1 - General information

Project code: PNRR-POC-2022-12376137

Project topic: A) Proof of concept

Applicant Institution: Toscana

PI / Coordinator: Massi Daniela

Istitution that perform as UO for UO1: Azienda Ospedaliero-Universitaria Careggi

Call section: Proof of concept

Proposal title: RObot-Assisted Gross pathology Examination of solid tumoRs (ROGER)

Duration in months: 24

MDC primary: Diagnostica

MDC secondary: Oncologia

Project Classification IRG: Bioengineering Sciences and Technologies

Project Classification SS: Instrumentation and Systems Development - ISD

Project Keyword 1: Automation and integration: design and development of both individual instrumentation modules and integrated systems for biological research or diagnostics.

Project Request: **Animals:** [ ] **Humans:** [X] **Clinical trial:** [X]

Patent number: EP19704460

Patent owner: Joint ownership by Sant¿Anna School of Advanced Studies (50%) and University of Florence (50%); the University of Florence approved (with nulla osta) the submission of the present Proof of Concept proposal as part of the exploitation plan of the patented technology; the inventors of the patent are affiliated to Sant¿Anna School of Advanced Studies, University of Florence and Careggi University Hospital of Florence.

Project total financing request to the MOH: € 993.835

Free keywords: robotic platform, gross pathology, gross examination, solid tumors, multisensory integration, tactile information, acoustic information, vision information, cancer profiling

Declarations

In case of a Synergy grant application 'Principal Investigator'(PI) means 'corresponding Principal Investigator on behalf of all Principal Investigators', and 'Host Institution' means 'corresponding Host Institution'.

1) The Principal Investigator declares to have the written consent of all participants on their participation and on the content of this proposal, as well as of any researcher mentioned in the proposal as participating in the project (either as other PI, team member or collaborator).	X
2) The Principal Investigator declares that the information contained in this proposal is correct and complete.	X
3) The Principal Investigator declares that all parts of this proposal comply with ethical principles (including the highest standards of research integrity — as set out, for instance, in the European Code of Conduct for Research Integrity — and including, in particular, avoiding fabrication, falsification, plagiarism or other research misconduct).	X
4) The Principal Investigator is only responsible for the correctness of the information relating to his/her own organisation. Each applicant remains responsible for the correctness of the information related to him and declared above.	X

Personal data protection

The assessment of your grant application will involve the collection and processing of personal data (such as your name, address and CV), which will be performed pursuant to Regulation (EC) No 45/2001 on the protection of individuals with regard to the processing of personal data by the Community institutions and bodies and on the free movement of such data. Unless indicated otherwise, your replies to the questions in this form and any personal data requested are required to assess your grant application in accordance with the specifications of the call for proposals and will be processed solely for that purpose. Details concerning the purposes and means of the processing of your personal data as well as information on how to exercise your rights are available in the privacy statement. Applicants may lodge a complaint about the processing of their personal data with the European Data Protection Supervisor at any time.

Abstract

The impact of workload in pathology departments and the complexity of laboratory procedures required in the latest years the introduction of new professional roles and technologies. Pathologist assistants (PAs) in international practice (such as USA and Canada) already efficiently support pathologists in the labor-intensive and time-consuming grossing phase, that is the qualitative assessment through visual inspection and manual palpation of resected surgical specimens [1]. Up to 2020, cases examined by PAs accounted for about 15% of the cases examined by pathologists, thus gradually allowing to dedicate the efforts of trained medical doctors into tasks presenting a higher degree of complexity. In the reported international cases, employing PAs at the grossing phase contributes reducing the costs and increasing the efficiency of the timing in the diagnostic process, however it does not improve the dependence on the expertise and inter-examiner variability of the result and anyway this is still not an integral part of the Italian regulations of the healthcare system.
The ROGER project aims at assessing whether the introduction, in anatomical pathology laboratories, of a multisensory robotic platform could mitigate these limitations, promoting a radical advancement in the efficiency and quality of clinical processes. The robotic platform, already preliminarily tested on artificial phantoms mimicking human tissue and on animal liver, integrates tactile (associated to stiffness), acoustic (associated to ultrasound measurements), and visual (reconstruction with a 3d camera) information to detect areas of pathological interest in resected tissue specimens. A multi-centric study will assess the non-destructive impact of the robot on the tissues and lymph node or nodules retrieval (including clinically non-detectable small alterations, size< 5 mm), suspect nodular lesion recognition comparable to human abilities (primary aims), and overall time spent in identifying the suspect alterations and ability to create an annotated database obtained from all the sensors of the platform including gross and radiological images of clinical history (secondary aims).
The success of the ROGER project will standardize the grossing phase, introducing in pathology laboratories an on-demand, digitalized, and reproducible tool for macroscopic examinations, to be used for both assistance and teaching purposes. Additionally, results from the ROGER project will allow pathologists to (i) build a common digitalized database on tissue properties through intelligent systems and (ii) establish a telemedicine system that could potentially allow remote guidance

by expert pathologists that are not located in the same facility of the robotic platform and pathologist assistants that support its operation. The future introduction of such technological innovation in pathology departments of clinical structures will thus contribute to enhancing the efficiency and efficacy of the sanitary system, addressing a phase of the workflow that was selected based on the analysis of the whole process and context.

In order to best review your application, do you agree that the above non-confidential proposal title and abstract can be used, without disclosing your identity, when contacting potential reviewers? Yes

2 - Participants & contacts

Operative Units

Institution that perform as UO	CF Institution	Department / Division / Laboratory	Role in the project	Southern Italy	SSN
1 - Azienda Ospedaliero-Universitaria Careggi	04612750481	Section of Pathological Anatomy, Department of Health Sciences, University of Florence, 50139, Florence, Italy.	PI and CO-PI		X
2 - Azienda Ospedaliero Universitaria di Sassari (AOUS)		Section of Pathological Anatomy, Department of Health Sciences, University of Florence, 50139, Florence, Italy.	Research collaborators	X	X
3 - Fondazione Policlinico Universitaria Gemelli (FPG)		Department of Woman and Child Health, Fondazione Policlinico Universitario A. Gemelli IRCCS, Italy; Università Cattolica del Sacro Cuore, Rome, Italy.	Research collaborators		X
4 - Scuola Superiore Sant'Anna (SSA)	93008800505	The BioRobotics Institute and Department of Excellence in Robotics and AI, Scuola Superiore Sant'Anna, Pisa, Italy.	Research collaborators		

Principal Research Collaborators

Key Personnel Name	Operative Unit	Role in the project
1 - CIANCHI FABIO	Azienda Ospedaliero-Universitaria Careggi	CO-PI
2 - Cossu Antonio Giuseppe Maria	Azienda Ospedaliero Universitaria di Sassari (AOUS)	Research collaborator
3 - ZANNONI GIAN FRANCO	Fondazione Policlinico Universitaria Gemelli (FPG)	Research collaborator
4 - Menciassi Arianna	Scuola Superiore Sant'Anna (SSA)	Research collaborator
5 - Santoro Angela	Fondazione Policlinico Universitaria Gemelli (FPG)	Research collaborator
6 Under 40 - Oddo Calogero Maria	Scuola Superiore Sant'Anna (SSA)	Research collaborator U40
7 Under 40 - Auletta Fabrizia	Scuola Superiore Sant'Anna (SSA)	Research collaborator U40

Project Code: PNRR-POC-2022-12376137	**Call section:** Proof of concept
Applicant Institution: Toscana	**Applicant/PI Coordinator:** Massi Daniela

Key Personnel Name	Co-PI	Resp. CE	Resp. Animal	Birth Date	Gender
1 - CIANCHI FABIO	X			31/08/1965	M
2 - Cossu Antonio Giuseppe Maria				19/02/1959	M
3 - ZANNONI GIAN FRANCO				05/02/1965	M
4 - Menciassi Arianna				23/04/1971	F
5 - Santoro Angela				25/01/1981	F
6 Under 40 - Oddo Calogero Maria				10/05/1983	M
7 Under 40 - Auletta Fabrizia				28/01/1991	F

Responsible who requests CE authorization: Massi Daniela

Additional research collaborators under 40 to hire

Key Personnel Name	Operative Unit	Birth Date	Gender	Role in the project	Degree	Actual Pos. and Inst.
0 - Ugolini Filippo	Azienda Ospedaliero-Universitaria Careggi	15/10/1990	M	Research collaborator U40 ex novo	Master of Science in Biology	Post-doctoral fellowship
1 - SIMI SARA	Azienda Ospedaliero-Universitaria Careggi	04/09/1987	F	Research collaborator U40 ex novo	Master of Science in Natural Sciences	Post-degree fellowship
2 - NUVOLI LUCA	Azienda Ospedaliero Universitaria di Sassari (AOUS)	18/10/1989	M	Research collaborator U40 ex novo	Master of Science in Chemical Science	Post-doctoral fellowship
3 - Cangemi Michela	Azienda Ospedaliero Universitaria di Sassari (AOUS)	30/11/1989	F	Research collaborator U40 ex novo	Master of Science in Biology	Post-doctoral fellowship

2.1 Administrative data of participating

Operative Unit Number 1:

Address: Largo Giovanni Alessandro Brambilla, 3, 50134 Firenze FI, Italy.
PEC: aoucareggi@pec.it

Operative Unit Number 2:

Address: Viale S. Pietro, 43 / B, 07100 Sassari SS, Italy.
PEC: protocollo@pec.aou.ss.it

Operative Unit Number 3:

Address: Via della Pineta Sacchetti, 217, 00168 Roma RM, Italy.
PEC: protocollo.generale.gemelli@pec.it

Operative Unit Number 4:

Address: Piazza Martiri della Libertà, 33, 56127 Pisa PI, Italy.

PEC: istituto-biorobotica@sssup.legalmail.it

Operative Unit Number 5 (self financing):

Address: N.A.

PEC: N.A.

2.2 Principal Investigator (PI) Profile

Last Name: Massi
First Name: Daniela
Last name at birth:
Gender: F

Title: Principal investigator
Country of residence: ITALY
Nationality: italiana
Country of Birth: ITALY
Date of birth: 25/05/1969
Place of Birth: Roma

Official H index (Scopus or Web of Science): 51.0

Scopus Author Id:7004665396 **ORCID ID:**0000-0002-5688-5923 **RESEARCH ID:**N.A

Contact address

Current organisation name: Azienda Ospedaliero-Universitaria Careggi
Current Department / Faculty / Institute / Laboratory name: Section of Pathological Anatomy, Department of Health Sciences, University of Florence, 50139, Florence, Italy.

Street: Viale Pieraccini 6
Postcode / Cedex: 50139
Town: Firenze
Phone:+393485244097
Phone 2: +390554478137

Education / training

Educational institution and location	Degree	Field of study	From year	To year
University of Verona, Verona	PhD	PhD in Human Pathology and Oncology	1999	2003
University of Florence, Florence	Specialization / Specializzazione	Residency in Anatomic Pathology, 70/70 cum laude	1993	1998
University of Florence, Faculty of Medicine and Surgery, Florence	Single-cycle master's degree / Laurea magistrale a ciclo unico	Degree in Medicine and Surgery, 110/110 cum laude	1987	1993

Personal Statement:

D Massi is an internationally-recognized dermatopathologist with a research interest and clinical expertise in skin cancer. She is Professor of Pathology at the University of Florence Medical School and Director of the Division of Histopathology and Molecular Diagnostics, Careggi University Hospital, Florence. The Division of Pathology provides diagnostic histopathological services and specialized molecular testing for patients with solid tumors. In the ROGER project, D Massi will be the clinical and research coordinator leading all feasibility study and monitoring relevant matters and ensuring all clinical work related to the clinical validation of the robotic platform for automatic recognition of nodules from ex-vivo samples adheres to ethical guidelines and FAIR science.

Positions and honors

Positions

Institution	Division / Research group	Location	Position	From year	To year
Careggi University Hospital, Florence	University Hospital, Florence, Department of Health Sciences	Florence	Director, CORD (Centro Oncologico di Riferimento Dipartimentale)	2015	2016
Careggi University Hospital, Florence	University Hospital, Florence, Department of Health Sciences	Florence	Director, Division of Histopathology and Molecular Diagnostics, Careggi	2016	2026
University of Florence, Florence	University of Florence, Florence, Department of Health Sciences	Florence	Associate Professor in Anatomic Pathology	2002	2016
University of Florence, Florence	University of Florence, Florence, Department of Health Sciences	Florence	Full Professor in Anatomic Pathology	2018	2039

Other awards and honors

2019, Member of Club Onda Top Italian Women Scientists (TWIS)

2017 Prix International Jean Civatte de Dermatopathologie

2016 Member of InterCommittee (IC) Scientific Advisory Group (SAG). European Medicines Agency (EMA).

1999 Ilaria Funtò award for the best original research in Anatomic Pathology

1998 Paolo Schlechter award from Fondazione Trentina per la Ricerca sui Tumori

1997 Leonardo Mosca award for the best original research in Anatomic Pathology

Other CV informations

Prof. Massi is Volume Editor of 'Pathology & Genetics of Skin Tumours', IARC/World Health Organization (WHO) Classification of Tumours series (4th edition) and Expert Member of the 5th edition. She has authored 3 volumes and 20 chapters in books. She has authored of 430 publications in peer-review international scientific journals with >10000 citations. She is Chair of EORTC Melanoma Pathology Group and Member of Executive Committee Italian Melanoma Intergroup. She is currently Editor-in-Chief of Virchows Archiv. She was invited as a speaker at 97 International conferences and 228 National conferences. Within the Advanced Bioimaging Research Laboratory (ABiR - https://www.dss.unifi.it/vp-259-abir.html) research activities are focused on translational studies in skin cancer.

Selected peer-reviewed publications of the PI valid for minimum expertise level

Title	Type	Pag	Vol	Year	DOI	PMID	Cit.**	P.*
Clinical and dermoscopic features of truly amelanotic plantar melanoma	Article	224-230	27	2017	10.1097/CMR.0000000000000337	28252554	7	L
TRK fusion positive cancers: From first clinical data of a TRK inhibitor to future directions	Article	NOT_FOUND	152	2020	10.1016/j.critrevonc.2020.103011	32521311	8	L
The complex management of atypical Spitz tumours	Article	132-141	48	2016	10.1016/j.pathol.2015.12.003	27020385	11	F

Title	Type	Pag	Vol	Year	DOI	PMID	Cit.**	P.*
Lymphatic and blood vasculature in primary cutaneous melanomas of the scalp and neck	Article	1596-1602	37	2015	10.1002/hed.23801	24931916	11	L
BRAF and KIT somatic mutations are present in amelanotic melanoma	Article	414-419	23	2013	10.1097/CMR.0b013e32836477d4	23938765	17	F
ESP, EORTC, and EURACAN Expert Opinion: practical recommendations for the pathological diagnosis and clinical management of intermediate melanocytic tumors and rare related melanoma variants	Article	3-11	479	2021	10.1007/s00428-020-03005-1	33432480	4	L
Clinical and dermoscopic features of vulvar melanosis over the last 20 years	Article	1185-1191	156	2020	10.1001/jamadermatol.2020.2528	32785609	2	L
Machine versus man in skin cancer diagnosis	Article	891-892	20	2019	10.1016/S1470-2045(19)30391-2	31201138	1	F
The density and spatial tissue distribution of CD8⁺ and CD163⁺ immune cells predict response and outcome in melanoma patients receiving MAPK inhibitors	Article	NOT_FOUND	7	2019	10.1186/s40425-019-0797-4	31730502	21	F
Baseline ?-catenin, programmed death-ligand 1 expression and tumour-infiltrating lymphocytes predict response and poor prognosis in BRAF inhibitor-treated melanoma patients	Article	70-81	78	2017	10.1016/j.ejca.2017.03.012	28412591	29	F
Immunomodulating property of MAPK inhibitors: From translational knowledge to clinical implementation	Article	166-175	97	2017	10.1038/labinvest.2016.132	27991907	19	L
The status of PD-L1 and tumor-infiltrating immune cells predict resistance and poor prognosis in BRAFi-treated melanoma patients harboring mutant BRAF^{V600}	Article	1980-1987	26	2015	10.1093/annonc/mdv255	26037795	65	F
Immunohistochemistry is highly sensitive and specific for the detection of NRASQ61R mutation in melanoma	Article	487-497	28	2015	10.1038/modpathol.2014.137	25341653	45	F
KIT genetic alterations in anorectal melanomas	Article	130-134	68	2015	10.1136/jclinpath-2014-202572	25398993	23	L
Atypical Spitz tumors in patients younger than 18 years	Article	37-46	72	2015	10.1016/j.jaad.2014.09.049	25446807	42	F
Circulating tumor cells detection and counting in uveal melanomas by a filtration-based method	Article	323-332	6	2014	10.3390/cancers6010323	NOT_FOUND	35	L
Nras in melanoma: Targeting the undruggable target	Article	107-122	92	2014	10.1016/j.critrevonc.2014.05.005	24985059	46	L
PD-L1 marks a subset of melanomas with a shorter overall survival and distinct genetic and morphological characteristics	Article	2433-2442	25	2014	10.1093/annonc/mdu452	25223485	94	F
The prognostic impact of the anatomical sites in the 'head and neck melanoma': Scalp versus face and neck	Article	402-405	22	2012	10.1097/CMR.0b013e3283577b96	22922466	34	L
Fluorescence in-situ hybridization analysis for melanoma diagnosis	Article	706-714	60	2012	10.1111/j.1365-2559.2011.03984.x	22007736	14	L

* Position: F=First L=Last C=Correspondent O=Other N=Not applicable

** Autocertificated

Selected peer-reviewed publications of the PI for the evaluation CV

Title	Type	Pag	Vol	Year	DOI	PMID	Cit.**
Wnt/?-catenin signaling in melanoma: Preclinical rationale and novel therapeutic insights	Article	1-12	49	2016	10.1016/j.ctrv.2016.06.009	27395773	61
PI3K-AKT-mTOR inhibition in cancer immunotherapy, redux	Article	91-103	48	2018	10.1016/j.semcancer.2017.04.015	28467889	160
PD-L1 expression in cancer patients receiving anti PD-1/PD-L1 antibodies: A systematic review and meta-analysis	Article	88-98	100	2016	10.1016/j.critrevonc.2016.02.001	26895815	239
Integrated Akt/PKB Signaling in Immunomodulation and Its Potential Role in Cancer Immunotherapy	Article	NOT_FOUND	107	2015	10.1093/jnci/djv171	26071042	52
Transient receptor potential vanilloid 4 (TRPV4) is downregulated in keratinocytes in human non-melanoma skin cancer	Article	2408-2417	134	2014	10.1038/jid.2014.145	24643128	51
Targeting the PD1/PD-L1 axis in melanoma: Biological rationale, clinical challenges and opportunities	Article	140-165	89	2014	10.1016/j.critrevonc.2013.08.002	24029602	127
Caveolin-1 as a promoter of tumour spreading: When, how, where and why	Article	325-336	17	2013	10.1111/jcmm.12030	23521716	62
?-adrenoceptors are upregulated in human melanoma and their activation releases pro-tumorigenic cytokines and metalloproteases in melanoma cell lines	Article	279-290	93	2013	10.1038/labinvest.2012.175	23318885	70
Multiparametric Analysis of Cell-Free DNA in Melanoma Patients	Article	NOT_FOUND	7	2012	10.1371/journal.pone.0049843	23209607	46
BRAF/NRAS mutation frequencies among primary tumors and metastases in patients with melanoma	Article	2522-2529	30	2012	10.1200/JCO.2011.41.2452	22614978	328

** Autocertificated

Grant

Funded by Institution	Researcher inst. where grant is/was performed	Year	Title	Position in Projects	Fund (euro)	Source website grant listed
Fondazione Ente Cassa di Risparmio di Firenze	University of Florence	2014-2016	Basi molecolari per lo sviluppo di nuove strategie terapeutiche di combinazione nel melanoma avanzato	Coordinator	30.000,00	Home - Fondazione CR Firenze
National Cancer Institute - NIH¿ Division of Cancer Epidemiology and Genetics, Bethesda, MD, USA (2015)	University of Florence	2014-2016	Caratterizzazione genetico-molecolare del melanoma in popolazioni dell¿Area Mediterranea (Melanostrum Consortium)	Collaborator	39.894,00	Division of Cancer Epidemiology and Genetics - NCI

Funded by Institution	Researcher inst. where grant is/was performed	Year	Title	Position in Projects	Fund (euro)	Source website grant listed
EORTC Melanoma Group	University of Florence	2016-2018	Integrazione di metodologie di imaging clinico, di analisi molecolare e genetica per la caretterizzazione di sottotipi di melanoma, per il miglioramento diagnostico, per la valutazione della aggressività biologica e per l¿identificazione di fattori predittivi di prognosi.	Coordinator	30.000,00	Melanoma - EORTC : EORTC
MIUR COFIN 2012 prot. 2012JJX494_002	University of Florence	2013-2016	Integrazione di metodologie di imaging clinico, di analisi molecolare e genetica per la caretterizzazione di sottotipi di melanoma, per il miglioramento diagnostico, per la valutazione della aggressività biologica e per l¿identificazione di fattori predittivi di prognosi.	Coordinator	98.000,00	Direzione Ricerca (unimore.it)
MIUR COFIN 2015 prot. 2015HAJH8E	University of Florence	2016-2018	Nuove metodologie di conservazione, processazione e analisi dei tessuti per indagini anatomo-molecolari applicate alla eterogeneità nel carcinoma della mammella e nel melanoma.	Coordinator	182.415,00	Portale dei bandi PRIN della Direzione Generale della Ricerca del MUR
EORTC Melanoma Group 2018	University of Florence	2018-2020	Morphological variants and molecular profiling of undifferentiated/dedifferentiated melanoma: An EORTC Melanoma Group Study	Coordinator	50.000,00	Melanoma - EORTC : EORTC
Fondazione Ente Cassa di Risparmio 2021	Careggi University Hospital	2021-2023	ID 50983, Sviluppo di una piattaforma di digital pathology applicata allo studio della patologia feto-placentare	Coordinator	150.000,00	Progetti italiani | Ricerca | Dipartimento di Scienze della Salute (DSS) | UniFI
Regione Toscana Bando Ricerca COVID-19	Careggi University Hospital	2020-2022	L'importanza della DIgItal pAthology durante la paNdEmia SARS-CoV-2 (DIANE)	Collaborator	499.600,00	DIANE_convenzione FSC completa alla firma_signed.pdf (uslcentro.toscana.it)
Bando Ricerca Salute 2018	Careggi University Hospital	2018-2022	An innovative TELEmedicine system for the early screening of Melanoma in Overall population (TELEMO)	Coordinator	867.831,00	Il progetto TELEMO per lo screening del melanoma (cnr.it)

Funded by Institution	Researcher inst. where grant is/was performed	Year	Title	Position in Projects	Fund (euro)	Source website grant listed
Programma AIRC 5 per 1000 ID#21073	University of Florence	2018-2024	ID#21073 Epigenetic modeling/remodeling of cancer metastases and tumor immune contexture to improve efficacy of immunotherapy	Coordinator	2.100.000,00	Epigenetic modeling/remodeling of cancer metastases and tumor immune contexture to improve efficacy of immunotherapy ¿ Institute for Genetic and Biomedical Research (IRGB) (cnr.it)

2.3 CO-PI Profile

Last Name: CIANCHI
First Name: FABIO
Last name at birth:
Gender: M

Title: CO-PI
Country of residence: ITALY
Nationality: Italiana
Country of Birth: ITALY
Date of birth: 31/08/1965
Place of Birth: Firenze

Official H index (Scopus or Web of Science): 32.0

Scopus Author Id:7004049217 **ORCID ID:**0000-0002-6936-8693 **RESEARCH ID:**N.A

Contact address

Current organisation name: Azienda Ospedaliero-Universitaria Careggi

Current Department / Faculty / Institute / Laboratory name: Section of Pathological Anatomy, Department of Health Sciences, University of Florence, 50139, Florence, Italy.

Street: Largo Brambilla 3
Postcode / Cedex: 50135
Town: Firenze
Phone:+393398589583
Phone 2:

Education / training

Educational institution and location	Degree	Field of study	From year	To year
University of Florence, Italy	Specialization / Specializzazione	Residency in Digestive Surgery and Endoscopy	1995	2000
University of Florence, Italy	Specialization / Specializzazione	Residency in General Surgery	1990	1995
University of Florence, Italy	Master's Degree / Laurea Magistrale	Master Degree in Medicine	1984	1990

Personal Statement:

F Cianchi is Full Professor of Surgery and Chief of the Digestive Surgery Unit at the University Hospital Careggi in Florence. In his role of co-PI of the ROGER project, he will share equal responsibility with the PI in determining the intellectual content and conduct of the scientific research and clinical activities. As part of a multi-investigator team, he will also lead a specific portion of the project related to validation of the robotic platform in tumor specimens of the digestive tract from conventional and minimally invasive surgery (laparoscopic and robotic surgery).

Positions and honors

Positions

Institution	Division / Research group	Location	Position	From year	To year
University of Florence, Italy	PhD Program in Anesthesiology and Surgery	Florence, Italy	Coordinator	2015	2027
University of Florence, Italy	Residency Program in General Surgery	Florence, Italy	Director	2016	2028
University of Florence, Italy	Research Center of Oncological Minimally Invasive Surgery ¿COMIS¿	Florence, Italy	Director	2011	2026
University Hospital Careggi	Digestive Surgery Unit	Florence, Italy	Chief	2015	2025
University Hospital Careggi	Endocrine and Minimally Invasive Surgery Unit	Florence, Italy	Chief	2009	2014
University of Florence, Italy	Dep. of Experimental and Clinical Medicine	Florence, Italy	Full Professor in General Surgery	2018	2035
University of Florence, Italy	Department of Surgery and Translational Medicine	Florence Italy	Associate Professor in General Surgery	2011	2017
University of Florence, Italy	Department of Surgery and Translational Medicine	Florence, Italy	Researcher in General Surgery	1998	2001

Other awards and honors

Referent for Tuscany of the Italian Society of Surgery
President of the Società Tosco-Umbra di Chirurgia

Other CV informations

Prof. Fabio Cianchi is Chief of the Digestive Surgery Unit at the University Hospital Careggi in Florence, Italy. His main clinical and scientific interest is the surgical oncology of the digestive tract, with particular emphasis in colorectal, gastric and esophageal minimally invasive surgery (laparoscopic and robotic surgery). He is the author and co-author of more than 250 scientific papers on both translational and surgical oncology, in particular on the molecular and genetic pathways of colorectal carcinogenesis. He investigated the role of inflammatory mediators such as cyclooxygenase-2, histamine, prostaglandin E2 and nitric oxide in stimulating tumor cell proliferation and angiogenesis through vascular endothelial growth factor production in colorectal cancer.

Selected peer-reviewed publications of the Co-PI valid for minimum expertise level

Title	Type	Pag	Vol	Year	DOI	PMID	Cit.**	P.*
Comparison among different techniques for en-bloc resection of rectal lesions: transanal endoscopic surgery vs. endoscopic submucosal dissection vs. full-thickness resection device with Over-The-Scope Clip® System	Article	234-243	75	2020	10.23736/S0026-4733.20.08298-X	32456395	0	L
Thoracic duct identification with indocyanine green fluorescence: A simplified method	Article	1	34	2021	10.1093/dote/doaa130	33479728	1	L
Robotic gastric surgery: A monocentric case series and review of the literature	Article	116-123	76	2021	10.23736/S2724-5691.21.08769-1	33908237	0	L

Title	Type	Pag	Vol	Year	DOI	PMID	Cit.**	P.*
Feasibility and safety of minimal-incision thyroidectomy for Graves' disease: A prospective, single-center study	Article	1345-1348	35	2013	10.1002/hed.23125	22907781	2	L
Survival after laparoscopic and open surgery for colon cancer: A comparative, single-institution study	Article	NOT_FOUND	15	2015	10.1186/s12893-015-0013-5	25887554	6	F
Laparoscopic total gastrectomy using the transorally inserted anvil (OrVil¿): A preliminary, single institution experience	Article	1-6	3	2014	10.1186/2193-1801-3-434	NOT_FOUND	8	F
The Clinical Value of Fluorescent Lymphography with Indocyanine Green During Robotic Surgery for Gastric Cancer: a Matched Cohort Study	Article	2197-2203	24	2020	10.1007/s11605-019-04382-y	31485904	15	F
Single-incision laparoscopic colorectal surgery for cancer: State of art	Article	6073-6080	20	2014	10.3748/wjg.v20.i20.6073	24876729	18	F
Totally laparoscopic versus open gastrectomy for gastric cancer: A matched cohort study	Article	117-122	23	2013	10.1089/lap.2012.0310	23216509	20	F
Robotic vs laparoscopic distal gastrectomy with D2 lymphadenectomy for gastric cancer: A retrospective comparative mono-institutional study	Article	NOT_FOUND	16	2016	10.1186/s12893-016-0180-z	27646414	26	F

* Position: F=First L=Last C=Correspondent O=Other N=Not applicable

** Autocertificated

Grant

Funded by Institution	Researcher inst. where grant is/was performed	Year	Title	Position in Projects	Fund (euro)	Source website grant listed
Regione Toscana	Department of Surgery and Translantional Medicine	2014-2017	IMEROS ¿ Integrated MEdical ¿ RObotic Solutions	Coordinator	410.000,00	http://v00obo-lasth.sphostserver.com/imeros/?page_id=73

2.3 Research Collaborators n. 2

Last Name: Cossu
First Name: Antonio Giuseppe Maria

Last name at birth:
Gender: M

Title: Research collaborator
Nationality: Italiana
Date of birth: 19/02/1959

Country of residence: ITALY
Country of Birth: ITALY
Place of Birth: Sassari

Official H index (Scopus or Web of Science): 33.0

Scopus Author Id:36849987200 **ORCID ID:**0000-0002-2390-2205 **RESEARCH ID:**I-8836-2018

Contact address

Current organisation name: Azienda Ospedaliero Universitaria di Sassari (AOUS)

Current Department / Faculty / Institute / Laboratory name: Section of Pathological Anatomy, Department of Health Sciences, University of Florence, 50139, Florence, Italy.

Street: Via Matteotti 60
Postcode / Cedex: 07100
Town: Sassari
Phone:+393475107380
Phone 2:

Education / training

Educational institution and location	Degree	Field of study	From year	To year
University of Sassari	Single-cycle master's degree / Laurea magistrale a ciclo unico	Degree in Medicine and Surgery	1977	1983
University of Pisa	Specialization / Specializzazione	Specialty training in Immunohematology	1983	1986
University of Bologna	Specialization / Specializzazione	Specialty training in Anatomic Pathology	1986	1990

Personal Statement:

Professor Antonio Cossu is a full professor of Anatomic Pathology and chief of the Unit of Anatomic Pathology and Histology at the University Hospital of Sassari. He is an expert pathologist and researcher with numerous participations in scientific research projects, publications in indexed scientific journals, and academic teaching activities. In the ROGER project, professor Cossu will organize and supervise the pathological examination of the histological specimens, especially those with breast cancer, and he will coordinate the collection and digital storage of the related scientific data. Professor Cossu, will also participate in the critical elaboration and evaluation, as well as in the dissemination and publication of the scientific data and results obtained.

Positions and honors

Positions

Institution	Division / Research group	Location	Position	From year	To year
AOU Sassari	Anatomic Pathology and Histology Unit	Sassari	Consultant	1988	2019
AOU Sassari	Anatomic Pathology and Histology Unit	Sassari	Chief	2019	2024
University of Sassari	Department of Medicine, Surgery and Pharmacy	Sassari	Full Professor	2019	2029

Other awards and honors

2017 to date: Member of the College of Professors in the PhD course in Biomedical Sciences at the University of Sassari, Italy.

Grant

Funded by Institution	Researcher inst. where grant is/was performed	Year	Title	Position in Projects	Fund (euro)	Source website grant listed
AIRC 5 per Mille 2018-2024	University of Sassari	2018-2024	Epigenetic modeling/remodeling of cancer metastases and tumor immune contexture to improve efficacy of immunotherapy	Collaborator	7.000.000,00	Epigenetic modeling/remodeling of cancer metastases and tumor immune contexture to improve efficacy of immunotherapy ¿ Institute for Genetic and Biomedical Research (IRGB) (cnr.it)
Finalized research by the Ministry of Health, Italy	University of Sassari	2003	Breast cancer research project	Coordinator	95.000,00	Progetti 2003 (salute.gov.it)
Sardinia region, Italy	University of Sassari	2002	Genetics and tumors in Northern Sardinia: correlation between epidemiology, histopathology and genetics	Coordinator	774.680,00	N.A.

2.4 Research Collaborators n. 3

Last Name: ZANNONI
First Name: GIAN FRANCO
Last name at birth:
Gender: M

Title: Research collaborator
Country of residence: ITALY
Nationality: Italiana
Country of Birth: ITALY
Date of birth: 05/02/1965
Place of Birth: Ferrara

Official H index (Scopus or Web of Science): 44.0

Scopus Author Id:35597997300 **ORCID ID:**0000-0002-4473-7560 **RESEARCH ID:**AAC-4754-2020

Contact address

Current organisation name: Fondazione Policlinico Universitaria Gemelli (FPG)

Current Department / Faculty / Institute / Laboratory name: Department of Woman and Child Health, Fondazione Policlinico Universitario A. Gemelli IRCCS, Italy; Università Cattolica del Sacro Cuore, Rome, Italy.

Street: Largo Agostino Gemelli 8
Postcode / Cedex: 00168
Town: Roma
Phone:+393401545335
Phone 2:

Education / training

Educational institution and location	Degree	Field of study	From year	To year
Università Cattolica del Sacro Cuore - ROMA	Specialization / Specializzazione	Anatomic Pathology and Cytopathology	1990	1994
Università Cattolica del Sacro Cuore - ROMA	Single-cycle master's degree / Laurea magistrale a ciclo unico	Medicine and Surgery	1984	1990

Personal Statement:

Prof. Gian Franco Zannoni is co-author of abstracts, book chapters and articles (H-index 44 by Scopus), including original studies, reviews, meta-analysis and case-reports in the field of anatomic and molecular pathology mainly concerning gynecological oncology, breast pathology and neuroendocrine neoplasms of gynaecological tract. He has been involved in multicentric studies ancd clinical trials regarding these topics in collaboration with other national and international institutions.

The overall goals of the present projects are the following:
- to develop and to finalize the mechatronic platform, being suitable for different types of human pathologies and surgical samples
- to integrate the experimental setup

Positions and honors

Positions

Institution	Division / Research group	Location	Position	From year	To year
Fondazione Policlinico Universitario A. Gemelli IRCCS - Rome	UOC Anatomia Patologica Generale	Fondazione Policlinico Universitario A. Gemelli IRCCS - Rome	Director	2022	2027
Fondazione Policlinico Universitario A. Gemelli IRCCS - Rome	UOSD Ginecopatologia e Patologia Mammaria	Fondazione Policlinico Universitario A. Gemelli IRCCS - Rome	Director	2015	2022
Università Cattolica del Sacro Cuore - Rome	Pathologic Anatomy	Università Cattolica del Sacro Cuore - Rome	Professore Associato (II Fascia) di Anatomia Patologica MED08	2015	2035

Other awards and honors

Not available

Grant

Funded by Institution	Researcher inst. where grant is/was performed	Year	Title	Position in Projects	Fund (euro)	Source website grant listed
N.A.	N.A.	N.A.	N.A.	Collaborator	0,00	N.A.

2.5 Research Collaborators n. 4

Last Name: Menciassi
First Name: Arianna

Last name at birth:
Gender: F

Title: Research collaborator
Nationality: italiana
Date of birth: 23/04/1971

Country of residence: ITALY
Country of Birth: ITALY
Place of Birth: Pisa

Official H index (Scopus or Web of Science): 57.0

Scopus Author Id:7004244810 **ORCID ID:**0000-0001-6348-1081 **RESEARCH ID:**N.A

Contact address

Current organisation name: Scuola Superiore Sant'Anna (SSA)

Current Department / Faculty / Institute / Laboratory name: The BioRobotics Institute and Department of Excellence in Robotics and AI, Scuola Superiore Sant'Anna, Pisa, Italy.

Street: v.le R. Piaggio 34
Postcode / Cedex: 56025
Town: Pontedera
Phone:+393480718865
Phone 2: +39 348 0718865

Education / training

Educational institution and location	Degree	Field of study	From year	To year
University of Pisa, Faculty of Engineering, Pisa	Master's Degree / Laurea Magistrale	McS in Physics Mark 110/110 cum laude	1990	1995
Scuola Superiore Sant'Anna	PhD	PhD in Bioengineering Mark 100/100 cum laude	1996	1999

Personal Statement:

A Menciassi has a track-record on integrating robotics and biomedicine for developing medical devices with advanced sensing technologies. She is the designer of the proof of concept aimed at improving histological analysis by combining robotics, visualization, and ultrasound technologies. Together with a variegated team of pathologists and bioengineers she contributed to the development of the first prototype and to the first histological results, by validating the system on phantom and on real tissue samples. In the ROGER project A. Menciassi leads the UO of Sant'Anna School of Advanced Studies with scientific responsibilities on the optimization of the current platform, its validation for a concrete benefit of the patients, the operators, the clinicians and the healthcare system.

Positions and honors

Positions

Institution	Division / Research group	Location	Position	From year	To year
Sant¿Anna School of Advanced Studies	Sant¿Anna School of Advanced Studies	Pisa	Assistant Professor (untenured)	2001	2006
Endotics	Endotics	Peccioli	Founding member of Era Endoscopy, now Endotics	2003	2006
Sant¿Anna School of Advanced Studies	Sant¿Anna School of Advanced Studies	Pisa	Associate Professor of Biomedical Engineering	2006	2014
Italian Institute of Technologies (IIT)	MicroBioRobotics	Pontedera	Affiliated member	2009	2013
Ecole Nationale Superiorieure de Mecaniques et des Microtechniques (ENSMM)	the FEMTO Institute	Besancon (France)	Visiting Professor	2013	2014
Universitè Pierre Marie Curie	Paris	Paris	Visiting Professor	2014	2014
Sant'Anna School of Advanced Studies	The BioRobotics Institute	Pisa	Full Professor of Biomedical Engineering (Italian Reference: 09/G2, ING-IND/34)	2014	2033

Other awards and honors

20 - KUKA Innovation Award for the HIFUSK project
17 - Women Innovation Award by WomenTech
16 - SupCam project as Special Electronic Design with the Compasso d'Oro, ADI
15 - FUTURA project awarded with TECHNOLOGY AWARD @ SMIT
07 - Gonfalone d'Argento from Tuscany Region
07 - Well-Tech Award Premio per l'innovazione che migliora la qualità della vita
2001 - Force Feedback-based Microinstrument for Measuring Tissue Properties and Pulse in Microsurgery as Best Manipulation Paper Award at ICRA

Grant

Funded by Institution	Researcher inst. where grant is/was performed	Year	Title	Position in Projects	Fund (euro)	Source website grant listed
European Commission, FP7-ICT-2009-4, Europe	Sant¿Anna School of Advanced Studies	2009-2011	SCath - Smart Catheterization	Collaborator	173.234,00	Smart Catheterization | SCATh Project | Fact Sheet | FP7 | CORDIS | European Commission (europa.eu)
Fondazione Cassa di Risparmi di Pisa	Sant¿Anna School of Advanced Studies	2010-2013	MicroVAST ¿ Microsystems for vascular diagnostics and intervention	Collaborator	1.501.540,00	Microsystems for vascular diagnostics and intervention (MICRO-VAST) - Fondazione Pisa

Funded by Institution	Researcher inst. where grant is/was performed	Year	Title	Position in Projects	Fund (euro)	Source website grant listed
European Commission, FP7-ICT-2011-7, Europe	Sant¿Anna School of Advanced Studies	2011 - 2017	STIFF-FLOP: STIFFness controllable Flexible and Learn-able manipulator for surgical Operations	Collaborator	655.232,00	STIFFness controllable Flexible and Learn-able manipulator for surgical OPerations | STIFF-FLOP Project | Fact Sheet | FP7 | CORDIS | European Commission (europa.eu)

2.6 Research Collaborators n. 5

Last Name: Santoro
First Name: Angela

Last name at birth:
Gender: F

Title: Research collaborator
Nationality: ITALIANA
Date of birth: 25/01/1981

Country of residence: ITALY
Country of Birth: ITALY
Place of Birth: Foggia

Official H index (Scopus or Web of Science): 21.0

Scopus Author Id:57197906141 **ORCID ID:**0000-0002-6964-5152 **RESEARCH ID:**AAC-5833-2022

Contact address

Current organisation name: Fondazione Policlinico Universitaria Gemelli (FPG)

Current Department / Faculty / Institute / Laboratory name: Department of Woman and Child Health, Fondazione Policlinico Universitario A. Gemelli IRCCS, Italy; Università Cattolica del Sacro Cuore, Rome, Italy.

Street: Largo Agostino Gemelli 8
Postcode / Cedex: 00168
Town: Roma
Phone:+393922319608
Phone 2:

Education / training

Educational institution and location	Degree	Field of study	From year	To year
University of Foggia - FOGGIA	Master's Degree / Laurea Magistrale	Medicine and Surgery	1999	2005
University of Foggia - FOGGIA	Specialization / Specializzazione	Anatomic Pathology and Cytopathology	2005	2010
University of Bari `Aldo Moro¿ - BARI	PhD	Analytical Morphometry and molecular medicine models	2010	2014

Personal Statement:

Dr. Angela Santoro is co-author of abstracts, book chapters and articles (H-index 21 by Scopus), including original studies, reviews, meta-analysis and case-reports in the field of anatomic and molecular pathology mainly concerning gynecological oncology, breast pathology, head and neck pathology and neuroendocrine neoplasms of gynaecological tract. She has been involved in multicentric studies regarding these topics in collaboration with other national and international institutions.

The overall goals of the present projects are the following:
- to develop and to finalize the mechatronic platform, being suitable for different types of human pathologies and surgical samples
- to integrate the experimental setup i

Positions and honors

Positions

Institution	Division / Research group	Location	Position	From year	To year
Fondazione Policlinico Universitario A. Gemelli IRCCS - Rome	UOC Anatomia Patologica	Fondazione Policlinico Universitario A. Gemelli IRCCS - Rome	Pathologist	2016	2048
Fondazione di Ricerca e Cura `Giovanni Paolo II¿ - Campobasso	UOSD Anatomia Patologica	Fondazione di Ricerca e Cura `Giovanni Paolo II¿ - Campobasso	Pathologist	2013	2016
Fondazione Policlinico Universitario A. Gemelli - Rome	UOC Anatomia Patologica	Fondazione Policlinico Universitario A. Gemelli - Rome	Fellowship `S. Komen-Italia¿	2011	2013
ASL Latina	UOC Anatomia Patologica	Presidio Ospedaliero Nord, Ospedale Santa Maria Goretti - Latina	Pathologist	2011	2011

Other awards and honors

Not available

Grant

Funded by Institution	Researcher inst. where grant is/was performed	Year	Title	Position in Projects	Fund (euro)	Source website grant listed
Protocollo 2009ZY7L4X_001 Università degli Studi di FOGGIA	University of Foggia, Foggia	2009	Ricerca di bio-marcatori del carcinoma orale nella matrice biologica della saliva mediante SELDI-TOF	Collaborator	380.256,00	https://loginmiur.cineca.it/front.php/login.html
Protocollo 20085RRRWZ_003 Università degli Studi di FOGGIA	University of Foggia, Foggia	2008	Analisi Proteomica di saliva e sangue in pazienti sottoposti a chemio e/o radioterapia	Collaborator	212.700,00	https://loginmiur.cineca.it/front.php/login.html
Protocollo 2007YMS5NS_001 Università degli Studi di FOGGIA	University of Foggia, Foggia	2007	Indagine mediante Proteinchip dei geni coinvolti nella progressione neoplastica del carcinoma orale a cellule squamose	Collaborator	238.620,00	https://loginmiur.cineca.it/front.php/login.html

2.7 Research Collaborators n. 6 - Under 40

Last Name: Oddo
First Name: Calogero Maria

Last name at birth:
Gender: M

Title: Research collaborator U40
Nationality: Italiana
Date of birth: 10/05/1983

Country of residence: ITALY
Country of Birth: ITALY
Place of Birth: Petralia Sottana

Official H index (Scopus or Web of Science): 21.0

Scopus Author Id:16176089500 **ORCID ID:**0000-0002-1489-5701 **RESEARCH ID:**N.A

Contact address

Current organisation name: Scuola Superiore Sant'Anna (SSA)

Current Department / Faculty / Institute / Laboratory name: The BioRobotics Institute and Department of Excellence in Robotics and AI, Scuola Superiore Sant'Anna, Pisa, Italy.

Street: Viale Rinaldo Piaggio 34
Postcode / Cedex: 56025
Town: Pontedera
Phone:+393316992273
Phone 2: 3316992273

Education / training

Educational institution and location	Degree	Field of study	From year	To year
University of Pisa, Faculty of Engineering, Pisa	Bachelor Degree / Laurea Triennale	BSc in Electronic Engineering, 110/110 cum laude. Electronic engineering, artificial tactile sensors (graduated as 1st student of the course)	2002	2005
Sant'Anna School of Advanced Studies, Academic Class of Experimental and Applied Sciences, Pisa	Bachelor Degree / Laurea Triennale	1st level degree in Industrial and Information Engineering, 100/100 cum laude. Bioengineering, artificial tactile sensors (admitted to honors college of Sant'Anna School of Advanced Studies after competitive selection with 10 scholarships and 334 applicants)	2002	2006
Sant'Anna School of Advanced Studies, Advanced Robotic Technologies and Systems Laboratory, Pisa	PhD	PhD in Innovative Technologies, curriculum BioRobotics, 100/100 cum laude. Bioengineering, artificial and human touch (admitted to PhD with scholarship, after competitive selection, ranking 1st in the BioRobotics curriculum)	2008	2011
University of Pisa, Faculty of Engineering, Pisa	Master's Degree / Laurea Magistrale	MSc in Electronic Engineering, 110/110 cum laude. Electronic engineering, robotic platforms for biomedical applications (graduated as 1st student of the course)	2005	2007
Sant'Anna School of Advanced Studies, Academic Class of Experimental and Applied Sciences, Pisa	Master's Degree / Laurea Magistrale	2nd level degree in Industrial and Information Engineering, 100/100 cum laude. Bioengineering, artificial tactile sensors (confirmed as honors college student of Sant'Anna school of Advanced Studies, ranking 1st in the ranking for the scholarship)	2005	2008
University of Gothenburg, Department of Physiology, Gothenburg	PhD	Visiting PhD student. Touch neurophysiology investigated with electrophysiological methods such as microneurography, microstimulation and EEG in combination with psychophysical protocols	2010	2010

Personal Statement:

CM Oddo has a track-record on integrating robotics and biomedicine for developing medical devices with advanced sensing technologies, mechatronic modules, control and communication strategies. In the ROBOTHIS project CM Oddo coordinates the development of the robotic platform for automatic palpation of histological samples, and identification of nodules in ex-vivo biological tissues based on the elaboration of information gathered via artificial touch, ultrasound and vision sensors.

CM Oddo will also co-supervise data analysis and scientific dissemination activities of the proposed clinical assessment and will be the main responsible for the definition and implementation of the exploitation plan of the proposed proof of concept.

Positions and honors

Positions

Institution	Division / Research group	Location	Position	From year	To year
Sant'Anna School of Advanced Studies	The BioRobotics Institute	Pisa	Associate Professor of Bioengineering (permanent position with tenure)	2019	2023
Sant'Anna School of Advanced Studies	The BioRobotics Institute	Pisa	Vice-coordinator of the PhD program in BioRobotics	2019	2025
Sant'Anna School of Advanced Studies	The BioRobotics Institute	Pisa	President of the University Committee for Equal Opportunities, Well-being at Work and Against Discrimination (CUG)	2021	2026
National Research Council (CNR) of Italy	Clinical Physiology Institute	Pisa	Co-PI of N2Lab joint laboratory of Microneurography and Microneurostimulation	2016	2022
ARTES 4.0 Competence Center on Advanced Robotics and enabling digital Technologies and Systems	ARTES4.0@SSSA	Pontedera	Coordinator of the BRI-SSSA Innovation and Demonstration Node, ARTES 4.0 Industry 4.0 Competence Center. SSSA representative within the ARTES 4.0 Assembly	2019	2022
Scuola Normale Superiore	Centro di Ricerca Matematica Ennio De Giorgi	Pisa	Member of the Council of the joint Center among Scuola Normale Superiore, University of Pisa and Sant¿Anna School of Advanced Studies	2016	2019
University of Pisa	Department of Information Engineering	Pisa	Adjunct Professor within the BSc in Biomedical Engineering or MSc in Bionics Engineering	2015	2023
Sant¿Anna School of Advanced Studies	The BioRobotics Institute	Pisa	Assistant Professor of Bioengineering (with tenure-track)	2016	2019
Sant¿Anna School of Advanced Studies	The BioRobotics Institute	Pisa	Assistant Professor of Bioengineering (without tenure-track)	2012	2016
Sant¿Anna School of Advanced Studies	The BioRobotics Institute	Pisa	Postdoctoral fellow in Biorobotics	2011	2012

Other awards and honors

20-21 General Co-Chair of IEEE MetroInd4.0&IoT
21 Co-organizer 10th Intern IEEE EMBSConf on Neural Engineering
19-20 IEEE Sens Council best and most innovative Italian Chapter of the year (Oddo Chapter vice-Chair)
18 Co-organizer and finance chair Intern Conf Neurorehab (ICNR)
16 Comitato dei Cento aw for bionic touch study published by eLife
12 Finalist Georges Giralt European PhD Aw
11 Working Capital aw by Telecom Italia
09 Finalist best student paper aw at IEEE RoBio conference

Grant

Funded by Institution	Researcher inst. where grant is/was performed	Year	Title	Position in Projects	Fund (euro)	Source website grant listed
European Commission, FP7-NMP-2008-SMALL-2, Europe	Sant¿Anna School of Advanced Studies	2010-2014	NANOBIOTOUCH project ¿ Nano-resolved multi-scale investigations of human tactile sensations and tissue engineered nanobiosensors. Project co-PI and leader of Workpackage 5 ¿ Integration (scientific responsible for 496033 €)	Collaborator	3.744.590,00	https://cordis.europa.eu/project/id/228844
Italian Ministry for Education, Universities and Research, PRIN Call, Italy	Sant¿Anna School of Advanced Studies	2013-2016	HANDBOT project ¿ Biomechatronic hand prostheses endowed with bio-inspired tactile perception, bi-directional neural interfaces and distributed sensori-motor control. Project co-PI and leader of Workpackage 4 ¿ Development of the biomechatronic prosthetic hand endowed with neuromorphic tactile sensors (scientific responsible for 283415 €)	Collaborator	1.230.111,00	http://handbot.unicampus.it/index.php/consortium/sssa-scuola-superiore-sant-anna-pisa
European Commission, FP7-ICT-2013-10, Europe	Sant¿Anna School of Advanced Studies	2013-2017	NEBIAS project ¿ NEurocontrolled BIdirectional Artificial upper limb and hand prosthesis. Project co-PI and leader of Workpackage 6 ¿ Neuromorphic coding of sensory information (scientific responsible for 213900 €)	Collaborator	3.464.600,00	https://cordis.europa.eu/project/id/611687/
Italian Ministry for Education, Universities and Research, Smart Cities and Social Innovation young investigator call, Italy	University off Venice	2016-2019	PARLOMA project¿ A Communication System for Deafblind People. Project co-PI and leader of Workpackage 2 ¿ New low-cost haptic interfaces (scientific responsible for 168400 €)	Collaborator	626.600,00	https://parloma.github.io/
Tuscany Region, PAR FAS 2007/2013, FAS Salute 2014 call, Italy	Sant¿Anna School of Advanced Studies	2016-2019	IMEROS project ¿ Integrated MEdical RObotic Solutions. Co-scientific responsible of SSSA partner (scientific responsible for 151675 €)	Collaborator	1.368.161,00	http://v00obo-lasth.sphostserver.com/imeros/?page_id=73

Funded by Institution	Researcher inst. where grant is/was performed	Year	Title	Position in Projects	Fund (euro)	Source website grant listed
Italian Ministry of Foreign Affairs, Projects of Significant Relevance Call, Italy	Sant¿Anna School of Advanced Studies	2016-2019	Human-Robot Co-Working as a Key Enabling Technology for the	Coordinator	50.000,00	https://www.esteri.it/mae/resource/doc/2019/05/assegnazione_a_progetti_di_grande_rilevanza_2018.pdf
Italian National Institute for Insurance against Accidents at Work (INAIL), Italy	Sant¿Anna School of Advanced Studies	2017-2020	MOTU project ¿ Protesi robotica di arto inferiore con smart socket ed interfaccia bidirezionale per amputati di arto inferiore¿. Project co-PI and leader of ¿Workpackage 5 ¿ Sistema di Feedback Aumentante¿ (scientific responsible for about 320000 €)	Collaborator	3.421.250,00	https://www.santannapisa.it/en/institute/biorobotics/motu
European Commission, H2020-FETPROACT-2018-2020, Europe	Sant¿Anna School of Advanced Studies	2019-2022	NeuHeart project ¿ A neuroprosthesis to restore the vagal-cardiac closed-loop connection after heart transplantation. Project co-PI and WP leader (scientific responsible for 259500 €)	Collaborator	4.983.465,00	https://cordis.europa.eu/project/id/824071
Italian National Institute for Insurance against Accidents at Work (INAIL), Italy	Sant¿Anna School of Advanced Studies	2021-2024	MOTU++ project ¿ Protesi robotica di arto inferiore con smart socket ed interfaccia bidirezionale per amputati di arto inferiore: personalizzazione mediante ¿human-in-the-loop optimization¿. Project co-PI and WP leader (scientific responsible for about 120000 €)	Collaborator	1.354.600,00	https://www.santannapisa.it/it/istituto/biorobotica/motu-1
Italian National Institute for Insurance against Accidents at Work (INAIL), BRIC 2018 call, Italy	Sant¿Anna School of Advanced Studies	2019-2022	SENSE-RISC project ¿ Sviluppo di abiti intelligENti Sensorizzati per prevenzione e mitigazione di RIschi per la SiCurezza dei lavoratori. Project co-PI, scientific responsible of SSSA partner	Collaborator	1.000.000,00	https://web.uniroma1.it/senseriscproject/home

2.8 Research Collaborators n. 7 - Under 40

Last Name: Auletta
First Name: Fabrizia
Last name at birth:
Gender: F

Title: Research collaborator U40
Country of residence: ITALY
Nationality: Italiana
Country of Birth: ITALY
Date of birth: 28/01/1991
Place of Birth: Nocera Inferiore

Official H index (Scopus or Web of Science): 0.0

Scopus Author Id:57219686373 **ORCID ID:**0000-0001-9314-9856 **RESEARCH ID:**N.A

Contact address

Current organisation name: Scuola Superiore Sant'Anna (SSA)
Current Department / Faculty / Institute / Laboratory name: The BioRobotics Institute and Department of Excellence in Robotics and AI, Scuola Superiore Sant'Anna, Pisa, Italy.

Street: Piazza Martiri della Libertà, 33
Postcode / Cedex: 56127
Town: Pisa
Phone:+393281578023
Phone 2:

Education / training

Educational institution and location	Degree	Field of study	From year	To year
University of Bristol, United Kingdom	Master's Degree / Laurea Magistrale	Laurea Magistrale	2017	2018
University of Naples Federico II, Naples, Italy	Master's Degree / Laurea Magistrale	McS in Automation Engineering, 100/100 cum laude	2014	2018
University of Naples Federico II, Naples, Italy	Bachelor Degree / Laurea Triennale	BSc in Electronic Engineering, 99/110	2009	2014

Personal Statement:

F Auletta's education and training focused on automatic control of electrical machines and drives, electronics, artificial intelligence, and human-machine interaction. She also completed an internship on the market analysis of haptic feedback products. In the ROBOTHIS project, she is involved in the development of the robotic platform for lumps recognition via multisensory integration of
tactile, acoustic, and vision information. She will integrate the design requirements specific to each diagnostic application object of the proof of concept to clinically validate the platform and to ease its way to the market in the specific anatomopathological sub-field. She will also perform data analysis and contribute to scientific dissemination activities of the proposed clinical assessment.

Positions and honors

Positions

Institution	Division / Research group	Location	Position	From year	To year
University of Bristol	School of Computer Science, Electrical and Electronic Engineering, and Engineering Maths	Bristol, United Kingdom	Teaching support assistant	2020	2020
Senmag robotics	Bristol, United Kingdom	Bristol, United Kingdom	Intern	2021	2021
Macquarie University	Department of Psychology, Faculty of Medicine, Health and Human Sciences	Sydney, Australia	PhD candidate	2020	2022
University of Bristol	School of Computer Science, Electrical and Electronic Engineering, and Engineering Maths	Bristol, United Kingdom	PhD candidate	2018	2022
Sant Anna School of Advanced Studies	The BioRobotics Institute	Pisa	Postdoctoral fellow in Biorobotics	2022	2023

Other awards and honors

2019 - International Macquarie University Research Excellence Scholarship Scheme awarded by Macquarie University for the PhD in Psychology under a joint degree with University of Bristol

2018 - Macquarie Cotutelle (IILF) Award awarded by the University of Bristol for the PhD in Engineering Mathematics under a joint degree with Macquarie University

2017 - Borsa di studio per l'internazionalizzazione dei corsi di studio awarded by Corso di Studi Ingegneria dell'Automazione

Grant

Funded by Institution	Researcher inst. where grant is/was performed	Year	Title	Position in Projects	Fund (euro)	Source website grant listed
N.A.	N.A.	N.A.	N.A.	Collaborator	0,00	N.A.

2.9 Additional Research Collaborators n. 2 - Under 40 to hire

Last Name: Ugolini
First Name: Filippo
Last name at birth:
Gender: M

Title: Research collaborator U40 ex novo
Country of residence: ITALY
Nationality: Italiana
Country of Birth: ITALY
Date of birth: 15/10/1990
Place of Birth: Firenze

Official H index (Scopus or Web of Science): 9.0

Scopus Author Id:57194555394 **ORCID ID:**0000-0003-3603-2111 **RESEARCH ID:**N.A

Contact address

Current organisation name: Azienda Ospedaliero-Universitaria Careggi
Current Department / Faculty / Institute / Laboratory name: Section of Pathological Anatomy, Department of Health Sciences, University of Florence, 50139, Florence, Italy.

Street: Viale Pieraccini 6
Postcode / Cedex: 50139
Town: Firenze
Phone:+393405134928
Phone 2:

Education / training

Educational institution and location	Degree	Field of study	From year	To year
University of Florence	Bachelor Degree / Laurea Triennale	Bachelor of Science in Biology, Grade: 101/110	2010	2013
University of Florence	Master's Degree / Laurea Magistrale	Master of Science in Biology, Grade: 110/110 cum laude	2013	2015
University of Florence	PhD	PhD in Pharmacology, Toxicology and Innovative Treatments (Cycle XXXII)	2016	2019

Personal Statement:

F Ugolini's education and training focused on pharmacology and cancer research. Currently, he has Post Doctoral fellowship at University of Florence focused on Bioimaging and development of AI tools for recognition of new biomarkers in solid tumors.
In the ROGER project, he is involved in handling and preparation of the biological sample in order to make it optimal for subsequent analysis, data collection and analysis and support in the bureaucracy and procedures for authorization by the ethics committee.

Positions and honors

Positions

Institution	Division / Research group	Location	Position	From year	To year
University of Florence	University of Florence, Department of Health Sciences (DSS)	Florence	Post-degree fellowship	2016	2016
University of Florence	University of Florence, Department of Health Sciences (DSS)	Florence	PhD student	2016	2019
University of Florence	University of Florence, Department of Health Sciences (DSS)	Florence	Post-doctoral fellowship	2019	2022

Other awards and honors

Not available

Grant

Funded by Institution	Researcher inst. where grant is/was performed	Year	Title	Position in Projects	Fund (euro)	Source website grant listed
N.A	N.A	N.A	N.A	Collaborator	0,00	N.A

2.10 Additional Research Collaborators n. 3 - Under 40 to hire

Last Name: SIMI
First Name: SARA
Last name at birth:
Gender: F

Title: Research collaborator U40 ex novo
Country of residence: ITALY
Nationality: Italiana
Country of Birth: ITALY
Date of birth: 04/09/1987
Place of Birth: Bagno a Ripoli

Official H index (Scopus or Web of Science): 4.0

Scopus Author Id:56708332500 **ORCID ID:**0000-0001-6145-8275 **RESEARCH ID:**N.A

Contact address

Current organisation name: Azienda Ospedaliero-Universitaria Careggi
Current Department / Faculty / Institute / Laboratory name: Section of Pathological Anatomy, Department of Health Sciences, University of Florence, 50139, Florence, Italy.

Street: Viale Pieraccini 6
Postcode / Cedex: 50139
Town: Firenze
Phone:+393391650888
Phone 2:

Education / training

Educational institution and location	Degree	Field of study	From year	To year
University of Florence	Bachelor Degree / Laurea Triennale	Bachelor of Science in Natural Sciences	2008	2012
University of Florence	Master's Degree / Laurea Magistrale	Master of Science in Natural Sciences	2012	2014

Personal Statement:

S Simi's education and training focused on Natural Sciences and Cancer research. Currently, she has Post Degree fellowship at University of Florence focused on management of patient's database.
In the ROGER project, she is involved in handling and preparation of the biological sample in order to make it optimal for subsequent analysis, data collection and management of database of patients and support in the bureaucracy and procedures for authorization by the ethics committee.

Positions and honors

Positions

Institution	Division / Research group	Location	Position	From year	To year
University of Florence	University of Florence, Department of Health Sciences (DSS)	Florence	Post-degree fellowship	2017	2023

Other awards and honors

Not available

Grant

Funded by Institution	Researcher inst. where grant is/was performed	Year	Title	Position in Projects	Fund (euro)	Source website grant listed
N.A.	N.A.	N.A.	N.A.	Collaborator	0,00	N.A.

2.11 Additional Research Collaborators n. 4 - Under 40 to hire

Last Name: NUVOLI
First Name: LUCA
Last name at birth:
Gender: M

Title: Research collaborator U40 ex novo
Country of residence: ITALY
Nationality: Italiana
Country of Birth: ITALY
Date of birth: 18/10/1989
Place of Birth: Sassari

Official H index (Scopus or Web of Science): 5.0

Scopus Author Id:57188724078 **ORCID ID:**0000-0002-6371-1112 **RESEARCH ID:**N.A

Contact address

Current organisation name: Azienda Ospedaliero Universitaria di Sassari (AOUS)
Current Department / Faculty / Institute / Laboratory name: Section of Pathological Anatomy, Department of Health Sciences, University of Florence, 50139, Florence, Italy.

Street: Sassari
Postcode / Cedex: 07100
Town: Sassari
Phone:+393493242163
Phone 2:

Education / training

Educational institution and location	Degree	Field of study	From year	To year
University of Cagliari	PhD	Chemical Science and Technology ¿ PhD Thesis: Material Chemistry	2015	2019
University of Sassari	Master's Degree / Laurea Magistrale	Chemical Science ¿ MD Thesis ¿ Analytical Chemistry	2012	2014
University of Sassari	Bachelor Degree / Laurea Triennale	Chemistry - BD Thesis: Biochemistry	2009	2012

Personal Statement:

He is a Chemist, Ph.D. since 2019, in Chemical Science and Technology. In this project, the researcher will carry out laboratory investigations for screening or diagnostic purposes, from chemical o biochemical point of view, handling and preparating the biological samples in order to make it optimal for subsequent analysis, data collection and analysis.

Positions and honors

Positions

Institution	Division / Research group	Location	Position	From year	To year
University of Sassari	Organic Chemistry	Sassari (SS)	Research Fellowship	2019	2020

Other awards and honors

Not available

Grant

Funded by Institution	Researcher inst. where grant is/was performed	Year	Title	Position in Projects	Fund (euro)	Source website grant listed
N.A.	N.A.	N.A.	N.A.	Collaborator	0,00	N.A.

2.12 Additional Research Collaborators n. 5 - Under 40 to hire

Last Name: Cangemi
First Name: Michela
Last name at birth:
Gender: F

Title: Research collaborator U40 ex novo
Country of residence: ITALY
Nationality: Italiana
Country of Birth: ITALY
Date of birth: 30/11/1989
Place of Birth: Alghero

Official H index (Scopus or Web of Science): 7.0

Scopus Author Id:56562847400 **ORCID ID:**0000-0001-7592-0969 **RESEARCH ID:**AAB-8437-2022

Contact address

Current organisation name: Azienda Ospedaliero Universitaria di Sassari (AOUS)
Current Department / Faculty / Institute / Laboratory name: Section of Pathological Anatomy, Department of Health Sciences, University of Florence, 50139, Florence, Italy.

Street: viale san pietro, 43
Postcode / Cedex: 07100
Town: Sassari
Phone:+393409609850
Phone 2:

Education / training

Educational institution and location	Degree	Field of study	From year	To year
University of Sassari	Bachelor Degree / Laurea Triennale	Bachelor's degree in Biotechnology	2008	2012
University of Torino	Master's Degree / Laurea Magistrale	Preclinical immunotheapy	2012	2014
University of Udine	PhD	Immunopathology and Cancer Biomarkers	2015	2018
University of Sassari	Specialization / Specializzazione	Clinical biochemistry	2019	2023

Personal Statement:

M Cangemi is a biotechnologist, PhD since 2019, and in recent years she has been pursuing graduate school in pathology and clinical biochemistry. In the ROGER project she is involved in handling and preparation of the biological sample in order to make it optimal for subsequent analysis, data collection and analysis and support in the bureaucracy and procedures for authorization by the ethics committee.

Positions and honors

Positions

Institution	Division / Research group	Location	Position	From year	To year
University of Sassari	Department of biomedical sciences/clinical biochemistry lab	Sassari (SS)	Regional-Fellowship	2019	2023
Centro di riferimento oncologico di Aviano	Translational Research Department, Immunopathology and Cancer Biomarkers Unit	Aviano (PN)	Research fellowship	2019	2019
University of Udine/ Centro di riferimento oncologico di Aviano	Translational Research Department, Immunopathology and Cancer Biomarkers Unit	Aviano (PN)	Ph.D student	2015	2018

Other awards and honors

2019 - Winner of a Sardinian regional fellowship for resident in Clinical biochemistry and clinical pathology specialization school

Grant

Funded by Institution	Researcher inst. where grant is/was performed	Year	Title	Position in Projects	Fund (euro)	Source website grant listed
N.A.	N.A.	N.A.	N.A.	Collaborator	0,00	N.A.

2.17 Expertise Research Collaborators

Selected peer-reviewed publications of the Research Group / Collaborators

Collaborato	Title	Type	Pag	Vol	Year	DOI	PMID	Cit.**	P.*
Cangemi Michela	Cytokine-induced killer cells as immunotherapy for solid tumors: Current evidence and perspectives	Review	999-1010	7	2015	10.2217/imt.15.61	26310715	15	C
Cangemi Michela	Dissecting the multiplicity of immune effects of immunosuppressive drugs to better predict the risk of de novo malignancies in solid organ transplant patients	Article	NOT_FOUND	9	2019	10.3389/fonc.2019.00160	NOT_FOUND	9	F
Cangemi Michela	Clinical and antitumor immune responses in relapsed/refractory follicular lymphoma patients after intranodal injections of IFN?-Dendritic cells and rituximab: A phase i clinical trial	Review	5231-5241	25	2019	10.1158/1078-0432.CCR-19-0709	31171545	9	O
Cangemi Michela	Cytokine-induced killer cells kill chemo-surviving melanoma cancer stem cells	Article	2277-2288	23	2017	10.1158/1078-0432.CCR-16-1524	27815354	16	O
Cangemi Michela	Radical hemithoracic radiotherapy induces systemic metabolomics changes that are associated with the clinical outcome of malignant pleural mesothelioma patients	Article	1-16	13	2021	10.3390/cancers13030508	NOT_FOUND	2	O
NUVOLI LUCA	Structural, thermal, and mechanical properties of gelatin-based films integrated with tara gum	Article	NOT_FOUND	214	2021	10.1016/j.polymer.2020.123244	NOT_FOUND	4	F
NUVOLI LUCA	Semi-interpenetrating polymer networks of methyl cellulose and polyacrylamide prepared by frontal polymerization	Article	1268-1274	55	2017	10.1002/pola.28498	NOT_FOUND	7	O
NUVOLI LUCA	Double responsive copolymer hydrogels prepared by frontal polymerization	Article	2166-2170	54	2016	10.1002/pola.28087	NOT_FOUND	10	F
NUVOLI LUCA	?-Cyclodextrin-based supramolecular poly(N-isopropylacrylamide) hydrogels prepared by frontal polymerization	Article	249-255	166	2017	10.1016/j.carbpol.2017.02.099	28385230	12	O

Collaborato	Title	Type	Pag	Vol	Year	DOI	PMID	Cit.**	P.*
NUVOLI LUCA	Synthesis and characterization of poly(2-hydroxyethylacrylate)/?-cyclodextrin hydrogels obtained by frontal	Article	166-171	150	2016	10.1016/j.carbpol.2016.05.017	27312626	13	O
SIMI SARA	Genome-wide association meta-analyses combining multiple risk phenotypes provide insights into the genetic architecture of cutaneous melanoma susceptibility	Article	494-504	52	2020	10.1038/s41588-020-0611-8	32341527	43	O
SIMI SARA	Managing of Procambarus clarkii by X-ray sterilisation of males: Cytological damage to gonads	Article	32-40	77	2015	10.1016/j.micron.2015.05.016	26093477	5	O
SIMI SARA	The density and spatial tissue distribution of CD8⁺ and CD163⁺ immune cells predict response and outcome in melanoma patients receiving MAPK inhibitors	Article	NOT_FOUND	7	2019	10.1186/s40425-019-0797-4	31730502	17	O
SIMI SARA	Digital immunophenotyping predicts disease free and overall survival in early stage melanoma patients	Article	1-20	10	2021	10.3390/cells10020422	33671367	1	O
Ugolini Filippo	The selective antagonism of adenosine A<inf>2B</inf> receptors reduces the synaptic failure and neuronal death induced by oxygen and glucose deprivation in rat CA1 hippocampus in vitro	Article	NOT_FOUND	9	2018	10.3389/fphar.2018.00399	NOT_FOUND	17	O
Ugolini Filippo	Different Patterns of Neurodegeneration and Glia Activation in CA1 and CA3 Hippocampal Regions of TgCRND8 Mice	Article	NOT_FOUND	10	2018	10.3389/fnagi.2018.00372	NOT_FOUND	12	F
Ugolini Filippo	Recognition of Cutaneous Melanoma on Digitized Histopathological Slides via Artificial Intelligence Algorithm	Article	NOT_FOUND	10	2020	10.3389/fonc.2020.01559	NOT_FOUND	7	O
Ugolini Filippo	The anti-migraine component of butterbur extracts, isopetasin, desensitizes peptidergic nociceptors by acting on TRPA1 cation channel	Article	2897-2911	174	2017	10.1111/bph.13917	28622417	20	O
Ugolini Filippo	A Fast and Automated Melanin-bleaching Method for Histopathologic Evaluation of Pigmented Melanoma Tissues	Article	NOT_FOUND	NOT_FOUND	2021	10.1097/PAI.0000000000001004	NOT_FOUND	0	F

Collaborato	Title	Type	Pag	Vol	Year	DOI	PMID	Cit.**	P.*
Auletta Fabrizia	Herding stochastic autonomous agents via local control rules and online target selection strategies	Article	469-481	46	2022	10.1007/s10514-021-10033-6	NOT_FOUND	0	F
Oddo Calogero Maria	A mechatronic platform for computer aided detection of nodules in anatomopathological analyses via stiffness and ultrasound measurements	Article	NOT_FOUND	19	2019	10.3390/s19112512	31159334	2	L
Oddo Calogero Maria	Artificial spatiotemporal touch inputs reveal complementary decoding in neocortical neurons	Article	NOT_FOUND	8	2017	10.1038/srep45898	28374841	16	L
Oddo Calogero Maria	Bioengineering: Restoring natural sensory feedback in real-time bidirectional hand prostheses	Article in press	NOT_FOUND	6	2014	10.1126/scitranslmed.3006820	24500407	388	O
Oddo Calogero Maria	Neuromorphic Artificial Touch for Categorization of Naturalistic Textures	Article	819-829	28	2017	10.1109/TNNLS.2015.2472477	26372658	53	L
Oddo Calogero Maria	Intraneural stimulation elicits discrimination of textural features by artificial fingertip in intact and amputee humans	Article	NOT_FOUND	5	2016	10.7554/eLife.09148	26952132	110	F
Santoro Angela	Prognostic implications of node metastatic features in OSCC: A retrospective study on 121 neck dissections	Article	2697-2704	30	2013	10.3892/or.2013.2779	24100780	15	C
Santoro Angela	Role of Runx2 phosphorylation in prostate cancer and association with metastatic disease	Article	366-376	35	2016	10.1038/onc.2015.91	25867060	35	O
Santoro Angela	Volume changes of iliac crest autogenous bone grafts after vertical and horizontal alveolar ridge augmentation of atrophic maxillas and mandibles: A 6-year computerized tomographic follow-up	Article	2559-2565	70	2012	10.1016/j.joms.2012.07.040	22959878	54	O
Santoro Angela	Pathological chemotherapy response score in patients affected by high grade serous ovarian carcinoma: The prognostic role of omental and ovarian residual disease	Article	NOT_FOUND	9	2019	10.3389/fonc.2019.00778	NOT_FOUND	11	F
Santoro Angela	New pathological and clinical insights in endometrial cancer in view of the updated esgo/estro/esp guidelines	Review	NOT_FOUND	13	2021	10.3390/cancers13112623	NOT_FOUND	15	F

Collaborato	Title	Type	Pag	Vol	Year	DOI	PMID	Cit.**	P.*
Menciassi Arianna	Soft Robotics Technologies to Address Shortcomings in Today's Minimally Invasive Surgery: The STIFF-FLOP Approach	Article	122-131	1	2014	10.1089/soro.2014.0001	NOT_FOUND	249	L
Menciassi Arianna	A fully implantable device for intraperitoneal drug delivery refilled by ingestible capsules	Article	NOT_FOUND	6	2021	10.1126/scirobotics.abh3328	34408097	1	L
Menciassi Arianna	Biomedical applications of soft robotics	Review	143-153	3	2018	10.1038/s41578-018-0022-y	NOT_FOUND	364	O
Menciassi Arianna	A Soft Modular Manipulator for Minimally Invasive Surgery: Design and Characterization of a Single Module	Article	187-200	32	2016	10.1109/TRO.2015.2507160	NOT_FOUND	106	L
Menciassi Arianna	A bioinspired soft manipulator for minimally invasive surgery	Article	NOT_FOUND	10	2015	10.1088/1748-3190/10/3/035008	25970550	178	L
ZANNONI GIAN FRANCO	Imaging in gynecological disease (12): clinical and ultrasound features of invasive and non-invasive malignant serous ovarian tumors	Article	788-799	50	2017	10.1002/uog.17414	28101917	43	C
ZANNONI GIAN FRANCO	Role and prognostic significance of the epithelial-mesenchymal transition factor ZEB2 in ovarian cancer	Article	18966-18979	6	2015	10.18632/oncotarget.3943	26136338	43	O
ZANNONI GIAN FRANCO	Near-Infrared Imaging with Indocyanine Green for Detection of Endometriosis Lesions (Gre-Endo Trial): A Pilot Study	Article	1249-1254	25	2018	10.1016/j.jmig.2018.02.023	29551477	32	C
ZANNONI GIAN FRANCO	The expression ratios of estrogen receptor ? (ER?) to estrogen receptor ?1 (ER?1) and ER? to ER?2 identify poor clinical outcome in endometrioid endometrial cancer	Article	1047-1054	44	2013	10.1016/j.humpath.2012.09.007	23266443	25	F
ZANNONI GIAN FRANCO	Early-stage cervical cancer: Tumor delineation by magnetic resonance imaging and ultrasound - A European multicenter trial	Article	449-453	128	2013	10.1016/j.ygyno.2012.09.025	23022593	83	O
Cossu Antonio Giuseppe Maria	Female Adnexal Tumors of Probable Wolffian Origin (FATWO): A Case Series with Next-Generation Sequencing Mutation Analysis	Article	575-581	36	2017	10.1097/PGP.0000000000000368	28463911	19	F
Cossu Antonio Giuseppe Maria	Epidemiology of thyroid cancer in an area of epidemic thyroid goiter	Article	NOT_FOUND	2013	2013	10.1155/2013/584768	NOT_FOUND	8	F

Collaborato	Title	Type	Pag	Vol	Year	DOI	PMID	Cit.**	P.*
Cossu Antonio Giuseppe Maria	A functional mammalian target of rapamycin complex 1 signaling is indispensable for c-Myc-driven hepatocarcinogenesis	Article	167-181	66	2017	10.1002/hep.29183	28370287	61	O
Cossu Antonio Giuseppe Maria	Combined CDK4/6 and pan-mTOR inhibition is synergistic against intrahepatic cholangiocarcinoma	Article	403-413	25	2019	10.1158/1078-0432.CCR-18-0284	30084835	34	O
Cossu Antonio Giuseppe Maria	Effect of dabrafenib on melanoma cell lines harbouring the BRAF^{V600D/R} mutations	Article	NOT_FOUND	13	2013	10.1186/1471-2407-13-17	23317446	23	O

* Position: F=First L=Last C=Correspondent O=Other N=Not applicable

** Autocertificated

3 - Ethics

1. HUMAN EMBRYOS/FOETUSES	
Does your research involve Human Embryonic Stem Cells (hESCs)?	No
Does your research involve the use of human embryos?	No
Does your research involve the use of human foetal tissues / cells?	No
2. HUMANS	
Does your research involve human participants?	No
Does your research involve physical interventions on the study participants?	No
3. HUMAN CELLS / TISSUES	
Does your research involve human cells or tissues (other than from Human Embryos/ Foetuses?	Yes
4. PERSONAL DATA	
Does your research involve personal data collection and/or processing?	Yes
Does your research involve further processing of previously collected personal data (secondary use)?	Yes
5. ANIMALS	
Does your research involve animals?	No

6. ENVIRONMENT & HEALTH and SAFETY	
Does your research involve the use of elements that may cause harm to the environment, to animals or plants?	No
Does your research deal with endangered fauna and/or flora and/or protected areas?	No
Does your research involve the use of elements that may cause harm to humans, including research staff?	No
7. DUAL USE	
Does your research involve dual-use items in the sense of Regulation 428/2009, or other items for which an	No
8. EXCLUSIVE FOCUS ON CIVIL APPLICATIONS	
Could your research raise concerns regarding the exclusive focus on civil applications?	No
9. MISUSE	
Does your research have the potential for misuse of research results?	No
10. OTHER ETHICS ISSUES	
Are there any other ethics issues that should be taken into consideration? Please specify	No

I confirm that I have taken into account all ethics issues described above and that, if any ethics issues apply, I will complete the ethics self-assessment and attach the required documents.	X

4 - Call-specific questions

Eligibility	
I acknowledge that I am aware of the eligibility requirements for applying as specified in the Call-PNRRXXXX_M6/C2, and certify that, to the best of my knowledge my application is in compliance with all these requirements. I understand that my proposal may be declared ineligible at any point during the evaluation or granting process if it is found not to be compliant with these eligibility criteria.	X
I confirm that the proposal that I am about to submit draws substantially don't repeat on an existing or recently finished GRANT funded.	X
Data-Related Questions and Data Protection (Consent to any question below is entirely voluntary. A positive or negative answer will not affect the evaluation of your project proposal in any form and will not be communicated to the evaluators of your project.)	
For communication purposes only, the MoH asks for your permission to publish,in whatever form and medium, your name, the proposal title, the proposal acronym, the panel, and host institution, should your proposal be retained for funding.	X
Some national and regional public research funding authorities run schemes to fund MoH applicants that score highly in the MoH's evaluation but which can not be funded by the MoH due to its limited budget. In case your proposal could not be selected for funding by the MoH do you consent to allow the MoH to disclose the results of your evaluation (score and ranking range) together with your name, non- confidential proposal title and abstract, proposal acronym, host institution and your contact details to such authorities?	X

The MoH is sometimes contacted for lists of MoH funded researchers by institutions that are awarding prizes to excellent researchers. Do you consent to allow the MoH to disclose your name, non-confidential proposal title and abstract, proposal acronym, host institution and your contact details to such institutions?	X
The Ministry of Health occasionally could contacts Principal Investigators of funded proposals for various purposes such as communication campaigns, pitching events, presentation of their project's evolution or outcomes to the public, invitations to represent the Ministry of Health in national and international forums, studies etc. Should your proposal be funded, do you consent to the Ministry of Health staff contacting you for such purposes?	X
For purposes related to monitoring, study and evaluating implementation of MoH actions, the MoH may need that submitted proposals and their respective evaluation data be processed by external parties. Any processing will be conducted in compliance with the requirements of Regulation 45/2001.	

5 – Description Project

Summary description

Histopathological examination of tissue specimens removed during surgery is a key step for cancer diagnosis, prognosis, and best treatment option. In the surgical pathology laboratory, pathologists undertake careful visual inspection and manual palpation for qualitative assessment and tissue-selective sampling of resected specimens with suspect pathologies, including lymph nodes. This procedure relies on pathologist¿s expertise and can be labor-intensive and time-consuming. A patented multisensory robot was developed by our team to assist pathologists in such assessment. The goal of the ROGER project is to customize the platform to provide personalized solutions to different tissues and perform a multicentric study to assess the patented robot in analyzing the tactile-acoustic-visual characteristics of resected tissue specimens. ROGER targets gastrointestinal and skin/soft tissues, breast, and gynecological tissues and will move from Technology Readiness Level 4 to 7.

Background / State of the art

Conventional grossing of tissues within histopathological examination relies on visual inspection and manual palpation by expert pathologists or PAs to identify and localize suspicious specimens to be resected. These samples vary in number and biomechanical properties depending on the (i) tissue characteristics and (ii) related pathology.
To reduce the clinical burden and time required for grossing tissue samples, and to lower inter-pathologist variability in sample assessment, our group proposed an automated robotic platform that exploits force and ultrasound measurements to identify hard inclusions in soft tissue phantoms [1]. Subsequently, the platform was enriched with an embedded algorithm to process data collected by the ultrasound sensors enhancing the platform in (i) localizing irregular masses of agar inserted in excised liver tissues and (ii) identifying regions to be resected [2]. These results were obtained within the IMEROS project (Tuscany Region, FAS-Salute call). In its follow-up, IMEROS++ (Joint Universities program for PoC, Ministry of Economic Development) the robot was enhanced by (i) integrating a stereo-vision system to discriminate and localize nodules within tissues more precisely so that suspicious pathologic tissues can be separated from healthy unaffected specimens, (ii) functionally re-designing the platform to reduce the overall dimensions and weight, increasing its mobility and scanning velocity.

Description and distribution of activities of each operating unit

The ROGER project is organized in three specific aims targeting different surgical specimens from various anatomical sites, each articulated along three phases:
- Phase 1: customization of the robotic platform to the specific biomechanical requirements of each targeted tissue and

pathology
- Phase 2: multicentric feasibilty pilot study to assess the developed platform
- Phase 3: data analysis and exploitation plan

Within the first phase of each specific aim, the patented technology will be customized by the bioengineering partner (Operative Unit 4, SSSA) to integrate specific mechatronic tools and develop tailored recognition algorithms to detect, localize and classify nodules in gastrointestinal and skin/soft tissues, breast, and gynecological tissues. Operative Unit 2 (AOUS) will contribute to the acquisition of the components that are needed for replicating the platforms in preparation of the multicentric study and to appointing independent certification partners.

In the second phase of each specific aim, the validation will be performed by the clinical partners (OU 1, 2 and 3) with the support of the bioengineering partner (OU 4) according to the following experimental protocol.
The surgical pathology specimens resected at the Operative Units will be submitted to routine gross (macroscopic) examination which includes description and sampling for histopathological examination. The robot will be tested on the fixed residual tissues that are archived for 15 days from the date of the histopathological report and then destroyed as by protocols in place.

Primary aims: to assess the non-destructive impact of the robot on the tissues and accuracy in lymph node or nodules retrieval (including clinically non-detectable small alterations, size less than 5 mm), suspect nodular lesion recognition comparable to human abilities.
Secondary aims: to assess the time for identifying suspect alterations and ability to create an annotated database obtained from all platform sensors including gross and radiological images of clinical history, and performance variability according to different tissue biomechanical properties.

Inclusion criteria: fixed residual tissues stored for 15 days as per protocol of adults older than 18 years old that signed the informed consent and enrollment according to the Declaration of Helsinki.
Exclusion criteria: samples not belonging to the fixed residual tissues or fixed residual tissues stored for less than 15 days from the date of the diagnostic report.
Sample size: approximately 200 biological specimens from 100 patients per each specific aim (gastrointestinal and skin/soft tissues in aim 1 headquartered in Florence, breast in aim 2 in Sassari, and gynecological tissues in aim 3 in Rome).
Enrollment procedure: informed consent is given at the time of the surgical visit (in compliance with Article 13 of the GDPR).
Definition of study conclusion: for each patient, the study end after the surgical resection of the specimen, the storage of the fixed residual tissues, and its analysis.
Data collection and analysis: the patient data will be collected in an ad-hoc form and computerized in a central database. Individual data will be computerized by encrypting the patient's identification data (i.e., an ID is associated with each fixed residual tissue whose re-association key is available to the OU scientific coordinator, namely Prof. Massi for OU1, Prof. Cossu for OU2 and Prof. Zannoni for OU3).

5.4 Specific Aims and Experimental Design

Specific aim 1

Customize the patented robotic platform for surgical samples of the gastrointestinal (GI) tract and skin/soft tissues and validate it through quantitative investigations of tactile-acoustic-visual characteristics of solid-tumor of fixed residual tissues. The platform will be tested on excised specimens from patients undergone gastrointestinal tract surgery, including liver resections for neoplastic conditions, bowel resections for non-neoplastic conditions as well as wide excisions for skin cancer and soft tissue tumors at OU1.

Aim 1.1: customization of the robotic platform to the specific biomechanical requirements of the gastrointestinal tract and skin/soft tissues.
The platform will be customized to detect and identify pathological alteration on fixed residual tissues. The customization will target the calibration of (i) the operative space of the platform, (ii) the sensibility of sensors and (iii) classification algorithms implemented based on the collected data.
Specimens from the GI tract have a large variability and are non-uniform, therefore the range of movement of the platform will be designed to operate in a large workspace of about 400 mm by 400 mm, both with thin samples (a few mm) and thick ones (several cm). Secondly, the stiffness, acoustic and visual measurements performed by the robot will be tuned to detect variations in the biomechanical characteristics of tissues.The stereo-camera vision system will acquire the image of each specimen analyzed. The information collected will be used to (i) generate a 3D model of the same to drive the indentation process of the robot and (ii) apply intelligent classification algorithms to detect visual differences between the sample itself and healthy tissues.

Aim 1.2: pilot study to assess the developed platform at Careggi University Hospital.
The majority of GI tract resections and skin/soft tissue resections operated at OU1 are complex tumor tissue specimens: bowel limited resection, hemicolectomy and colectomy, gastrectomy, partial hepatectomy, pancreatectomy, skin/soft tissue excision. In gastrointestinal resection cancer specimens, the robotic prototype will be used to identify: i) small (<5 mm) neoplastic nodules in surgical resections, especially in post-NACT settings; ii) small (<5 mm) nodules in omentum and peritoneum; iii) not detectable neoplastic tissue and lymph-nodes by gross examination of the specimen, especially in patients previously chemo-radio-treated, to sample a minimum of 12 nodules for accurate staging and to identify the residual neoplastic tissue in the colon. Skin/soft tissue specimens include: i) soft/hard soft tissue nodules in dermal/subcutaneous, intramuscular location; ii) nodular satellitosis in cutaneous melanoma; iii) lymph-nodes by gross examination of fat tissue, including metastatic lymph nodes after neo-adjuvant treatment. The evaluation of stiffness and acoustic properties will be performed by indenting the tissue at multiple points. Such indentation points will be computed from the 3D model of the specimen. At each indentation point, the ultrasound probe will collect acoustic properties of the tissue while its stiffness will be evaluated by position and force measurements. The customization of the platform will involve calibrating the range of the variations in stiffness of tissues and density detectable. For example, normal liver tissue has a Young's modulus between 4 and 10 kPa, yet the stiffness of a liver cancer tends to be higher (20 to 50 kPa or higher Youngs modulus) [3,4], to this end, the force sensor will be tuned to detect differences in the order of kPa.

Aim 1.3: Data analysis and exploitation plan. The validation of the platform diagnostic result will be performed statistically comparing the robot-assisted gross examination with the diagnostic result given by the operator after having performed the manual gross examination of the same sample.

Specific aim 2

Customize the patented robotic platform for surgical samples of the breast district and validate it through quantitative investigations of tactile-acoustic-visual characteristics of solid-tumor of fixed residual tissues
The platform will be validated on excised specimens from patients submitted to breast surgery at the OU2 under the coordination of Prof. Cossu. Any type of breast specimen will be studied (excisional biopsy, lumpectomy, quadrantectomy, mastectomy, axillary dissection).

Aim 2.1: customization of the robotic platform to the specific biomechanical requirements of the breast tissues.
The robotic platform will be customized to operate on the fixed residual tissues from patients submitted to excisional biopsy, lumpectomy, quadrantectomy, mastectomy, axillary dissection.
The residual tissues of breast district tissue contain a large variety of specimens, ranging from small dimension of 5 mm to bigger specimens >15 mm. To compensate such variability the operating space will be designed to reach about 200 mm by 200 mm.

Aim 2.2: pilot study to assess the developed platform at Sassari University Hospital.
The performance of the robotic prototype in breast specimens will be applied to the recognition of: i) Small multicentric/multifocal invasive neoplastic foci in extensive in situ disease and eventually their distance from surgical margins; ii) Small multicentric/multifocal invasive neoplastic foci in mastectomy/lumpectomy samples and eventually their distance from surgical margins; iii) Small tumor beds in post-NACT mastectomy/lumpectomy samples and eventually their distance from surgical margins; iv) Not detectable lymph-nodes by gross examination of axillary fatty tissue, either in non-treated patients or in patients preliminarly subjected to neoadjuvant therapy, in order to allow staging of the disease as accurate as possible (minimum 20 lymph nodes identified); v) Lymph nodes with different tissue properties: fatty or fibrotic nodes, especially after treatment, in order to evaluate the pathological response.
As described in Aim 1.2, for each specimen, the platform will (1) 3D reconstruct it through stereo-camera acquisition, (2) compute the best strategy to indent the specimen and (3) perform measurements of stiffness of the tissues and their acoustic properties. The majority of breast interventions operated at the OU2 relate to excision of breast specimens and analyses will require sensors to be adapted to the target elastic modulus [5].

Aim 2.3: data analysis and exploitation plan.
The specimen data measured by the platform on the fixed residual tissued and the diagnosis given by the operator, after a manual examination of the same, will also be stored in pseudonymized form. Such collected data will be statistically analyzed as also described in Aim 1.3.
An exploitation plan will be designed for roadmapping the translational application of the proposed technological solution for surgical samples of the breast district.

Specific aim 3

Customize the patented robotic platform for surgical samples of the gynecological district and validate it through quantitative investigations of tactile-acoustic-visual characteristics of solid-tumor residual tissues.
The platform will be validated on excised specimens from patients submitted to gynecological surgery and analyzed at the OU3 (Prof. Zannoni). Gynecological tract resections are complex specimens taken from bilateral/monolateral hystero-adnexectomy for neoplastic and non-neoplastic conditions, omentectomy, multiple peritoneal biopsies, colpectomy, cystectomy, colo-rectal resections, splenectomy, pelvic and para-aortic node dissections. Other surgical procedures include conization (cone biopsy), LEEP (loop electrosurgical excision procedure), vulvectomy, vulvar biopsies or uterine polipectomy. After the first phase of customization of the platform to perform gross examination of tissues from the gynecological district, the platform will be validated on in the anatomical pathology laboratories of OU3 (phase 2), with collected data analyzed to assess the ability of the platform to assist operators.

Aim 3.1: customization of the robotic platform to the specific biomechanical requirements of the gynecological tissues.
The fixed residual tissues from the gynecological tract contains a large variety of complex surgical specimens, ranging from small dimension of less than 5 mm to bigger specimens (more than 20 cm). To compensate such variability the operating space will be designed to reach about 300 mm by 300 mm and force sensors will be tuned to detect elastic modulus variations in the order of hundreds of Pa.

Aim 3.2: pilot study to assess the developed platform at Gemelli Policlinic University Hospital.
The performance of the prototype will be applied for the identification of: i) small (less than 5 mm) invasive and non-invasive peritoneal/omental implants of ovarian borderline tumors; ii) residual tumor in ovaries and other pathological extraovarian tissues in advanced treated High Grade Serous Carcinoma or following neoadjuvant therapy; iii) residual tumor in post-neoadjuvant chemotherapy cervix and parametrial/paracervical tissues in locally advanced cervical cancer; iv) small cancer foci in excised uteri in case of previous diagnosis of atypical endometrial hyperplasia; v) multicentric/multifocal neoplastic disease in vulvar specimens with assessment of surgical margins; vi) not detectable lymph-nodes by gross examination of

fat tissue.
As described in Aim 1.2 and 2.2, a 3D reconstruction of each specimen, created from stereo-camera acquisition, will allow the platform to compute the best indentation strategy to perform multiple measurements of stiffness of tissues and their acoustic properties through the compliant vertical actuator and the ultrasound probe, respectively.

Aim 3.3: data analysis and exploitation plan.
The diagnostic result of the platform, based on force measurements, ultrasound signals, indentation position, and images, will be compared with the diagnostic result given by the operator after having performed the manual gross examination of the same sample. Statistical analyses will evaluate the adequateness of the machine as described in Aims 1.3 and 2.3.
An exploitation plan will be designed for roadmapping the translational application of the proposed technological solution for surgical samples of the gynecological district.

Experimental design aim 1

Aim 1 involves the customization and validation of the patented robotic platform on residual fixed tissue specimens of the gastrointestinal tract and skin/soft tissues.

Pairs of specimens from the same patient or from the same anatomical district, if comparable in size/shape, will be randomly assigned to either the pathologist or the platform for the Gross Examination (GE), otherwise, if the size/shape is not comparable, the tissue specimen will be divided into comparable sections and randomly assigned to the pathologist or to the platform.

In the traditional GE procedure, as done by trained pathologists, gastrointestinal resection specimens are oriented, and the length, diameter, and wall thickness are measured. GE of non-neoplastic resections, requires sequential sections, including transition regions between normal and diseased segments, margins, and lymph nodes. In neoplastic specimens, the maximal size of the tumor and the distance to the proximal and distal resection margins are documented; resection margins are inked as appropriate. GE of the lesion includes colors, viability, texture, and nodularity. The tumor is then sectioned to assess the depth of invasion; blocks for microscopic examination are taken to include the area of deepest penetration and the relationship to adjacent grossly non-neoplastic mucosa. Additional sections include proximal and distal resection margins; the mesentery and soft tissue are also manually explored to isolate lymph nodes. In wide skin and soft tissue resections, the macroscopic examination is guided by tumor location, extent, and type. Margins are inked, and the distance from the tumor to the closest margin is documented. The tumor maximum dimension is recorded, as well as the color and consistency of the cut surface, and the presence of hemorrhage and necrosis.

The targeted procedure to assess the robotic platform with the evaluation of residual fixed tissue samples is:
a) sample reception;
b) positioning of the sample on the platform tray;
c) association of a unique sample ID to the sample and input of the code into the dedicated database and creation of a digital folder storing platform measurements;
d) detection by HD camera of the sample image, extrapolation of its contour and subsequent definition of the matrix of points to be indented (indentation matrix). The software generates the indentation matrix by randomly selecting the pitch (i.e., the angle w.r.t. the horizontal plane) among the values 1, 3, 5, 7, and 9 mm scanning the entire sample, so that data analysis will provide statistical information on the trade-off between spatial resolution and the number of indentation sites (affecting sample exploration time);
e) indentation of the matrix of points created in d) and acquisition of vision, tactile and ultrasound data. Tactile and ultrasound data are collected via the central probe. For each point of the indentation matrix, the compression force generated between the probe and the sample is recorded with the dynamic trajectory of the end-effector; above an interaction force threshold, a trigger signal is generated enabling the transmission of the ultrasonic pulse;

f) tactile, ultrasound, and vision data processing for the classification of indented points;
g) generation of maps of suspected areas of inclusion, to be superimposed on the real image of the sample originally acquired;
h) saving of all the results collected in the folder created at point c).

As ancillary study, a haptic glove [11] will be used to selectively telepalpate areas of pathological interest of the gastrointestinal tract and skin/soft tissues, delivering vibrotactile feedback about the specimen properties to allow perceiving: solid or cystic lesions, solid versus soft nodules, hemorrhagic or necrotic areas, calcification, metaplastic ossification, soft versus fleshy cut surface, infiltrative/pushing borders.

Experimental design aim 2

Aim 2 involves the customization and validation of the patented robotic platform on residual fixed tissue specimens of the breast district (excisional biopsy, lumpectomy, quadrantectomy, mastectomy, axillary dissection).

Pairs of residual fixed tissue specimens from the same patient or from the same anatomical district, if comparable in size/shape, will be randomly assigned to either the pathologist or the platform for the Gross Examination (GE), otherwise, if the size/shape is not comparable, the tissue specimen will be divided into comparable sections and randomly assigned to the pathologist or to the platform.

The traditional procedure carried out by trained pathologists is summarized in the following:
Biopsy specimen. The size of an excisional biopsy specimen should be recorded in three dimensions, and the general shape (e.g., ovoid, spherical) should be described. If a tumor is found, the size should be recorded in three dimensions. Because of the critical prognostic significance of tumor size, this measurement should be made prior to removing for frozen section or other studies. It may be difficult to accurately measure the tumor if the specimen is received previously sliced or otherwise disrupted. The gross character of the tumor (shape, consistency, appearance of cut surface) should be described. Each sample taken from a specimen should be identified with a unique letter and number, which ought to appear on the paraffin block and corresponding histologic slide. Because the contours and orientation of tissue slices may be altered while preparing histologic sections, it is necessary to mark surfaces corresponding to the margin so that they can be identified microscopically.
Mastectomy specimen. The external description of the specimen should include the following: overall size, dimensions, and appearance of the skin with measurement of scars or incisions, the appearance of the nipple and areola (if present), presence of muscle, and axillary tissue, and location of any distinct palpable lesion. The breast is sectioned by a series of parallel incisions at least 5 mm apart through the posterior surface up to the skin. A tumor, if present, should be described in the same fashion as a biopsy specimen.
Axillary lymph nodes. Optimal staging of the axilla requires histopathologic examination of at least 10 lymph nodes. Typically, a dissection of axillary level I and II lymph nodes should yield about 15 lymph nodes, and one including level III should approach 20 lymph nodes. Careful manual blunt dissection of the unfixed axillary fat is currently the most cost-effective method for isolating lymph nodes for microscopic study. Although the gross description should include an approximate count of samples thought to be lymph nodes that were submitted for histology, the final number of nodes is determined microscopically.

The targeted procedure to assess the patented robotic platform (dimension 400mmx400mmx700mm), is the same as the one detailed in the experimental design of Aim 1. For the targeted pathology the platform will be tuned to generate an indentation matrix with an average 7 mm pitch over the entire sample and a load cell/linear actuator, an ultrasound probe and an HD camera will collect mechanical characteristics, ultrasonic information, and vision data to identify suspected inclusions.

As ancillary study, a haptic glove [11] will be used to selectively telepalpate areas of pathological interest of the breast district, delivering vibrotactile feedback about the specimen properties to allow perceiving soft tissue lesions such as: solid lesions, hemorrhagic or necrotic areas, and calcification, and inclusions in the axillary fat.

Experimental design aim 3

Aim 3 involves the customization and validation of the patented robotic platform on residual fixed tissue specimens of the gynecological district.

Pairs of residual fixed tissue specimens from the same patient or from the same anatomical district, if comparable in size/shape, will be randomly assigned to either the pathologist or the platform for the Gross Examination (GE), otherwise, if the size/shape is not comparable, the tissue specimen will be divided into comparable sections and randomly assigned to the pathologist or to the platform.

The traditional procedure carried out by trained pathologists is summarized in the following:
the gynecologic specimens are divided into two categories: biopsies and therapeutic resections. Biopsies are processed expeditiously, with a brief description. For operative specimens, procedures are based on institutional protocols and guidelines from the International Collaboration on Cancer Reporting (ICCR) and the College of American Pathologists (CAP). Surgical specimens should be preferably examined and processed assuring a correct orienting and adequate margins inking.
Any grossly visible lesion is described in terms of size, appearance, site, extent, and distance to margins. Pathologists adopt tissue-selective sampling of tumors, omental nodules, and lymph nodes. Blocks for microscopic examination are taken to include the area of deepest penetration and the relationship to adjacent tissues/organs.
The specimens are then fixed in formaldehyde and stored in the residual fixed reserve for 15 days. After the 15th day, the fixed specimen is grossly re-assessed by the pathologist and analyzed by the robotic platform.

The targeted procedure to assess the patented robotic platform is the same as the one detailed in the experimental design of Aim 1 and 2 and here summarized. The sample is positioned on the platform tray, and a label with a unique sample ID is associated with the sample and stored in the dedicated database. Following the assignment of the label, a folder identified by the same sample ID is created to store the corresponding experimental data. An image of the sample is captured by an HD camera, the contour of the sample is extracted and a matrix of points to be indented with the ultrasound probe is generated. At each point, the tri-axial motorized actuator system moves the ultrasound probe in contact with the sample, and the probe transmits an ultrasound pulse; the corresponding reflected signal is stored, along with the indentation depth reached by the probe and the contact force. Following data processing, a map of the detected inclusion is generated.
For the targeted pathology the platform will be tuned to generate an indentation matrix with a pitch chosen among 3, 5, 7, 9 and 11 mm over the entire sample, as the average dimension of samples to be examined vary from few cm up to 20 cm.
The robotic platform will be tuned to detect specific pathological measures with the following prognostic purposes: (i) omental metastases (< / ¿ 2cm) in ovarian cancer, (ii) < 5mm peritoneal implants in ovarian borderline tumors, (iii) residual tumor (< 2mm, CRS3 / ¿2 mm, CRS1-2) in advanced treated HGSC, (iv) residual tumor (< 3mm, pR1 / ¿3mm, pR2) in locally advanced cervical cancer and, (v) surgical margins status assessment (< or ¿8 mm) in vulvar cancer.

As ancillary study, a haptic glove [11] will be used to selectively telepalpate areas of pathological interest of the gynecological district, delivering vibrotactile feedback about the specimen properties to allow perceiving soft tissue lesions: (i) softness, often in presence of tumoral necrosis, hemorrhage, and cystic degeneration, (ii) hardness or fleshy appearance, in presence of tumoral mass and (iii) grainy consistency, in presence of a reactive/inflammatory process.

Picture to support preliminary data

Figura_v2.png

Hypothesis and significance

ROGER aims at validating the robot claimed in the patent Apparatus for ex vivo intraoperative analysis of biological tissue samples jointly invented by personnel currently affiliated to Sant'Anna School of Advanced Studies, the University of Florence, and Careggi University Hospital of Florence.
The robot, composed of a stereo-vision camera, tri-axial position-controlled actuators, a magnetic force-controlled actuator along the indentation direction, force sensors and an ultrasound probe, is designed to localize and identify hard lumps in soft tissues.
The first prototype of such a multisensory robot was validated on laboratory-made Agar phantoms, that mimicked mechanical and acoustic properties of human ex-vivo tissues, and on biological samples of animal origin [1,2]. Tests on soft-Agar phantoms [1] confirmed the ability of the robotic system to identify eight spherical hard-Agar inclusions of diameters between 3 mm and 12 mm. The detection ability of the robot was later improved by combining the evaluation of amplitude and shape of the acoustic signal measured by the ultrasound probe [2]. The strategy allowed the robot to detect hard-Agar inclusions of non-regular geometry, randomly distributed in animal liver tissue with an accuracy above 86%.

In the ROGER project, the statistical analysis performed on collected data will first assess the non-destructive impact of the machine on the tissues, and then evaluate the adequateness of the machine by comparing (i) the result obtained by automatic palpation and by manual palpation and (ii) the time required by the platform and by the pathologist to complete the analysis of a tissue specimen. Statistical tests for categorical variables (e.g., Chi-square test) and for paired data (e.g., t-test or Wilcoxon test, following verification of the normality of the sample) will be employed for the two comparisons, respectively.

5.5 Methodologies and statistical analyses

Methods of data collection

In the study, demographic, clinical and instrumental data will be collected.

Data collection. Demographics and clinical history of the patient, collected during the enrolment procedure, will include age and gender, pre-operative treatments (e.g. drugs, radio- or chemotherapy) and additional available diagnostic reports (e.g. annotated images as RX, CT scans). Clinical data on the resected tissue specimen, collected after the surgical resection will include the type, site, dimension, relevant details on the surgical procedure performed and reports of the post-operative gross examination (type of fixative, timing and duration of fixation, other fixation methods details, dimension, weight, color, shape, consistency, and texture) [14].
Clinical and demographic data will be collected by the clinical partners (Operative Units 1, 2 and 3) during patient enrolment, pathology assessment and post-operative grossing phases.
Instrumental data, collected on the fixed residual tissue specimens after the 15th day of storage, will include indentation force and depth, ultrasound signal (reflected from a stainless-steel specimen support plate), color (RGB) image and its corresponding depth map, 2D and 3D reconstruction of the tissue specimen, a real image of the sample with an indication of the position and size of the inclusions with potential pathological interest, a text file with the relevant information (e.g., number of inclusions, position, size). Instrumental data will be collected by means of the sensors (load cell, ultrasound probe, and RGB-D camera) integrated by the bioengineering partner (OU 4, SSSA) into the patented platform.

Data storage and management. All data will be pseudonymized (i.e., a 4-digit identification code associated with each fixed residual tissue specimen) and stored, for each OU, in an ad-hoc form and computerized in a central database for data sharing among researchers, with account-based access. The original paper forms will be kept at the anatomic pathology departments in locked cabinets with limited access to the OU scientific coordinator. Individual data will be computerized by encrypting the patient's identification data. These will be decrypted only for the phases and times strictly necessary for verifying the completeness of the enrollment of each patient. Researchers will have access to the pseudonymized data

stored in the database only, while the re-association key between specimen and patient will be available only to the scientific coordinator of the clinical OUs (namely Prof. Massi for OU1, Prof. Cossu for OU2 and Prof. Zannoni for OU3). At the end of the ROGER study, the re-association key will be destroyed, and the data will be stored for future uses that are not incompatible with the purposes for which they were collected.

Statistic plan

Statistical data will include both categorical and paired data.

Categorical data will include (i) frequency of alteration detected by the robotic platform and by the pathologist per size and depth of the alteration, per type of pathology, per anatomical district, per experience of the pathologist; (ii) frequency of alteration detected by the robotic platform through the evaluation of only indentation force, only ultrasound signals, the combination of indentation force and US signals, of indentation force and images, of US and images, or the combination of indentation force, US signals and images.

Paired data will include the time spent by the robotic platform and the clinical personnel to localize possible pathological alterations in tissue specimens.
Any confounding factors such as temperature, and brightness will be compensated through a standardization procedure and measurement of the environmental conditions (e.g., lighting and temperature) and in any case included in statistical analyzes as confounding factors.

Population and subgroups to be analyzed will include fixed residual tissues stored for 15 days as per the protocol of adults older than 18 years old that signed the informed consent and enrollment according to the Declaration of Helsinki. With this constraint, samples not belonging to the fixed residual tissues or fixed residual tissues stored for less than 15 days from the date of the diagnostic report will be excluded from the study.

The sample size was chosen to allow the hypothesis of normality in categorical and paired data to be statistically analyzed. The final sample size required was estimated to be approximately 200 biological specimens from 100 patients per each specific aim (gastrointestinal and skin/soft tissues in aim 1 headquartered in Florence, breast district in aim 2 in Sassari, and gynecological tissues in aim 3 in Rome).

Randomization is introduced for defining samples to be analyzed by trained pathologists versus those investigated through the patented robotic platform, and bias is mitigated through pseudonymization (reversible re-identification) of fixed tissue specimens; a 4-digit code will be assigned to the sample and the access key will be in the exclusive possession of the study manager in each Operative Unit 1, 2, and 3. The execution or not of the ancillary tests with the haptic glove will be subject to randomization as well.

In case of missing data (e.g., samples from specific pathologies), the sample will be excluded from the analysis.

Statistical analysis

Statistical analysis will assess the ability of the robotic platform to identify small alterations (size less than 5mm) not clinically detectable by pathologists, to retrieve pathological alteration with performance comparable to human ability, and to reduce the average time necessary to examine fixed tissue specimens during the gross examination.

Linear mixed models will be used for the estimation of the alteration retrieval occurrences, with the successful retrieval as the response variable. Corrections in the model will be made for the characteristics of the tissue specimen: size, depth, anatomical district, and pathology. In all models, a random intercept will be modeled to account for clustering by the center. Differences in alteration retrieval occurrences will be tested on both statistical and clinical significance.

Chi-squared test or Fisher exact test will be performed to reject the hypothesis of an association between alterations retrieved by the robotic platform and by the pathologist per size and depth of the alteration, per type of pathology, per anatomical district, per experience of the pathologist. The chi-squared test will be chosen if 1 or more variables (e.g., the number of alterations smaller than 5mm retrieved by the robotic platform) has an expected frequency greater than 5, otherwise, Fisher exact test will be performed.

Statistical samples (i.e., number of retrieved alterations) are expected to be drawn from populations (e.g., pathologist¿s retrieval/robotic platform¿s retrieval) with different mean or median values. This hypothesis will be tested using one-way ANOVA or Kruskal-Wallis test if samples can be assumed normally distributed or not, respectively.

Statistical tests for paired variables such as the t-test or Wilcoxon-Mann-Whitney test will be used to confirm the hypothesis that the difference in average time spent grossing by the robotic platform and pathologist is statistically significant.

Timing of analysis data

The study will last 24 months, from the installation of the robotic platform and the submission of ethical approvals by the Ethical Committees to the experiments, data analysis, and dissemination of the study results.

The first month of the ROGER project will be dedicated to the organization and planning of the study (month 1). At the same time approvals from Ethical Committees will be requested at Operative Units 1, 2, and 3 (namely AOC, AOUS, and FPG respectively) and the trials registered (months 1 to 4). Concurrently, OU4 (SSSA) will start the customization and setup of the robotic platform and of the graphical user interfaces, including the required certification tests and the production of three replicas with the collaboration of AOUS, one per each clinical partner (months 2 to 5).

Upon reception of Ethical Committees approvals, the robotic platform replicas will first be delivered at the surgical pathology laboratories of OU 1, and patients¿ recruitment will start at OU1 (month 6). Patients at OU 1 will be recruited from months 6 to 18 of the project, with experiments starting at month 7. Per each patient, the enrollment in the study will end after the surgical resection of the tissue specimen, the storage of the fixed residual tissues, and their analysis.

Operative Units 2 and 3 will receive the robotic platform replicas between months 7 and 8, with patient recruitment starting at month 7 and the experimental campaign programmed to start at month 10.

Preliminary analyses to monitor data consistency will be carried out during the experimental campaigns, whereas the experimental data collected at OU 1, 2, and 3 will be thoroughly analyzed starting from month 18; i.e., once the experimental campaign has ended. Consequently, data analysis and statistical analysis results will be prepared for publication and presentation at dissemination events upon the end of the project.

The timing of the project here described is also summarized in the attached Gantt Chart.

5.6 Expected outcomes

Histopathological examination of tissue specimens involves both macroscopic (gross) and microscopic examinations. Among the outcomes of tissue specimen grossing is the composition of a descriptive record of the specimen and its slide index (i.e., correlating each slide to a precise location on the specimen) to be referenced in following microscopic examinations. Conventionally, pathologists still employ visual inspection and manual palpation during the gross examination.

The robotic platform validated within the ROGER project will instead leverage an RGB-D camera to locate the tissue specimen on the tray, 3D reconstruct it, and perform multiple automatically controlled force indentations with an ultrasound

probe. Once completed the scan, tactile, acoustic and vision data acquired are processed and a descriptive record will provide images, position, size, number of suspect alterations in the tissue specimen, their mechanical stiffness and acoustic impedance values.

As a primary outcome, we expect the robotic platform to accurately detect lymph nodes or nodules, including alterations smaller than 5mm (clinically not-detectable with traditional manual procedures) with retrieval performance comparable to expert pathologists¿ abilities.

As a secondary outcome, we expect the robotic platform to identify suspect alterations in less than 8 minutes, that is to achieve accurate retrievals faster than the average grossing time per tissue specimen per pathologist.

The successful validation of the robotic platform within the ROGER project will benefit surgical pathology laboratories by lowering inter-pathologist variability in sample assessment (primary outcome) and reducing the clinical burden and time required for grossing (secondary outcome).

Additionally, the annotated database created from clinical and instrumental data collected within the project will enhance inter-laboratories consultation procedures and will foster open-science approaches to anatomic pathology investigations.

5.7 Risk analysis, possible problems and solutions

Hereafter, a list of possible scientific, technological, clinical and management risks is discussed together with the contingency plan.

Risk #1. Not recruiting the proposed number of patients
Brief risk description: The expected number of specimens to be gross examined by the clinical personnel and the robotic platform is 200 biological specimens from 100 patients per specific aim; i.e., 100 patients to be recruited at each OU 1, 2 and 3 between months 6 and 18 of the ROGER project.
Risk severity (1: low ¿ 3: high): 3
Risk likelihood (1: low ¿ 3: high): 1
Risk impact (severity x likelihood): 3
Risk mitigation strategy: Each of the clinical operating units involved has a large pool of patients, and related surgical operations, ensuring that the target number of samples to be analyzed can be reached.

Risk #2. Under-represented data
Brief risk description: due to the high variety of pathologies gross examined at the Operative Units 1, 2 and 3, there could exist data categories (e.g., pathology, size of the tissue specimen, anatomic district) under-represented.
Risk severity: 2
Risk likelihood: 2
Risk impact: 4
Risk mitigation strategy: performance of the robotic platform will be assessed over the most represented categories within each aim.

Risk #3. Delay in platform setup, replicas, and maintenance
Brief risk description: delay in production and low availability of mechatronic components, necessary for the replicas of the robotic platform, due to the ongoing international shortage of electronic components (e.g., sensors, actuators) and raw materials (e.g., aluminum extrusion profile bars of the platform structure).
Risk severity: 3

Risk likelihood: 2
Risk impact: 6
Risk mitigation strategy: non-electronic components will be in-house designed and built at the prototype level (e.g., 3D printed connection interfaces). Moreover, where in-house design and prototyping will not be possible, we will request dedicated assistance services to reduce commissioning times and to speed up platform operation; moreover, we will evaluate and choose equally high-quality suppliers with a shorter supply and distribution chain (e.g., national rather than international suppliers).

Risk #4. Tissue specimen damage or destruction
Brief risk description: damage or destruction of the tissue specimen during the gross examination by the robotic platform or the clinical personnel
Risk severity: 3
Risk likelihood: 2
Risk impact: 6
Risk mitigation strategy: The ROGER project aims at residual fixed tissue samples, i.e. residual samples otherwise destined for disposal by pathological anatomy laboratories. Furthermore, the platform will be optimized by aiming for safe interaction between the robot and the tissue sample.

Risk #5. Privacy, digital security, compliance, and access to data
Brief risk description: Violation of the General Data Protection Regulation and sensitive patient data disclosed to unauthorized personnel.
Risk severity: 3
Risk likelihood: 1
Risk impact: 3
Risk mitigation strategy: All data will be pseudonymized (i.e., a 4-digit identification code associated with each fixed residual tissue specimen) and stored, in an ad-hoc form and computerized in a central database for data sharing among researchers, with account-based access. The original paper forms will be kept at the anatomic pathology departments in locked cabinets with limited access to the OU scientific coordinator.

Risk #6. Principal research collaborators exit from the project
Brief risk description: Interruption of funding and of the ROGER project due to abandonment by the PI, the Co-Pi, or one or more of the research collaborators.
Risk severity: 3
Risk likelihood: 1
Risk impact: 3
Risk mitigation strategy: The organizations to which the researchers belong are committed to maintaining their employment contracts for the entire duration of the project, and dual affiliations will be set in place if needed.

5.8 Significance and Innovation

The macroscopic examination phase of tissue specimens still relies on manual palpation and visual examination by an expert pathologist; leading to rare cases of missed detection of areas (smaller than 5mm) of pathological interest.

The success of the validation experiments described in aims 1, 2, and 3, could open the path to the integration in surgical pathology laboratories of the robotic platform (i.e., medical device) that would (i) assist pathologists in the detection of inclusion while (ii) reducing the analysis time spent per specimen. More specifically, the different aims of the project target different anatomical districts (gastrointestinal tract and skin/soft tissues at OU 1, breast district at OU 2, and gynecological

district at OU3) in order to assess the flexibility of the robotic platform to detect fixed tissues areas of interest (i.e., having mechanic-acoustic-visual characteristic different than healthy tissues) for various pathologies.

5.9 Bibliography

1. Massari L, et al. Sensors 2019;19:2512
2. Bulletti A, et al. Sensors 2020;20:1183
3. Georges PC, et al. Am J Physiol Gastroint Liv Physiol 2007;293:G1147
4. de Ledinghen V, et al. J Hepatol 20
5 Samani A, et al. Phys Med Biol. 2003;48:2183
6 Bortesi M, et al. Virch Archiv 2018;472:1041
7 Niazi MKK, et al. Lancet Oncol 2019;5:e253
8 Tizhoosh HR, et al. J Pathol Inform 2018;9:38
9 Farahani N, et al. Pathol Lab Med Int 2015;7:23
10 Williams BJ, et al. J Clin Pathol 2020;73:418
11 Sorgini F, et al. Sensors 2018;18:261
12 Gryzbicki D, et al. Am J Clin Pathol 1999;112:619-26
13 Gryzbicki D, et al. Arch Pathol Lab Med; 2004;128:165-72
14 Chandra A, et al. J Clin Pathol 2010; 63: 475-79.

5.10 Timeline / Deliverables / Payable Milestones

Project management phases:
Organization and planning of the project (M1) [Lead: AOUC; Part: all]
Ethics Committees approval and trial registration (M1 - 4) [Lead: AOUC; Part: all]
Robotic platforms and graphic user interface setup, replicas and maintenance (M2 - 20) [Lead: SSSA; Part: AOUS, all]
Patients' recruitment (months 6 - 18) [Lead: AOUC; Part: AOUS, FPG]
Experiments at Operative Unit 1 (M7 - 18) [Lead: AOUC; Part: SSSA]
Experiments at Operative Unit 2 (M10 - 18) [Lead: AOUS; Part: SSSA]
Experiments at Operative Unit 3 (M10 - 18) [Lead: FPG; Part: SSSA]
Data analysis (M18 - 20) [Lead: SSSA; Part: all]
Statistical analysis, manuscript writing and dissemination (M20 - 24) [Lead: SSSA; Part: all]
Final project report (M24) [Lead: AOUC; Part: all]

Milestones 12 month

The robotic platform replicas are finalized, delivered to all clinical partners, and made operative at the surgical pathology laboratory of Operative Units 1, 2, and 3.
Approvals from the Ethics Committees has been received and patient recruitment started.

Deliverables:
Robotic platforms setup (M4) [Resp: SSSA]
Ethics Committees approval (M4) [Resp: AOUC]
Robotic platforms delivered to all clinical partners (M10) [Resp: SSSA]
Mid-term project report (M12) [Resp: AOUC]

Milestones 24 month

Experiments at the Operative Units 1, 2, and 3 concluded. Experimental data collected from the robotic platform and the clinicians analyzed.

Results prepared for publication and to be presented at dissemination events.

Deliverables:
Results of experiments at OU 1 (M18) [Resp: AOUC]
Results of experiments at OU 2 (M18) [Resp: AOUS]
Results of experiments at OU 3 (M18) [Resp: FPG]
Results of statistical analysis (M20) [Resp: SSSA]
Final project report (M24) [Resp: AOUC]

Gantt chart

ROGER_Gantt.pdf

5.11 Equipment and resources available

Facilities Available

OU 1 (AOUC):
- Surgical Pathology lab
- MagCore® DNA and RNA semi-automatic extr
- Easy PGX® Real-Time PCR
- Illumina MiSeq® and NextSeq® 550 next-generation seq platf
- PyroMark Q48 Pyrosequencer
- OSNA assay
- Tissue uarray (Alphelys)
- ROCHE Automatic Immunostainer
- FISH assay
- Scanner Leica AT2
- Zeiss Axio Imager 2
- HALO sw
- HALO Link Sharing Platf
- HALO AI sw
- IMARIS sw

OU 2 (AOUS):
- Surgical pathology lab
- Cytopathology section
- Autoptic pathological section
- Immunohistochemistry and immunofluorescence
- FISH lab
- Molecular pathology lab
- Research histology lab
- Telepathology/Digital Pathology serv
- IntelliSite Ultra Fast Scanner
- Tissue uarray (Alphelys)

OU 3 (FPG):
- Surgical pathology lab
- Cytopathology section

- Autoptic pathological section
- Professional consultation service
- Immunohistochemistry and immunofluorescence
- OSNA assay lab
- FISH assay
- Molecular pathology lab
- Research histology lab
- Telepathology/Digital Pathology serv by Pathox system

OU4 (SSSA)
- 3D printers
- meas instr and assembly tools
- mechatronic components
- early prototype of robotic platform
- licenses (Labview, Solidworks, Matlab)
- Dept of Excell in Robotics and AI and Biorobotics Res and Innov Eng Facilities (30+ M€ infrastructure plans from MUR and NRRP)

Subcontract

Third parties will be subcontracted by SSSA and AOUS to
a) perform the tests, necessary (e.g., measurements in an anechoic chamber) to obtain the CE biomedical device marking; that is, to satisfy the regulations necessary for the use of class IIa devices in the biomedical field (e.g., the fulfillment of the EN 14971 standards: 2020, EN 20417: 2021, EN 15223-1: 2021, EN IEC 60601-1, EN IEC 60601-1-6, CEI EN 62304) including the assignment of the Unique Device Identification (UDI). Costs estimated about: 20000 €.

b) prepare the user guide and the maintenance booklet, including the risk analysis for biomedical devices and the production of the labels to be affixed to the device (robotic platform). Costs estimated: about 6000 €.

c) design and manufacture the external structure of the robotic platform with materials suitable for use in pathological anatomy laboratories (e.g., biomedical steel). Costs estimated: about 15000 €.

5.12 Desc. of the complementarity and sinergy of secondary collab. researchers

Histopathological examination of gross specimens removed during surgery is a crucial step for an accurate cancer diagnosis and correspondingly to define prognosis. Pathologists adopt careful inspection and manual evaluation for qualitative and quantitative gross exam and tissue-selective sampling of resected tumor specimens, including lymph nodes. This procedure is relying on time-consuming expertise and could be performed by an innovative professional figure: the pathologist assistants (PAs). PAs are highly qualified technicians who work alongside the pathologist and are responsible for grossing [6]. To date, most institutes in the USA and Canada currently employ the technical personnel for grossing, and numerous papers published over the last few years demonstrate the quality of the assistance provided by the PAs which is equal to or sometimes even better than the performance of pathologists alone [6].
A patented multisensory robot to assist pathologists in the manual grossing assessment is available by our team. The ROGER project will customize the robotic-assisted platform and perform a multicentric study to provide and assess personalized clinical solutions to discriminate different densiometric tissue characteristics during gross exam of skin and gastrointestinal surgical samples in OU1, breast tissue in OU2 and gynecological tissues in OU3. This automatic analysis will be performed by the patented robotic platform via tactile-acoustic-visual features of resected tissue specimens.
New staff will be hired to assess the robotic platform while carrying out semi-automatic experiments in the multicentric pilot study of the ROGER project in the premises of the three clinical OUs involved in the partnership, coordinated by Prof. Massi

(OU1). The figures selected for this task, Dr. Ugolini, Dr. Simi, Dr. Nuvoli and Dr. Cangemi already have a strong background in the development of research objectives. In case that the project will be funded, their expertise will be made available to the ROGER research units, with the aim of training, supporting, and helping the technical and medical staff in the use of the new robotic platform. Dr. Ugolini, Dr. Cangemi and Dr. Nuvoli will coordinate the handling and preparation of the biological samples in order to make them optimal for subsequent operations, including data collection and analysis. On the other hand, thanks to her experience in database management, Dr. Simi will be involved in the collection of data of patients and in supporting the activities related to the required procedures for authorization by the local ethics committee.

5.13 Translational relevance and impact for the national health system (SSN)

What is already know about this topic?

International reports recently demonstrated an increased use of technicians or digital assistants in assisting pathologists during diagnosis [6-8]. Since 2017, international hospitals and pathology laboratories (e.g., in USA, Canada and The Netherlands) started pairing experts with PAs and technologies highlighting benefits and limitations [6-10]. However, the organization framework of the Italian healthcare system has not formally regulated such professional figures yet. The workflow within pathological anatomy departments in clinical settings has a high degree of automatization and technological intervention, however the grossing phase of the whole chain is still lacking new tools.

Details on what is already know about this topic

The automatization of surgical pathology laboratories and, especially, the introduction of pathology assistants (PAs) has been demonstrated to ease the workload of pathologists and reduce the costs associated with the gross examination. PAs can be expected to be responsible for robotic platforms like the one to be validated within the ROGER project. Gryzbicki [12,13] reports savings of roughly 560000 USD a year when Pas grossly examine surgical specimens in laboratories with a surgical caseload of 50000 specimens, saving time for pathologists. Nevertheless, in most European countries pathology laboratories still lack PAs within their staff and, in Italy, only a few universities have started in recent years offering Master degrees for PAs [6]. The experimentation of these new professionals and robotic technologies is expected to promote a leap forward in enhancing clinical practice and optimizing the use of resources.

What this reasearch adds?

ROGER could deploy new technological solutions and pave the way towards the experimentation and consolidation of new organizational frameworks and professional figures under the supervision of expert pathologists. ROGER aims at enriching the national healthcare system by means of a robotic assistant for pathologists during the gross examination phase of resected surgical specimens preceding histopathological diagnosis. Expert pathologists will benefit from the robot assistant, putting their efforts on more-challenging tasks. Resident pathologists will have at their disposal an additional on demand, digitalized and reproducible tool that may be used for training purposes. Data gathered will be used to create an annotated ATLAS of tactile, visual (e.g., 3D reconstruction of the specimen) and acoustic information (ultrasound signal) associated with ex vivo tissue specifications and clinical images.

Details on what this reasearch adds

Successfully assessing the ability of the robotic platform and of the automated gross examination process is the starting point to introducing in surgical pathology laboratories a medical device that will ease the workload of pathologists and the piloting and introduction of new job roles (i.e., pathology assistants).The preliminary assessment of the robotic platform's performances within the ROGER project has the aim of documenting the ability of the platform (i) not to destroy the sample, (ii) to identify areas of suspected pathological interest (<5mm) and (iii) to speed up the gross examination procedure. These results will open the path to an increase in the automatization of surgical pathology laboratories. Moreover, successfully assessing the platform¿s flexibility w.r.t. tissue specimens originating from a variety of anatomical districts and suspected pathologies, will ensure its use in any anatomic pathology department.

What are the implications for public health, clinical practice, patient care?

ROGER will allow reducing pathologists workload, inter-pathologist variability in specimen assessment, and patients awaiting diagnosis. ROGER will standardize manual palpation and optimize costs and enhance safety of patients. Additionally, results from the ROGER project will allow pathologists to (i) build a common digitalized database on tissue properties through intelligence systems and (ii) establish a network of pathologists and assistants to enable the possibility of asking for a remote opinion.

References

1. Massari L, et al. Sensors 2019;19:2512
2. Bulletti A, et al. Sensors 2020;20:1183
3. Georges PC, et al. Am J Physiol Gastroint Liv Physiol 2007;293:G1147
4. de Ledinghen V, et al. J Hepatol 20
5 Samani A, et al. Phys Med Biol. 2003;48:2183
6 Bortesi M, et al. Virch Archiv 2018;472:1041
7 Niazi MKK, et al. Lancet Oncol 2019;5:e253
8 Tizhoosh HR, et al. J Pathol Inform 2018;9:38
9 Farahani N, et al. Pathol Lab Med Int 2015;7:23
10 Williams BJ, et al. J Clin Pathol 2020;73:418

Details on what are the implications for public health, clinical practice, patient care

In a surgical pathology laboratory, gross examination of tissue specimens removed during surgery represents the first and crucial step for cancer diagnosis and prognosis, being fundamental to provide the best treatment options. This process includes an accurate visual inspection and manual palpation for qualitative assessment and tissue-selective sampling of resected specimens with the suspect disease, including lymph nodes. The proposed automated robotic platform is expected to have a significant impact on pathology daily practice, relieving the pressure on pathologists in the routine workload, saving time required for grossing tissue samples, and reducing inter-pathologist variability in sample assessment, thanks to a standardized method of gross specimens¿ evaluation. All these elements will lead to a faster and more accurate histopathological diagnosis, which is essential to establishing the most appropriate therapeutic treatment.

6 - Budget

Total proposed budget (Euro)

Costs	TOTAL BUDGET	Co-Funding	List of costs proposed for funding to the MOH	Percentage of total proposed to the MOH
1 Staff Salary	101.118,00	101.118,00	not permitted	0,00
2 Researchers' Contracts	557.500,00	0,00	557.500,00	56,10
3a.1 Equipment (Leasing -	0,00	0,00	0,00	0,00
3a.2 Equipment (buying)	20.000,00	0,00	20.000,00	2,01
3b Supplies	223.000,00	0,00	223.000,00	22,44
3c Model Costs	0,00	0,00	0,00	0,00
4 Subcontracts *	41.000,00	0,00	41.000,00	4,13
5 Patient Costs	0,00	0,00	0,00	0,00
6 IT Services and Data Bases	4.000,00	0,00	4.000,00	0,40
7 Travels	23.000,00	0,00	23.000,00	2,31
8 Publication Costs	35.000,00	0,00	35.000,00	3,52
9 Dissemination	23.000,00	0,00	23.000,00	2,31
10 Overheads *	62.335,00	0,00	62.335,00	6,27
11 Coordination Costs	5.000,00	0,00	5.000,00	0,50
Total	1.094.953,00	101.118,00	993.835,00	100,00

* percentage calculated as average value between all the Operating Units.

Report the Co-Funding Contributor:

N.A.

Budget Justification

1 Staff Salary	Economic value of the productive time of Principal Research Collaborators: Prof. Massi and Prof. Cianchi for OU1; Prof. Cossu for OU2; Prof. Zannoni and Dr. Santoro for OU3; Prof. Oddo, Prof. Menciassi and Dr. Auletta for OU4.
2 Researchers' Contracts	Recruitment of Additional Research Collaborators under 40: Dr. Ugolini and Dr. Simi for OU1; Dr. Cangemi and Dr. Nuvoli for OU2. Additional Research Fellowship for OU2, OU3 and OU4
3a.1 Equipment (Leasing - Rent)	N.A.
3a.2 Equipment (buying)	Purchase of instruments
3b Supplies	Purchase of consumables

3c Model Costs	N.A.
4 Subcontracts	Subcontracts for the tests necessary to obtain the CE biomedical device marking; Prepare the user guide and the maintenance booklet; Design and manufacture the external structure of the robotic platform
5 Patient Costs	N.A.
6 IT Services and Data Bases	Purchase of softwares
7 Travels	Travel costs
8 Publication Costs	Publications in Open Access Scientific Journals
9 Dissemination	Partecipation in national and international conferences
10 Overheads	General costs incurred by the OUs for the implementation of the ROGER project
11 Coordination Costs	Costs for any additional patent developed within the project, to be borne by PI on behalf of the partnership

Proposed total budget UO1 Institution: Azienda Ospedaliero-Universitaria Careggi (Euro)

Costs	TOTAL BUDGET	Co-Funding	List of costs proposed for funding to the MOH	Percentage of total proposed to the MOH
1 Staff Salary	39.456,00	39.456,00	not permitted	0,00
2 Researchers' Contracts	112.500,00	0,00	112.500,00	47,25
3a.1 Equipment (Leasing - Rent)	0,00	0,00	0,00	0,00
3a.2 Equipment (buying)	0,00	0,00	0,00	0,00
3b Supplies	80.000,00	0,00	80.000,00	33,60
3c Model Costs	0,00	0,00	0,00	0,00
4 Subcontracts	0,00	0,00	0,00	0,00
5 Patient Costs	0,00	0,00	0,00	0,00
6 IT Services and Data Bases	0,00	0,00	0,00	0,00
7 Travels	7.000,00	0,00	7.000,00	2,94
8 Publication Costs	11.000,00	0,00	11.000,00	4,62
9 Dissemination	7.000,00	0,00	7.000,00	2,94
10 Overheads	15.575,00	0,00	15.575,00	6,54
11 Coordination Costs	5.000,00	0,00	5.000,00	2,10
Total	277.531,00	39.456,00	238.075,00	100,00

Budget Justification	
1 Staff Salary	Economic value of the productive time of PI: Prof. Daniela Massi and Co-PI: Prof Fabio Cianchi
2 Researchers' Contracts	Recruitment of Dr. Ugolini and Dr. Simi with 2-year contract by AOUC
3a.1 Equipment (Leasing - Rent)	N.A.
3a.2 Equipment (buying)	N.A.
3b Supplies	Purchase of consumables
3c Model Costs	N.A.
4 Subcontracts	N.A.
5 Patient Costs	N.A.
6 IT Services and Data Bases	N.A.
7 Travels	Travel costs
8 Publication Costs	Publications in Open Access Scientific Journals
9 Dissemination	Partecipation in national and international conferences
10 Overheads	General costs incurred by the OUs for the implementation of the ROGER project
11 Coordination Costs	Costs for any additional patent developed within the project, to be borne by PI on behalf of the partnership

Proposed total budget UO2 Institution: Azienda Ospedaliero Universitaria di Sassari (AOUS) (Euro)

Costs	TOTAL BUDGET	Co-Funding	List of costs proposed for funding to the MOH	Percentage of total proposed to the MOH
1 Staff Salary	12.337,00	12.337,00	not permitted	0,00
2 Researchers' Contracts	235.000,00	0,00	235.000,00	58,89
3a.1 Equipment (Leasing - Rent)	0,00	0,00	0,00	0,00
3a.2 Equipment (buying)	0,00	0,00	0,00	0,00
3b Supplies	90.000,00	0,00	90.000,00	22,55
3c Model Costs	0,00	0,00	0,00	0,00
4 Subcontracts	31.000,00	0,00	31.000,00	7,77
5 Patient Costs	0,00	0,00	0,00	0,00
6 IT Services and Data Bases	0,00	0,00	0,00	0,00
7 Travels	6.000,00	0,00	6.000,00	1,50
8 Publication Costs	7.000,00	0,00	7.000,00	1,75
9 Dissemination	6.000,00	0,00	6.000,00	1,50
10 Overheads	24.080,00	0,00	24.080,00	6,03
11 Coordination Costs	not permitted	not permitted	not permitted	0,00
Total	411.417,00	12.337,00	399.080,00	100,00

Budget Justification	
1 Staff Salary	Economic value of the productive time of Prof. Antonio Cossu
2 Researchers' Contracts	Recruitment of Dr. Cangemi and Dr. Nuvoli with 2-year contract by AOUS; Additional Research Fellowships
3a.1 Equipment (Leasing - Rent)	N.A.
3a.2 Equipment (buying)	N.A.
3b Supplies	Purchase of consumables
3c Model Costs	N.A.
4 Subcontracts	Subcontracts for the tests necessary to obtain the CE biomedical device marking; Prepare the user guide and the maintenance booklet; Design and manufacture the external structure of the robotic platform
5 Patient Costs	N.A.
6 IT Services and Data Bases	N.A.
7 Travels	Travel costs
8 Publication Costs	Publications in Open Access Scientific Journals
9 Dissemination	Partecipation in national and international conferences
10 Overheads	General costs incurred by the OUs for the implementation of the ROGER project
11 Coordination Costs	N.A.

Proposed total budget UO3 Institution: Fondazione Policlinico Universitaria Gemelli (FPG) (Euro)

Costs	TOTAL BUDGET	Co-Funding	List of costs proposed for funding to the MOH	Percentage of total proposed to the MOH
1 Staff Salary	32.811,00	32.811,00	not permitted	0,00
2 Researchers' Contracts	100.000,00	0,00	100.000,00	56,13
3a.1 Equipment (Leasing - Rent)	0,00	0,00	0,00	0,00
3a.2 Equipment (buying)	20.000,00	0,00	20.000,00	11,23
3b Supplies	28.000,00	0,00	28.000,00	15,72
3c Model Costs	0,00	0,00	0,00	0,00
4 Subcontracts	0,00	0,00	0,00	0,00
5 Patient Costs	0,00	0,00	0,00	0,00
6 IT Services and Data Bases	0,00	0,00	0,00	0,00
7 Travels	5.000,00	0,00	5.000,00	2,81
8 Publication Costs	8.500,00	0,00	8.500,00	4,77
9 Dissemination	5.000,00	0,00	5.000,00	2,81
10 Overheads	11.655,00	0,00	11.655,00	6,54
11 Coordination Costs	not permitted	not permitted	not permitted	0,00
Total	210.966,00	32.811,00	178.155,00	100,00

Budget Justification	
1 Staff Salary	Economic value of the productive time of Prof. Gianfranco Zannoni and Dr. Angela Santoro
2 Researchers' Contracts	Two annual and one six-months contracts with FPG
3a.1 Equipment (Leasing - Rent)	N.A.
3a.2 Equipment (buying)	Purchase of instruments (microscope, PC, cameras for image acquisition)
3b Supplies	Purchase of consumables
3c Model Costs	N.A.
4 Subcontracts	N.A.
5 Patient Costs	N.A.
6 IT Services and Data Bases	N.A.
7 Travels	Travel costs
8 Publication Costs	Publications in Open Access Scientific Journals
9 Dissemination	Partecipation in national and international conferences
10 Overheads	General costs incurred by the OUs for the implementation of the ROGER project
11 Coordination Costs	N.A.

Proposed total budget UO4 Institution: Scuola Superiore Sant'Anna (SSA) (Euro)

Costs	TOTAL BUDGET	Co-Funding	List of costs proposed for funding to the MOH	Percentage of total proposed to the MOH
1 Staff Salary	16.514,00	16.514,00	not permitted	0,00
2 Researchers' Contracts	110.000,00	0,00	110.000,00	61,62
3a.1 Equipment (Leasing - Rent)	0,00	0,00	0,00	0,00
3a.2 Equipment (buying)	0,00	0,00	0,00	0,00
3b Supplies	25.000,00	0,00	25.000,00	14,00
3c Model Costs	0,00	0,00	0,00	0,00
4 Subcontracts	10.000,00	0,00	10.000,00	5,60
5 Patient Costs	0,00	0,00	0,00	0,00
6 IT Services and Data Bases	4.000,00	0,00	4.000,00	2,24
7 Travels	5.000,00	0,00	5.000,00	2,80
8 Publication Costs	8.500,00	0,00	8.500,00	4,76
9 Dissemination	5.000,00	0,00	5.000,00	2,80
10 Overheads	11.025,00	0,00	11.025,00	6,18
11 Coordination Costs	not permitted	not permitted	not permitted	0,00
Total	195.039,00	16.514,00	178.525,00	100,00

Budget Justification	
1 Staff Salary	Economic value of the productive time of Prof. Calogero Maria Oddo, Prof. Arianna Menciassi and Dr. Auletta
2 Researchers' Contracts	Two Research Fellowship
3a.1 Equipment (Leasing - Rent)	N.A.
3a.2 Equipment (buying)	N.A.
3b Supplies	Purchase of consumables
3c Model Costs	N.A.
4 Subcontracts	Subcontracts for the tests necessary to obtain the CE biomedical device marking; Prepare the user guide and the maintenance booklet; Design and manufacture the external structure of the robotic platform
5 Patient Costs	N.A.
6 IT Services and Data Bases	Purchase of Softwares
7 Travels	Travel costs
8 Publication Costs	Publications in Open Access Scientific Journals
9 Dissemination	Partecipation in national and international conferences
10 Overheads	General costs incurred by the OUs for the implementation of the ROGER project
11 Coordination Costs	N.A.

Principal Investigator Data

Cognome: Massi
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Datore/ente di lavoro? Yes
Datore/ente di lavoro SSN? No
Nome datore/ente di lavoro non SSN: Università degli Studi di Firenze
Nome istituzione SSN: Azienda Ospedaliero Universitaria Careggi
Tipo contratto: Professore Ordinario distaccato presso IRCCS/IZS/ISS/Ente SSN (convenzione di clinicizzazione e/o ricerca)

Con l'invio della presente proposta si dichiara che la stessa o parti significative di essa non sono oggetto di altri finanziamenti pubblici o privati e che di conseguenza vi è assenza del c.d. doppio finanziamento ai sensi dell'art. 9 del Regolamento (UE) 2021/241, ossia che non ci sia una duplicazione del finanziamento degli stessi costi da parte di altri programmi dell'Unione, nonché con risorse ordinarie da Bilancio statale.

By submitting this proposal, I declare that no significant part or parts of it are recipient of any other public or private funding and that consequently there isn't any so-called double financing pursuant to art. 9 of Regulation (EU) 2021/241, i.e. that there is no duplication in the financing of the same costs by other Euopean Union programs or any other ordinary resources from the State budget.

Project validation result