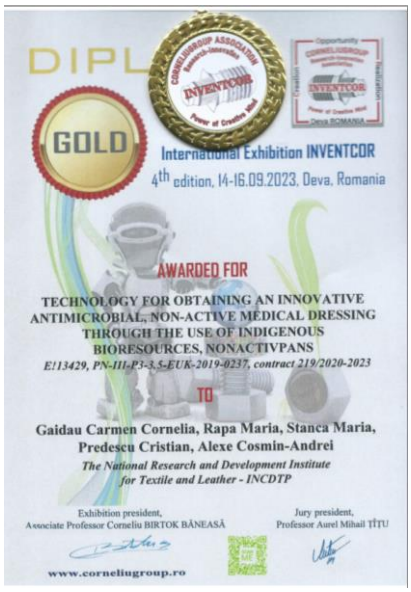
♦ *Gold Medal* at 4th International Exhibition InventCor, 14-16.09.2023 – Deva, Romania, *COLLAGEN NANOFIBERS FROM FISH SCALE AND PROCEDURE FOR OBTAINING Patent number: OSIM A/00782/29.11.2022 Published in BOPI no 3/2023. Pg23.Author/s: Gaidau Carmen Cornelia, Rapa Maria, Stanca Maria, Predescu Cristian, Alexe Cosmin-Andrei , Institution: R&D National Institute for Textiles &Leather Bucharest.*

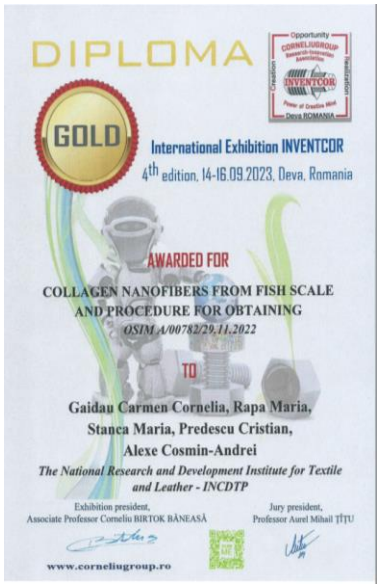
♦ *Gold Medal* at 4th International Exhibition InventCor, 14-16.09.2023 – Deva, Romania , *COLLAGEN AND COLLAGEN-KERATIN NANOFIBERS FROM DONKEY BY-PRODUCTS. PROCESS FOR THEIR OBTAINING, Patent number: A 2022 00770, Maria Râpă, Carmen Gaidau, Ecaterina Matei, Maria Stanca, Daniela Mariana Berechet, Institution: National University of Science and Technology POLITEHNICA Bucharest, Catalog2023, pg 74.*

♦ *Gold Medal* at 4th International Exhibition InventCor, 14-16.09.2023 – Deva, Romania, *TECHNOLOGY FOR*

OBTAINING AN INNOVATIVE ANTIMICROBIAL, NON-ACTIVE MEDICAL DRESSING THROUGH THE USE OF INDIGENOUS BIORESOURCES, NONACTIVPANS Project number: E!13429, PN-III-P3-3.5-EUK-2019-0237, contract 219/2020-2023. Author/s: Gaidau Carmen Cornelia, Rapa Maria, Stanca Maria, Predescu Cristian, Alexe Cosmin-Andrei, Institution: R&D National Institute for Textiles and Leather Catalog2023, pg 148-149.

♦**Eureka Innovation Award** for the Network project category, at *Global Innovation Summit 2024*, 13- 14 June, 2024, Istanbul, Turkyie.





CONTACT PERSON:
Dr.Carmen Gaidau, R4-leading researcher, carmen.gaidau@icpi.ro
Leather Research Department