



IL COMMISSARIO STRAORDINARIO

Dott. Giuseppe Micale

nominato con D.G.R. della Lombardia n. XI/7601 del 23 dicembre 2022

Il giorno 20 del mese di ottobre dell'anno 2023 presso l'Azienda Socio Sanitaria Territoriale dei Sette Laghi con sede legale in Varese (VA) – Viale L. Borri n. 57

ha assunto la seguente deliberazione:

n. 614 del 20/10/2023

OGGETTO: CONVENZIONE CON L'UNIVERSITA' DEGLI STUDI DELL'INSUBRIA E IL COMUNE DI VARESE PER ATTIVITA' DI COLLABORAZIONE NEL PROGETTO "STIMA EPOCA DECESSO". DURATA DUE ANNI DALLA SOTTOSCRIZIONE.



OGGETTO: CONVENZIONE CON L'UNIVERSITA' DEGLI STUDI DELL'INSUBRIA E IL COMUNE DI VARESE PER ATTIVITA' DI COLLABORAZIONE NEL PROGETTO "STIMA EPOCA DECESSO". DURATA DUE ANNI DALLA SOTTOSCRIZIONE.

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Su proposta n. 652 in data 09/10/2023 della S.C. AFFARI GENERALI E LEGALI qui di seguito trascritta:

vista la L.R. n. 33 del 30.12.2009 così come modificata dalla L.R. n. 23 dell'11.8.2015 "Evoluzione del sistema sociosanitario lombardo: modifiche al Titolo I e al Titolo II della legge regionale 30 dicembre 2009, n. 33 (Testo unico delle leggi regionali in materia di sanità)" e s.m.i.;

vista la D.G.R. n. X/4481 del 10.12.2015 "Attuazione L.R. 23/2015: costituzione Azienda Socio-Sanitaria Territoriale (ASST) dei Sette Laghi" con sede legale in viale Borri n. 57 – 21100 Varese;

premesso che l'art. 15, comma 1, della Legge 7 agosto 1990, n. 241 e s.m.i. "Nuove norme in materia di procedimento amministrativo e di diritto di accesso ai documenti amministrativi", prevede che le amministrazioni pubbliche possano sempre concludere tra loro accordi per disciplinare lo svolgimento in collaborazione di attività di interesse comune;

evidenziato che,

- l'Università degli Studi dell'Insubria e questa ASST hanno interesse comune nella ricerca per la tanatologia e, in particolare, per lo studio delle modificazioni post-mortali dell'osso umano e correlazione con la tipologia del suolo di deposizione per una stima dell'epoca di decesso in ambito forense;
- lo scopo del progetto in oggetto è la creazione, per la prima volta in Italia, di un laboratorio a cielo aperto dedicato a comprendere meglio lo schema della decomposizione umana anche a supporto delle scienze forensi;

premesso che:

- l'Università degli Studi dell'Insubria, con pec acquisita agli atti con prot. n. 38878 dell'8.6.2023, comunicava ad ASST dei Sette Laghi che il Consiglio di Amministrazione dell'Università degli Studi dell'Insubria aveva approvato la convenzione in oggetto per una verifica della nostra Azienda;
- con e-mail del 28.07.2023 questa ASST chiedeva all'Università degli Studi dell'Insubria modifiche e integrazioni al testo della convenzione;
- con e-mail del 23.08.2023 il Commissario Straordinario chiedeva di procedere con l'adozione della delibera e la stipula della relativa convenzione;
- con e-mail in data 6.10.2023, acquisita con prot. n. 65330 in pari data, l'Università degli Studi dell'Insubria inviava il testo definitivo della convenzione con alcune modifiche apportate dal Comune di Varese;



rilevato che, attesa la particolarità dell'attività richiesta, si ritiene opportuno ricorrere alla collaborazione tra Enti;

considerato che la finalità che si intende perseguire attraverso la stipula della convenzione in argomento è quella di svolgere un'attività collaborativa per garantire efficienza ed economicità all'azione della Pubblica Amministrazione;

esaminata la convenzione allegata al presente provvedimento quale parte integrante e sostanziale del medesimo (allegato n. 1);

precisato che con tale convenzione l'ASST si impegna a mettere a disposizione dell'Università degli Studi dell'Insubria i locali nei quali la stessa eventualmente allestirà il laboratorio per l'esecuzione degli esami di competenza in relazione al progetto di cui sopra, con eventuali costi ad esclusivo carico dell'Università;

preso atto del parere favorevole espresso dal Direttore Sanitario f.f. in data 6.10.2023 e della conferma del nominativo della referente di questa ASST per il progetto da parte del Direttore della S.C. Medicina Legale in data 9.10.2023, con email acquisite agli atti;

ritenuto, alla luce delle considerazioni sopra indicate, di proporre la stipula della convenzione con l'Università degli Studi dell'Insubria e il Comune di Varese per attività di collaborazione per il progetto "Stima Epoca Decesso", con decorrenza dalla data di sottoscrizione di tutte le parti e con durata di due anni;

dato atto che la presente proposta di deliberazione è conforme ai requisiti richiesti dalla Legge affinché l'atto sia valido (inerenti l'agente, l'oggetto, la forma, la funzione e il contenuto);

rilevato che il presente provvedimento non rientra nell'ambito delle funzioni e dei compiti attribuiti per delega di funzioni al Responsabile/Direttore della Struttura proponente e, pertanto, assume la conformazione di deliberazione del Commissario Straordinario;

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ritenuto di condividere la sopra richiamata proposta;

visto il parere di conformità della presente proposta di deliberazione ai requisiti richiesti dalla Legge affinché l'atto sia valido (inerenti l'agente, l'oggetto, la forma, la funzione e il contenuto) reso dal Responsabile/Direttore della struttura proponente e dal Direttore o suo delegato della S.C. Affari Generali e Legali, per quanto di rispettiva competenza;

assunta la competenza procedurale, la legittimità e la correttezza del processo istruttorio correlato, la cui responsabilità è riconducibile all'ambito dirigenziale della struttura proponente;

acquisito il parere favorevole espresso, per quanto di rispettiva competenza, dal Direttore Amministrativo, dal Direttore Sanitario f.f. e dal Direttore Sociosanitario;



DELIBERA

Per i motivi di cui in premessa che qui si intendono integralmente richiamati:

1. di approvare la stipula della convenzione, allegata al presente provvedimento quale parte integrante e sostanziale del medesimo (allegato n. 1), con l'Università degli Studi dell'Insubria e il Comune di Varese per l'attività di collaborazione per il progetto "Stima Epoca Decesso", con decorrenza dalla data di sottoscrizione di tutte le parti e con durata di due anni;
2. di precisare che il presente provvedimento non comporta oneri a carico di questa Azienda in quanto l'ASST si impegna solo a mettere a disposizione dell'Università degli Studi dell'Insubria i locali nei quali la stessa eventualmente allestirà il laboratorio per l'esecuzione degli esami di competenza in relazione al progetto di cui sopra, con eventuali costi ad esclusivo carico dell'Università stessa;
3. di individuare la Dott.ssa Chiara Rossetti della S.C. Medicina Legale quale referente per l'ASST dei Sette Laghi;
4. di trasmettere il presente provvedimento per opportuna conoscenza e per il seguito di competenza alle seguenti Strutture: Direzione Sanitaria e Medicina Legale;
5. di dare atto che, ai sensi dell'art. 17, comma 6, della L. R. n. 33/2009 e successive modificazioni ed integrazioni, il presente provvedimento deliberativo, non soggetto a controllo, verrà pubblicato nei modi di legge, ed è immediatamente esecutivo.

Convenzione
per Progetto “STIMA EPOCA DECESSO”

TRA

l'Università degli Studi dell'Insubria di Varese con sede in Varese, via Ravasi, 2 – 21100 Varese Partita I.V.A. 02481820120, C.F. 95039180120, in persona del Rettore pro tempore prof Angelo Tagliabue, domiciliato per gli effetti della presente convenzione, presso la sede dell'Università degli Studi dell'Insubria di Varese (in prosieguo denominata “Università”),

E

l'Azienda Socio Sanitaria Territoriale (ASST) dei Sette Laghi con sede legale in Viale Luigi Borri n. 57 a Varese, con recapito di posta elettronica certificata all'indirizzo: protocollo@pec.asst-settelaghi.it, P.IVA n. 03510050127, rappresentata per la firma del presente atto dalla dott.ssa Clara Pelliccia, Direttore S.C. Affari Generali e Legali a ciò delegata dal Commissario Straordinario, Dott. Giuseppe Micale, con nota prot. n. 33487 del 16.05.2023(in prosieguo denominata “ASST”);

E

il Comune di Varese con sede in Varese, via Sacco n.5, C.F.00441340122, in persona del Sindaco pro tempore Avv. Davide Galimberti, domiciliato per gli effetti della presente convenzione, presso la sede del Comune di Varese (in prosieguo denominato “Comune”).

L'Università, l'ASST e il Comune sono di seguito congiuntamente definiti per brevità anche “Parti” o ciascuna singolarmente “Parte”.

si conviene e stipula quanto di seguito.

Premesse:

- L'Università e l'ASST hanno interesse comune nella ricerca per la tanatologia.
- Il Comune intende sostenere il progetto di ricerca "Progetto stima epoca decesso" mettendo a disposizione una porzione di area cimiteriale ed il personale di supporto nelle operazioni meglio descritte in prosieguo.
- Le Parti che procedono alla stipula ai sensi dell'art. 15, l. 241/1990, si attendono dalla presente Convenzione un'attività collaborativa e di ricerca in ambito della stima dell'epoca del decesso.

ARTICOLO 1

Oggetto

1.1 La presente Convenzione, della quale il "Progetto stima epoca decesso" richiamato nelle premesse è parte integrante e sostanziale (Allegato 1), disciplina lo svolgimento in collaborazione fra le Parti delle seguenti attività di interesse comune:

- l'Università si impegna ad eseguire gli scavi iniziali ed apportare i diversi tipi di terreno (sabbia, argilla, agricolo);
- L'ASST si impegna a mettere a disposizione dell'Università i locali nei quali la stessa eventualmente allestirà il Laboratorio per l'esecuzione degli esami di competenza con eventuali costi ad esclusivo carico dell'Università;
- il Comune si impegna a:

• mettere a disposizione un'area nel Cimitero di Belforte, appositamente identificata, di 200 mq;

• garantire il supporto operativo:

– nella fase iniziale di deposizione/inumazione di 45 teste;

– nelle fasi intermedie: ogni 3 mesi esumazione di 9 teste, e così per 5 volte;

– disporre la rimozione dei resti alla fine di ogni esumazione.

Il Comune potrà avvalersi dei propri appaltatori.

L'Università – tramite il Dipartimento di Biotecnologie e Scienze della Vita – assume a proprio carico:

• la delimitazione dell'area cimiteriale;

• le spese di trasporto delle teste dal luogo di conservazione al cimitero e dal cimitero al crematorio;

• la direzione lavori nelle fasi di scavo, inumazione ed esumazione nonché di ripristino;

• le spese di cremazione;

• le spese di ripristino finale dell'area;

Nel caso siano previsti tirocini, gli stessi saranno attivati a seguito di stipula di apposite convenzioni redatte nel rispetto dei vigenti regolamenti dell'Università relativi rispettivamente ai tirocini curriculari ed a quelli formativi e di orientamento.

ARTICOLO 2

Referenti e Responsabili

2.1 Ciascuna delle Parti indica un Referente della Convenzione. Al Referente compete di rappresentare la parte che l'ha designato per le attività esecutive della Convenzione e di reportistica al proprio interno, nonché di monitorare costantemente l'avanzamento delle attività convenute.

2.2 Il Referente dell'Università è il Prof. Paolo Battaglia paolo.battaglia@uninsubria.it

2.3 Il Referente dell'ASST Sette Laghi è la dr.ssa Chiara Rossetti della S.C. Medicina Legale, email chiara.rossetti@asst-settelaghi.it

2.4 Il Referente del Comune è il Dott. Francesco Fachini, email: direzione.area1@comune.varese.it

2.5 I responsabili del progetto per il Comune di Varese sono l'Avv. Stefano Morassi, email: stefano.morassi@comune.varese.it la sig.ra Silvia Laudisio, email silvia.laudisio@comune.varese.it

ARTICOLO 3

Comitato di gestione

3.1 Ai fini del monitoraggio di cui al successivo *Articolo 4*, è istituito un Comitato di gestione composto da:

• per l'Università: dr.ssa Giulia Monti (giuliamonti2403@gmail.com – Head and Neck Surgery and Forensic Dissection Research Center),

• per l'ASST: dr.ssa Chiara Rossetti (chiara.rossetti@asst-settelaghi.it) e dr. Alberto Macchi (alberto.macchi@asst-settelaghi.it – Head and Neck Surgery and Forensic Dissection Research Center),

• per il Comune: Dott. Francesco Fachini, Avv. Stefano Morassi e sig.ra Silvia Laudisio;

3.2 Ciascuna Parte potrà in qualunque momento modificare i componenti del Comitato di gestione diversi dal proprio Referente, mediante comunicazione scritta alle altre Parti.

3.3 Il Presidente del Comitato di gestione sarà nominato d'intesa tra le Parti.

- 3.4 Il Comitato si riunirà con periodicità semestrale o comunque almeno una volta l'anno per definire il piano di attività comune e valutarne i risultati.

ARTICOLO 4

Monitoraggio

- 4.1 Il Comitato si riunirà annualmente al fine di verificare lo stato di avanzamento del progetto.

ARTICOLO 5

Durata e recesso

- 5.1 La presente Convenzione ha durata di n. 2 (due) anni a decorrere dalla data di sottoscrizione e potrà essere rinnovata per ulteriori due anni previo accordo scritto tra le Parti. Non è ammesso il tacito rinnovo.
- 5.2 Resta inteso che ciascuna Parte avrà facoltà di recedere in qualsiasi momento inviando PEC alle altre Parti, con un preavviso di almeno tre mesi, fermo restando l'obbligo di adempimento degli impegni già assunti in specifici atti e accordi di esecuzione della Convenzione medesima.

ARTICOLO 6

Accesso alle strutture ed utilizzo di attrezzature

- 6.1 Per il conseguimento dei fini prefissati dalla presente Convenzione, l'Università, il Comune e ASST si impegnano a consentire, in linea con gli obiettivi previsti e nel rispetto delle regolamentazioni esistenti, alle persone impegnate nell'attività di collaborazione, l'accesso alle rispettive strutture e l'uso di attrezzature necessarie all'espletamento dell'attività didattica e di ricerca, previa autorizzazione scritta del Responsabile dei Servizi Cimiteriali. L'autorizzazione all'accesso non implicherà la concessione dell'uso esclusivo di spazi o strutture.
- 6.2 Ciascuna Parte provvederà alle coperture assicurative di legge del proprio personale che, in virtù della presente Convenzione, frequenterà le sedi di svolgimento delle attività. L'Università dichiara di essere titolare di una polizza assicurativa per responsabilità civile verso terzi a copertura di eventuali danni materiali e diretti cagionati a terzi dal personale di cui si avvale per l'utilizzo della strumentazione scientifica e/o delle apparecchiature collocate in ASST. L'Università inoltre dichiara che la strumentazione scientifica e/o le apparecchiature suddette sono assicurate per danni da incendio e furto, sollevando ASST da qualunque responsabilità derivante dall'utilizzo delle stesse o alle stesse. Ciascuna Parte garantisce che il proprio personale si atterrà ai regolamenti disciplinari e di sicurezza in vigore nelle sedi di esecuzione delle attività oggetto della presente Convenzione, nel rispetto reciproco della normativa per la sicurezza dei lavoratori di cui al D.Lgs. n. 81/2008 e successive modificazioni e integrazioni, osservando, in particolare, le disposizioni del responsabile del servizio di prevenzione e protezione. Il personale che effettuerà operazioni di polizia mortuaria, (inumazioni, esumazioni delle teste) nonché lavori di manutenzione nell'area assegnata al progetto, dovrà essere dotato di tutti i dispositivi di sicurezza previsti dalla normativa per la sicurezza dei lavoratori nello specifico (caschetto, scarpe anti infortunistica, guanti, occhiali protettivi).
- 6.3 Il personale afferente alle Parti, compresi eventuali collaboratori esterni delle stesse, comunque designati, sarà tenuto, prima dell'accesso nei luoghi di pertinenza delle Parti, sedi di espletamento delle attività, ad acquisire le informazioni riguardanti le misure di sicurezza, prevenzione, protezione e salute.

ARTICOLO 7

Utilizzo dei segni distintivi delle Parti

7.1 I loghi delle Parti potranno essere utilizzati nell'ambito delle attività comuni oggetto della presente Convenzione. La presente Convenzione non implica alcuna spendita del nome e/o concessione e/o utilizzo del marchio e dell'identità visiva dell'Università, come anche del Comune e dell'ASST per fini commerciali e/o pubblicitari. L'utilizzo, straordinario o estraneo all'azione istituzionale, dovrà esser regolato da specifici accordi a titolo oneroso, approvati dagli organi competenti e compatibili con la tutela dell'immagine dell'Università e dell'ASST.

ARTICOLO 8

Trattamento dei dati

8.1 In relazione ai trattamenti di dati personali oggetto della presente Convenzione, l'Università, l'ASST e il Comune, ciascuna per quanto di rispettiva competenza, si conformano alle disposizioni del Regolamento UE 2016/679 e alla vigente normativa nazionale, impegnandosi a collaborare per quanto possa occorrere all'operativo adempimento delle relative prescrizioni in conseguenza della stipula della presente Convenzione.

ARTICOLO 9

Comunicazioni

9.1 Qualsiasi comunicazione o notifica richiesta o consentita dalle disposizioni qui contenute sarà eseguita per iscritto e inviata con qualsiasi mezzo atto a comprovarne l'avvenuta ricezione agli indirizzi di seguito indicati:

- se all'Università: dbsv@pec.uninsubria.it
- se all'ASST Sette Laghi: protocollo@pec.asst-settelaghi.it
- se al Comune: protocollo@comune.varese.legalmail.it

o all'eventuale diverso indirizzo o destinatario che ciascuna Parte potrà successivamente comunicare all'altra a mezzo di comunicazione inoltrata in conformità a quanto sopra.

ARTICOLO 10

Codice Etico

10.1 L'Università, l'ASST e il Comune dichiarano di aver preso visione, in sede di perfezionamento della presente Convenzione, dei rispettivi Codici Etici e di Condotta, così come pubblicati nei rispettivi siti istituzionali, ai cui principi etico-comportamentali si conformeranno nell'esecuzione della presente Convenzione.

ARTICOLO 11

Controversie

11.1 Le Parti concordano di definire amichevolmente qualsiasi vertenza che possa nascere dalla interpretazione o esecuzione della presente Convenzione.

11.2 Nel caso in cui non sia possibile raggiungere in questo modo un accordo bonario, il Foro di Varese sarà competente in via esclusiva per qualunque controversia inerente alla validità, all'interpretazione e all'esecuzione della presente Convenzione.

ARTICOLO 12

Registrazione e spese

12.1 La presente convenzione, firmata digitalmente, è soggetta a registrazione solo in caso d'uso ai sensi degli artt. 4, 5, 6 e 39 del D.P.R. 26.4.1986, n. 131. Le spese per l'eventuale registrazione sono a carico della Parte richiedente.

12.2 Il presente atto è redatto in unico esemplare è soggetto all'imposta di bollo fin dall'origine ai sensi dell'art. 2, Tariffa Parte I del D.P.R. 642/1972, assolta in modo virtuale dall'Università

degli Studi dell'Insubria ai sensi dell'art. 15 del D.P.R. 642/1972 – Autorizzazione della Direzione Regionale per le Entrate della Lombardia prot. n. 2014/136508 del 9 dicembre 2014.

ARTICOLO 13
Disposizioni finali

13.1 La presente Convenzione può essere emendata, modificata, sostituita, rinnovata o ampliata solo con atto scritto, firmato da tutte le Parti.

Letto e stipulato in Varese, *[data della firma digitale]*.

Università degli Studi dell'Insubria	Firma Legale Rappresentante Prof. Angelo Tagliabue
Azienda Socio Sanitaria Territoriale (ASST) dei Sette Laghi	Per delega di firma del Commissario Straordinario Il Direttore della S.C. Affari Generali e Legali Dott.ssa Clara Pelliccia
Comune di Varese	Firma Legale Rappresentante Avv. Davide Galimberti



Finanziato
dall'Unione europea
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Ministero dell'Università e della Ricerca

Segretariato Generale

Direzione Generale della Ricerca

PRIN: PROGETTI DI RICERCA DI RILEVANTE INTERESSE NAZIONALE – Bando 2022 PNRR
Prot. P2022BBYXT

PART A

1. Line of intervention

Main line/Linea Principale

2. Research project title

Environmental and Molecular-based solution and Technology for death investigation.

3. Duration of the project (months)

24 months

4. Strategic emerging Topics - 5. Related Cluster

Strategic emerging topic: HUMAN WELLBEING

Cluster: Civil Security for Society

Sub Cluster:

6. Security threats are more effectively addressed thanks to better cross-cutting knowledge across different areas of security, enhanced implementation of the research and innovation cycle and improved uptake.

6. Main ERC field

LS - Life Sciences

7. Other ERC field

SH - Social Sciences and Humanities

8. ERC subfields

1.	LS1_4 Protein biology
2.	LS1_8 Structural biology
3.	SH3_3 Aggression and violence, antisocial behaviour, crime

9. Keywords

n°	Testo inglese
1.	PMI ESTIMATION
2.	DECOMPOSITION
3.	DIAGENESIS
4.	FORENSIC ENTOMOLOGY
5.	PROTEOMICS
6.	MICROBIOME

10. Principal Investigator

RASPANTI (Surname)	MARIO (Name)
Professore Ordinario (Qualification)	
26/08/1956 (Date of birth)	RSPMRA56M26C265Z (Personal identification code)
Università degli Studi INSUBRIA Varese-Como (Organization)	
0332-217451 (Phone number)	mario.raspanti@uninsubria.it (E-mail address)

Declarations

☒ I declare that I have not participated as PI in PRIN 2022 call (n. 104 02/02/2022)

☐ I declare that I have participated as associated PI in PRIN 2022 call (n. 104 02/02/2022)

Current funding and applications submitted



Age limits derogation

The principal investigator and or the substitute are over 40 at the time of the publication of the call. They do not intend to benefit from the derogations to the age limits for the amount allocated to under 40 PI;

11. List of research units (RU)

n°	Associated Investigator	Qualification	University/ Research Institution	Registered office (address)	e-mail address
1.	RASPANTI Mario	Professore Ordinario	Università degli Studi INSUBRIA Varese-Como	Via Ravasi, 2 - VARESE (VA)	mario.raspanti@uninsubria.it
2.	VANIN Stefano	Professore Associato confermato	Università degli Studi di GENOVA	Via Balbi, 5 - GENOVA (GE)	stefano.vanin@gmail.com

12 - Substitute Principal Investigator (PI)* (To be identified among one of the associated PIs participating in the project).

VANIN (Surname)	STEFANO (Name)
Professore Associato confermato (Qualification)	
02/06/1971 (Date of birth)	VNNSFN71H02L407I (Personal identification code)
Università degli Studi di GENOVA (Organization)	
3481360682 (Phone number)	stefano.vanin@gmail.com (E-mail address)

13. Brief description of the proposal

Forensic scientists (e.g., coroners, entomologists, anthropologists) play a key role in criminal investigations as auxiliary members or police advisers for law enforcement and judicial authorities. Indeed, their skills permit the acquisition of data useful for determining the cause and the manner of death and for estimating the time of death.

Comprehending the exact moment of death (from now PMI - Post Mortem Interval) can be a decisive element for understanding the identification of the subject, how a crime occurred and for providing information about the reliability of the deposition of a possible suspect. However, PMI estimation remains a challenge in forensic practice, especially for intermediate and later stages of decomposition; although new studies are published regularly, the accuracy and applicability of the methods remain weak.

The complexity of PMI estimation is due to many variables related to physical, biological, and chemical changes.

In cases of discovery of buried human remains probably linked to homicide with concealment of the body, the difficulties of analysis

reside in the relationship between the corpse and the deposition soil. The soil and the human body determine a modification of their characteristics through a reciprocal organic and inorganic exchange, which will be different according to the type of deposition soil. Buried bodies are known to decompose markedly differently than exposed ones. However, data on how established methods for estimating PMI perform under these conditions are scarce, and studies on different soil types are not currently available. This project, titled "Environmental and Molecular-based solution and Technology for death investigation" (TECHNODEATH) aims to create, for the first time in Italy, an open-air lab dedicated to better understanding the pattern of human decomposition. During this study, 45 heads belonging to human bodies donated to science will be buried, to investigate, through the most innovative technologies of the forensic sciences, the trend of cadaveric decomposition over two calendar years. For the burial, we will use agricultural, sandy, and clayey soil to test the different interactions based on the soil matrix. We expect to exhumate the remains after 3, 6, 9, 12 and 18 months to acquire data on the progress of the experiment in several steps. The project, thanks to the experience of American body farms, also aims to develop a transdisciplinary investigation model based on anthropological, entomological, microscopic (OM and ESEM), proteome and microbiome analyses. Our open-air lab will also host one of more numerous human samples dedicated to forensic analysis at the European level. Finally, it will provide data of great scientific interest in the international forensic community, which could be fundamental in solving judicial cases, and judiciary advising.

14. Total cost of the research project identified by items

Associated Investigator	item A.1	item A.2	item B	item C	item D	item E	item F	Total
RASPANTI Mario	55.047	40.703	0	20.000	14.363	4.000	18.000	152.113
VANIN Stefano	19.012	81.375	7.500	8.000	15.058	10.000	6.000	146.945
Total	74.059	122.078	7.500	28.000	29.421	14.000	24.000	299.058

N.B. The Item D and TOTAL columns will be filled in automatically

- item A.1: enhancement of months/person of permanent and temporary employees
- item A.2: cost of contracts of non-employees, specifically to recruit
- item B: cost of equipment and tools
- item C: cost of consulting and other services
- item D: overhead
- item E: materials cost
- item F: other costs

PART B

B.1

1. State of the art

The study of decomposition for PMI estimation is a longstanding task in forensic science. Indeed, human decomposition is a complex biological and chemical process that begins immediately after death and involves the interaction of cadaver enzymes, bacteria, fungi, and protozoa (1-2).

Several biotic and abiotic factors influence the process. These are also associated with exogenous and endogenous factors, including body size, age, pathologies, typical environmental parameters (i.e., temperature, humidity, soil composition), depth or other burial conditions (i.e., open air or indoor exposition of the body), and the accessibility of the corpse to insects and/or scavengers (3). Gradual physical decay characterizes the decomposition of the body, starting from the fresh stage, through the bloated stage, followed by decay and a post-decay stage, and finally skeletonization (4-5-6).

In the "recent" stage (0-72 hours after death), multiple methods are used: Henssge-nomogram (7), the electrical or mechanical stimulation of skeletal muscles, the pharmacological excitability of the iris, the analysis of chemical or biochemical substances in the fluids (vitreous humour, blood).

The longer the time since death, the more imprecise the chronological or sequential indicators detectable on the remains are (7). For this reason, there are few standardized methods for estimating the PMI in the intermediate and late post-mortem phases.

Yet, forensic entomology is considered one of the most accurate methods to estimate a minimal post-mortem interval in later phases of decomposition (8). However, severe limitations (e.g., no specific insect activity during the dry stage of decomposition, weakness of the method in a body buried in the soil at different depths) require new techniques and new sampling to address the problem.

Megyesi et al. (2005) (9) developed a decomposition scoring method and connected the decomposition to temperature using accumulated degree days (ADD). The ADD is the sum of the average daily ambient temperatures between the date of death and the

date of being found. It represents the heat energy units needed for the biological and chemical reactions to decompose a body. This decomposition scoring method and ADD allowed us to predict the PMI by 84%.

More recently, for PMI estimation in this later phase, some studies have been carried out regarding changes in the intestinal microbiome (10) or skeletal muscle proteins (11), RNA degradations of the dental pulp, and DNA degradation. However, these procedures are tainted by lower reliability and by difficult reproducibility.

As skeletonization progresses, most techniques are useless due to the degradation and colliquation of biological specimens and soft tissue. Estimating the PMI in skeletal remains is even more challenging.

Indeed, the techniques most frequently used by forensic pathologists in the case of "skeletal remains" are based on morphological, chemical, physical and histological data. Some of the most used methods concern nitrogen loss, citrate content, immunological activity, radio nuclide analyses, spectroscopy, luminescence, luminol test, UV fluorescence test, the decomposition pattern, micro-computed tomography, infrared spectroscopy, and Raman spectro-microscopy (12)

However, these methods are useful only for the distinction between forensic and archaeological skeletal remains, although often pathologists try to minimize the error in the PMI estimation by combining two or more methods for each case.

More recently, molecular taphonomic approaches have been proposed for PMI estimation, for example, by assessing the levels of DNA preservation in bones associated with prolonged PMIs (13). However, environmental factors significantly affect the quality of recovered DNA.

In recent years, some studies have dealt with the degeneration of collagen in bone, and with a semi-quantitative evaluation, using staining with Sirius Red and Fast Green (14-15), which allowed the staining of collagen and non-collagen, respectively, to evaluate a difference in the ratio between organic and inorganic matrix. These studies have shown that collagen degeneration is evident already in the first months after death.

Recent studies investigated the applicability of bone proteomic analyses on muscles and bones to PMI estimation during decomposition (16-17), analysing the decrease in the range and abundance of proteins present (e.g., the proteome) and the increase of post-translational modifications occurring in these proteins. These studies found several new potential biomarkers to connect to PMI, demonstrating the applicability of proteomic analyses to forensic sciences.

It is emphasized that much of the published literature on post-mortem interval estimation has been based on nonhuman animal subjects as proxies for humans, including rats and pigs. However, recent studies demonstrated different decomposition patterns and trajectories in humans for each season (18).

2. Detailed description of the project: methodologies, objectives, and results that the project aims to achieve; indicate deliverables and milestones outlining the project coherence as to the strategic themes, indicating clear and innovative objectives, setting out the project sector relevance and its positioning with reference to the state of art, describing the role and contribution of each research unit

- Objectives.

- Develop new methodologies to estimate the PMI - Post Mortem Interval, to allow the forensic scientist, as auxiliary members or police advisers for law enforcement and judicial authorities, to provide elements for the resolution of criminal investigations, in particular cases of homicides with concealment of the corpse.
- Create, for the first time in Italy, an open-air laboratory that studies post-mortem decomposition on a large sample of buried human remains.
- Carry out a PMI estimation study under conditions closer to reality than previous experiments performed on animals or de-fleshed human bones performed in the laboratory.
- Develop new transdisciplinary methods useful in the forensic and coroner fields through an inter and multidisciplinary approach.
- Verify the influence of soil types (agricultural, clayey and sandy) on putrefaction, especially in bone diagenesis.
- Improve our knowledge of the PMI of the intermediate stages of decomposition, understudied by researchers, during a two-year time interval.
- Parameterize new methodologies for PMI estimation, more reliable and accurate, which can be of great scientific interest in the international forensic scientific community and fundamental in the resolution of judicial cases and judicial consultancy.

- Materials

TECHNODEATH project will use 45 human heads, complete with skin, soft tissues and brain in situ, belonging to bodies donated to science, coming from the Global Anatomy Security of Irvine in California. The heads were purchased by the University of Insubria (RU1) and used by the School of Specialization in Otorhinolaryngology and Laryngology for research purposes on endoscopic surgery of the paranasal sinuses and skull base. The heads were made available for this study following micro-invasive analyses of the nasal cavities carried out for surgical technique improvement that did not compromise their integrity.

The project has the "Presa d'atto" of the Comitato Etico dell'Ospedale di Circolo e Fondazione Macchi of Varese, permissions required for this type of search.

The two Universities involved in the project (RU1, RU2) will collaborate to set up the open-air lab, a field of 200m² located inside the cemetery of Varese. This operation has the authorization of the Municipality and the Cemetery Services, which provides for the deposition of identified human remains in full compliance with the Mortuary Police Regulations (Presidential Decree 285/1990) and the measures required by the Health and Public Hygiene Services of the ATS (Health Protection Agencies).

In this area will be excavated three graves of 20 cubic meters (5 x 8 x 0.4 m), in which 15 heads will each be placed approximately 1.5 meters from each other at a depth of 40 cm. A data logger will be positioned near each head to constantly record all the data relating to the temperature and humidity of the surrounding soil. The holes will be filled with different soils, one with agricultural, one with clay and one with river sand. Finally, a meteorological station will be positioned in the area for the constant monitoring of all environmental variables.

- Methods

Both RUs will attend the exhumation of 3 heads from each hole at 3, 6, 9 and 18 months from the deposition. At each step, the various RUs will sample for the following analyses:

1. Optical and scanning microscope analysis.

A thin section of portion of the frontal bone (4 x 2 cm) will be prepared and send to the Human Morphology Laboratory of University of Insubria (RU1) for microscopical analyses.

Microscopical analyses will make it possible to acquire qualitative and semiquantitative data by observing the preparations at very high magnification, allowing for the evaluation of diagenetic alterations and their variation over time.

Diagenesis is the process of altering the bone tissue after its burial.

Bones after death can lead to the demineralization (the initial degradation of the hydroxyapatite)(19-20), the denaturation of the collagen (e.g., the decrease in its quantity and the loss of orientation of the osteonic lamellae), and the remineralization determined by the exchanges with the soil.

Analysis of post-mortal modifications will be performed by optical microscopy and scanning microscopy.

One-third of the sample collected will be prepared for optical microscopy. First, the sample will be fixed in formaldehyde for seven days. Then, it will be immersed in 5% hydrochloric acid and 5% acetic acid solution for its decalcification. Finally, the preparation of histological specimens will be carried out, following these steps: fixation, dehydration, clearing, embedding, section cutting, staining and mounting in slide preparation.

For this project we will stained specimens with hematoxylin/eosin (EE) and Sirius Red (specific staining, developed by Junqueira and colleagues in 1979, for the collagen fibres, which will appear an intense red colour).

The histological specimens will be observed both in transmitted and polarized light.

In transmitted light, the preparations stained with EE and Sirius red will allow a general evaluation of the state of conservation of the bone tissue and the study of the arrangement of the osteonic lamellae of the two layers of compact bone.

Furthermore, specimens stained with Sirius Red will allow a semi-quantitative evaluation of the collagen component and its possible progressive degeneration over time. This effect can be noted by a progressive decrease in the intensity of the red colouration.

The observation in polarized light of the same thin sections will allow us to evaluate the intensity of the birefringence of the osteons. Its decrease over time can be interpreted as a deterioration of the collagen, but it can also indicate a loss of orientation of the hydroxyapatite, consequent to that of the organic matrix.

Two-thirds of the original sample will undergo preparation for scanning electron microscopy. Specimens for SEM were fixed in Karnowski's solution, dehydrated in graded ethanol and hexamethyldisilazane, mounted on appropriate stubs with a colloidal silver glue, gold coated with an Emitech K550 sputter-coater (Emitech, Montigny-le Bretonneux, France) and observed with a FEI XL-30 FEG high resolution SEM (now Thermo Fisher, Waltham, MA, USA) operated in secondary electron imaging.

Scanning microscopy with secondary electrons (SE) allows a more detailed morphological evaluation of the inorganic component and the arrangement of the lamellae of the Haversian system, with particular attention to the phenomena of demineralization and remineralization.

We will evaluate the presence of microscopic focal destructions (MFD) or tunnels on the section surface (21-22). These features are characterized by focal losses of hydroxyapatite and collagen with hypermineralized surrounding areas, determined by the action of bacterial or fungal collagenases (morphologically, four types of tunnels are distinguished: linear longitudinal, budded, lamellate, and wedged) (19). These determinations will allow us to verify the action of the microorganisms and to correlate their presence to the type of soil.

Inclusions of exogenous material in empty spaces of the bone tissue will also be identified. Their origin will be verified, which can usually be traced back to fungal deposits, soil infiltrations and qualitative alterations of the hydroxyapatite crystals.

The presence of "cracks" or "fissures" will also be evaluated. Those of larger dimensions can give information regarding possible physical stresses suffered by the bone tissue, such as changes in the environment, while the microcracks of the osteon are an indicator of the loss of the organic component of the bone and its lamellar arrangement.

Furthermore, with the scanning electron microscope equipped with an EDX detector for microanalysis and backscattered electrons (BSE), semi-quantitative investigations will be carried out to identify the variation over time of the organic and inorganic composition of the non-decalcified bone surface.

2. Entomological analyses.

Insects will be collected using Malaise traps sampled every month and from the soil surrounding the heads at the head collection times. Samples will be taken at the University of Genoa (RU2).

From the soil, insects will be extracted using a Berlese method and by flottation. The European guidelines for forensic entomology will be used to process the specimens. Morphological identification will be performed using an optical microscope and a stereomicroscope equipped with cameras. Specific identification keys will be used for the identification of the specimens. When necessary, the molecular approach will be used to validate the morphological identification for specimens identified only at family level. Specific DNA extraction kits will be used to extract total DNA from the specimens subjected to mechanical grinding using a plastic pestle. The COI barcode region (658 bp) will be amplified using the universal primers LCO1490 and HCO2198 (23).

Sequencing reactions will be carried out by an external company. The obtained FASTA sequences will be compared with GenBank DNA sequences using BLAST-n® (24) and with home-produced sequences as reported in Bortolini et al. (2018) (25).

Average daily temperature and total rainfall data will be obtained from a weather monitoring station placed on the sampling site. data loggers will be placed in each heads and data will be downloaded at the moment of the sampling. Temperature data will be later converted into Accumulated Degree Days (ADD, Day°C) by thermal summation models with a base temperature of 0°C, which accounts for temperature variation over decomposition.

3. Proteomic analyses.

Proteomic analysis (proteomics) refers to the systematic identification and quantification of the complete complement of proteins (the proteome) of a biological system (cell, tissue, organ, biological fluid, or organism) at a specific point in time.

In this project will evaluate the proteome cumulative decay during decomposition.

A thin section of a portion of the frontal bone (1 x 1 cm) will be sampled and send to the UCLAN University (UK) for proteomic analysis.

Proteins will be extracted following the protocol proposed by Procopio and Buckley 2017 (26).

Each bone fragment will be individually decalcified with 1 mL of 10% formic acid for 6 hours at 4 °C. The acid-soluble fraction will be discarded, and the pellet will be then treated with 6 M guanidine hydrochloride/100 mM TRIS buffer with an adjusted pH of 7.4 for 18 h at 4 °C.

The acid-insoluble fraction will be then exchanged with 50 mM ammonium acetate using 10 kDa molecular weight cut-off filters, and the proteins will be then reduced with 5 mM dithiothreitol for 40 min at room temperature, alkylated using 15 mM iodoacetamide for 45 min in the dark at room temperature, and quenched by adding 5 mM dithiothreitol.

Proteins will be digested using trypsin for 5 hours at 37 °C, and then frozen. 1 v/v% trifluoroacetic acid will be added to the samples prior to their desalting and purification, in order to bring them to a final concentration of 0.1 v/v% trifluoroacetic acid. The purification will be achieved using OMIX C18 pipette tips, in accordance with the manufacturer's instructions.

The peptides will be finally eluted into 100 µL of 50 v/v% acetonitrile/0.1 v/v% trifluoroacetic acid. Samples will be then dried prior to their submission for LC-MS/MS analysis using an Ultimate™ 3000 Rapid Separation LC (RSLC) nano LC system coupled to a Q Exactive™ Plus Hybrid Quadrupole-Orbitrap Mass Spectrometer.

The LC separation will be followed by a cleaning cycle with an additional column equilibration time.

Peptide ions will be analysed in full-scan MS scanning mode at 35,000 MS resolution with an automatic gain control (AGC) of 1e6, injection time of 200 ms, and scan range of 375–1400 m/z. The top 10 most abundant ions will be selected for data-dependent MS/MS analysis with a normalized collision energy (NCE) level of 30, performed at 17,500 MS resolution with an AGC of 1 × 10⁵ and maximum injection time of 100 ms. The isolation window will be set to 2.0 m/z, with an underfilled ratio of 0.4%, and dynamic exclusion will be employed; thus, one repeat scan (i.e., two MS/MS scans in total) will be acquired in a 45 s repeat duration, with the precursor being excluded for the subsequent 45 s.

Peptide mass spectra will be then searched against the SWISS-PROT database using the Mascot search engine (www.matrixscience.com) for matches to primary protein sequences.

This search includes the fixed carbamidomethyl modification of cysteine, which results from the addition of DTT to proteins.

In the light of our aims, deamidation (asparagine and glutamine) and oxidation (lysine, methionine and proline) will be also considered as variable modifications. The enzyme will be set to trypsin, with a maximum of two missed cleavages allowed.

Progenesis Q1 for Proteomics software will be used to identify the proteins and assess their relative abundance in each sample. The relative abundance of the proteins present in the samples is calculated by the software by measuring the peptide ion abundances as a result of the sum of the areas under the curve (AUC) for each peptide ion. The software normalizes each LC-MS/MS run against a reference run automatically selected as the normalization reference, in order to consider and to correct the systematic experimental variations that can occur between different runs; then, it enables protein comparisons between different experimental conditions, and the identification of protein expression changes. Peptide ions with a score of <23, indicating identity or extensive homology ($p < 0.05$), will be excluded from the analysis based on the Mascot evaluation of the peptide score distribution. To further increase the reliability of the obtained results, proteins with a peptide count of <2 will be also excluded from further analysis.

STRING software will be used to visualize links among the identified proteins, and to evaluate the significance of their interactions. The confidence score set for showing interactions will be set to "medium = 0.400".

Statistical analysis will be carried out on arcsinh normalised data in the same way in which the Progenesis software operates.

Principal component analysis (PCA) will be performed on the normalized abundance values exported from Progenesis, using R software with the factoextra and ggplot2 packages, using proteins sorted by their ANOVA FDR adjusted p values (or "q value") in order to exclude the proteins that showed similar relative abundances across different conditions.

Protein abundances will be considered to have significantly contributed to the explanation of the variance between different groups

of samples when their ANOVA $p < 0.05$. For post-hoc analysis, Tukey's HSD test will be employed with significance set at $p < 0.05$ for pairwise comparison.

4. Microbiome analyses.

Thanatomicrobiome is the microbial community associated with the host after its death. It characterizes the microbial succession in and around dead biomass and contributes significantly to modulating decomposition.

Bacterial swab samples will be taken for each head from three areas: brain cavity (internal region), nasal or oral cavity and interface soil-head (upper part of the head). Swabbing will be performed for 30 s using dry DNA-free sterile cotton swabs.

For each head area, triplicate samples will be collected and immediately stored in ice.

One set will be used the same day of the collection, from expert of University of Genoa (RU2), in order to assess the phenotype of the microbial communities by BIOLOG EcoPlates™. The two remaining swabs will be stored at -20°C until further molecular processing such as DNA extraction for 16S rRNA gene amplification, performed at NUOmicS DNA Sequencing Research Facility (Northumbria University, Newcastle, UK).

BIOLOG EcoPlates™ will be used to investigate the phenotype of the microbial communities as a function of their ability in using different carbon sources. Every single swab will be gently shaken in 15 ml of 0.9% NaCl sterile solution to obtain a microbial suspension. One hundred and fifty microliters of suspension will be inoculated directly into each of the 96 wells of a BIOLOG EcoPlate™. The absorbance of each well will be measured automatically at 590 nm every 24 hr for 5 days (120 hr) at a constant temperature of 25°C using a spectrophotometer. Microbial functionality index will be calculated as the ratio between the numbers of positive wells on the total 31 carbon sources. The obtained value expressed as percentage varies from 0% to 100% with 0% being the lowest diversity and 100% being the highest one (27).

DNA extraction kit will be used to extract total bacterial DNA from swabs using the manufacturer's protocol. DNA amplification will be carried out on the 16S rRNA gene, widely used as a molecular marker using forward 515FB (GTGYCAGCMGCCGCGGTAA) and reverse 806RB (GGACTACNVGGGTWTCTAAT) primers to verify the bacterial presence. Positive samples' extracts will be sent to the NUOmicS DNA Sequencing Research Facility (Northumbria University, Newcastle, UK) for the amplification and sequencing of the hypervariable region V4 of the 16S ribosomal RNA gene using the Illumina Miseq Next Generation Sequencer (Illumina Inc., Cambridge, UK), following the gold standards suggested by the Earth Microbiome Project to target and sequence the highly variable V4 region of the 16S rRNA gene for microbial identification.

Paired-end reads from each sample will be sequenced with forward and reverse reads in separate files and processed by means of the microbiome bioinformatics platform QIIME2 (Quantitative Insights Into Microbial Ecology 2), v.2021.2. Denoising and quality control, including removal of chimeras, will be achieved by means of the DADA2 plugin and to avoid low quality sequences reads will be truncated (250 bp for forward, 240 bp for reverse reads). The classifier adopted for the taxonomic assignment will be Silva v.138 (99% OTUs full-length sequences).

Statistical analyses will be performed within the computing environment R (<https://www.R-project.org/>). All the taxon abundances will be calculated and graphically plotted with the aid of the PHYLOSEQ v.1.22.3 package. Prior to performing formal analyses and creating the figures, pre-processing steps will be applied to the Amplicon Sequence Variants (ASV) counts: ASVs with fewer than 5 reads will be filtered out and abundances will be standardized to the median sequencing depth according to McMurdie and Holmes 2014; ASVs recognized as mitochondrial or chloroplast sequences will be also excluded. The Indicator Species Analysis (ISA), (a classification-based method to assess the statistical significance of the relationship between species occurrence/abundance and groups of sites) will be performed using the multipatt function from the indicpecies v.1.7.9 R package, with 999 permutations in order to assess whether ASVs will be significantly associated with a particular stage/time of decomposition.

At identified time intervals (3, 6, 9, 12 and 18 months), soil adjacent to each exhumed head will be sampled and taken at University of Genoa (RU2) for the analysis of its structure and biological components, in order to verify the organic and inorganic exchanges between the human head and the enclosed environment.

At each times (3, 6, 9, 12 and 18 months), at the end of all the samplings for the microscopic, entomological, proteomic and microbiome analyses, the 9 heads will be taken to the Crematorium of the Municipality of Varese, in full compliance with the Mortuary Police Regulations in force (Presidential Decree 285/90), through the intervention of an identified Funeral Honours Company.

At the end of the last esumation (18 month), the graves containing clay and sand will be emptied and filled with agricultural soil, as originally.

- Results and their significance in terms of advancement of knowledge.

This project represents a unique in the PMI estimation field in Italy and more in general in Europe because of its multidisciplinary approach and because the methodology using human head and not animal surrogate such as pig model. In fact the transformation of the bones and the decomposition processes affecting the soft tissue have been primarily investigated in exposed bodies, and in the majority of the case using pigs or other mammals. Only in the USA and in Australia experiments have been done using human bodies thanks to the existence of several "body farms". However, this topic is of particular relevance in Italy, in Europe and in other close countries in order to provide useful information to National and International courts of laws. Local crimes, religion/tradition related homicides and war mass graves represent some of the cases where the results of the proposed project will find their application. The project in fact starting from a scientific point of view will provide rigorous tools and a validate methodology to be applied in forensic cases.

At the end of the project, we expect to observe a progression of bone diagenesis as the PMI increases (e.g., of demineralization,

remineralization and degeneration of the organic matrix), and to document a trend that is not necessarily linear, probably directly proportional to the environmental variables (e.g., temperature).

Morphological (SE) and semi-quantitative (BSE) evaluations of the inorganic component and its alteration in the first months after the death were analysed thanks to optical microscopy and ESEM. This approach has few comparisons in the scientific literature and represents an innovative method in the forensic field for PMI estimation.

Furthermore, SE and BSE could provide important information regarding the soil's influence on demineralization and remineralization processes (e.g., inclusions, and cracks).

The optical microscopy observations in transmitted and polarized light of the samples during two years will enrich the few data available in the scientific literature on the decrease of collagen components thanks to the evaluation of samples stained with Sirius Red.

Degeneration of the organic matrix will also be observed through scanning microscopy microanalysis.

More significant data, to be compared with the previous ones, will be provided by proteomic investigations, which will be able to demonstrate a cumulative decay over time of organic bone matrix proteins, allowing us to identify the identification of new potential biomarkers for PMI estimates.

Proteomics must be considered an innovative and cutting-edge method in forensic science, and the results of this project would represent a validation of its great utility in the study of bone diagenesis.

Bone diagenesis has been, until now, a field of investigation linked to archaeology. Very little has been analysed from the point of view of forensic science.

Moreover, post-mortal modifications in bone tissue analyses allow us to develop methods for PMI estimation also in the intermediate-late phases of putrefaction, in which only the skeleton could be present and the collimation of soft tissues makes difficult to apply methods based on the study of muscle proteins degeneration.

Therefore, this project could lead to the development of new methodologies based precisely on bone tissue which, jointly, could provide more accurate results than those currently present in the literature.

The following up of the microbial and entomological communities will also represent an important achievement for burial bodies PMI estimation due to the fact that forensic entomology and Microbiome analyses have been largely performed in exposed bodies and few data are reported for burial. Moreover, there is a lack of information about the microbial and entomological communities that can colonize or develop on bodies buried on different substrata, one important aspect that will be explored in this project. The usage of external traps (such as Malaise and interception traps) through the year will allow also to describe and evaluate the biodiversity of the local saprophagous fauna that would be communicate to the National Biodiversity Future Center – NBFC (funded by the PNRR). This project will allow the creation of one of the few research realities in the world for the buried human remains decomposition in conditions closer to reality. The open-air lab will have a large sample of human heads, various burial conditions linked to the soil type, constant monitoring of environmental variables and observation of the interaction between human remains and soil.

The goal is to create a network of collaborations that, thanks to numerous innovative methods, will obtain results for the international forensic science community.

These results will be new elements for the forensic scientist to answer the questions posed by the Magistrate on the estimate of the time of death (PMI) in cases of judicial interest. It will be useful in homicides with concealment of the body, providing fundamental indications for understanding the identification of the subject, the methods of carrying out the crime and to provide information on the reliability of the testimony of a possible suspect.

3. Detailed description of the project team and planning; indicating the research team components – PI and associated PIs - and their relative expertise/track record, gender equality of the composition, the interrelation and coherence of the team components. RUs- and the feasibility of the project, thus outlining the congruity between objectives, timing and costs

THECNODEATH is a 24-month project. It will be headed by a multidisciplinary research group including two research units: the University of Insubria (RU1) and the University of Genoa (RU2).

RU1 will coordinate the project and will be responsible for the investigation.

RU1:

- Management of municipal authorizations and cemetery services and contracts with the excavation company for setting up the open-air lab.
- Procurement of the human sample with Prof. Paolo Battaglia, Associate of Otolaryngology at the University of Insubria.
- Management of legal and ethical issues related to the human sample donated to science for research purposes. These issues will be supervised by Prof Mario Picozzi, Associate in Forensic Medicine, affiliated with the Centre for Clinical Ethics (CREC) of the University of Insubria, expert in the ethic field. CREC is part of the European Clinical Ethics Network (ECEN) and is also a member of the European Association of Centres for Medical Ethics (EACME)
- Transport of the samples to the open-air lab, through the intervention of an identified Funeral Honours Company.

RU1 and RU2:

- Preparation of the open-air lab with the supervision of the identified excavation company.
- Burial of the human samples and the related data loggers at the established distances.
- Exhumation of 9 heads, 3 for each hole, at each established time interval (3, 6, 9, 12 and 18 months). At first, RU2 will proceed with

the sampling of the entomological material (via traps, sieving, flottation, Berlese-Tulgren funneland) and the sampling of the brain parenchyma, of the nasal or oral cavity and of the skin adjacent to the soil. Then, RU1 will take care of the sampling on the frontal bone for subsequent microscopic and proteomic investigations.

RU1:

- Organisation of Cremation of the heads, at each time intervals (3, 6, 9, 12 and 18 months), at the end of the sampling for microscopic, entomological, proteomic and microbiome analyses, in full compliance with the Mortuary Police Regulations in force (Presidential Decree 285/90), through agreements with the Municipality of Varese and the intervention of an identified Funeral Honours Company.

- Study the bone diagenesis trends, through the evaluation, in optical and scanning microscopy and with proteomics, of the degeneration of the bone extracellular matrix (organic and inorganic).

The microscopic analyses will be carried out by RU1 (University of Insubria - ONU) and coordinated by the PI, Prof. Mario Raspanti, Full Professor of Human Anatomy and Director of the Laboratory of Human Morphology.

Professor Mario Raspanti is one of the leading international experts in the study of the extracellular matrix and its collagen and mineral components, on which he has concentrated all his scientific production (more than 100 papers). He is an ex-president and member of the Italian Society for the Study of Connective Tissue (SISC), and member of the International Society of Matrix Biology (ISMB). Furthermore, over the years, he has developed several original preparatory and investigative techniques in Optical Microscopy and high-resolution SEM to optimize the study of the extracellular matrix.

This project will represent one of the few internationally conducted studies on diagenesis involving the extracellular matrix for forensic purposes, using optical and electron microscopy methods.

Promising results could pave the way for subsequent studies in the international forensic scientific community that will want to reproduce the methods. Therefore, the setting of methodologies, supervision of sample preparation and microscopic identification of potential features indicative of mineral or collagen degeneration are operations performed by a leading expert in the field.

The analyses will be carried out with the contribution of further specialists in the sector, Prof. Marina Protasoni, Associate of Human Anatomy, Dr Marcella Reguzzoni, a University Researcher in Histology, and Dr Marina Borgese and Dr Piero Antonio Zecca, both RTDa in Human Anatomy) which have a great experience in the study of bone tissue in optical and electron microscopy.

Fundamental to the project will be the contribution of following forensic researchers: RU1 - Dr Cesare Garberi, a University Researcher and expert in thanatology and forensic pathology; RU1 - Prof Jutta Maria Birkhoff, an Associate in Forensic Medicine and a top expert in Criminology; RU1 - Dr Chiara Rossetti, a PhD student who has concentrated her research on bone diagenesis analyses.

The medico-legal contribution will be useful in interpreting the data obtained and will allow their use in the PMI estimation. Indeed, the coroners and forensic geneticists will be the forensic experts to whom the Judiciary will ask to express their opinion on the PMI in cases of judicial interest.

- Sending the bone samples taken from each head to the UCLAN University (UK) for proteomic analysis.

RU2

- Insects and other arthropods morphological and molecular identification.

- Sending the samples for microbiome analyses to NUOmicS DNA Sequencing Research Facility (Northumbria University, Newcastle, UK) for microbiome analyses. Microbiome sampling, preparation of the samples to be sent for DNA analysis.

- Functional Microbiome (EcoPlate) analysis.

- Meteorological data acquisition (temperature, RH%, wind, solar radiation, photoperiod).

- Soil sampling and analysis (structure, biological component).

- Statistical analysis.

Professor S. Vanin, President of the European Association of Forensic Entomology, has 25 year's experience in forensic and archaeo-funerary entomology. He worked in several cases of buried bodies, and he performed research on insect and microbiome associated with decomposition. His PhD student G. Carta has a bio-archaeological background and is specialized in insects from ipogean contexts.

RU1 and RU2

- Interpretation of the results of the proteomic analyses and the study of the microbiome.

- Dissemination of the results (cfr. next session).

- Scientific paper writing.

- Conferences participation.

- Organization of meetings (every 3 months, in presence or online) for result sharing and to coordination of the field and lab activities.

4. Detailed description of the Project impact, as such; indicating knowledge improvements, technological innovation and/or industrial applications, scientific community reinforcement, level of research internationalization, dissemination and exploitation of the results

This project foresees the construction of the first "human farm" in Italy, with which a pool of experts in the various forensic sciences

will collaborate. The multidisciplinary approach, the number of samples, the deposition in the ground and the creation of large graves with three types of soil can make this open laboratory a centre of reference for the scientific community at National, European and International level and a model for research to be emulated. Furthermore, this research will have different levels of impact, including biological, scientific, and forensic, civil security for society and social and public sectors.

The study will make it possible to reach the new goals listed below.

- The accuracy of the methods for PMI estimation, especially if combined, in the intermediate stage of putrefaction, compared to those developed up to now (forensic sector).
 - Generate large volumes of data thanks to the number of samples and innovative technologies (scientific and forensic sector).
 - Evaluation of the diagenesis in the first and intermediate stages of putrefaction (scientific and forensic sector).
 - Evaluation of the decomposition of buried heads compared to exposed corpses (scientific and forensic sector).
 - Study of decomposition on human samples compared to animal surrogates, such as pigs (scientific and forensic sector).
 - Data on entomological and microbial communities that can colonize buried bodies (scientific and forensic sector). This data will be passed to the Biodiversity National Center (PNNR) also in a "One Health" perspective.
 - Study on the most suitable site to carry out a swab for microbiome analysis (forensic sector).
 - Knowledge of the influence of soil typology on the course of putrefaction and separately on diagenesis, entomological and microbiomic colonization (biological, scientific, forensic sectors).
 - Helpful information to be provided to national and international courts for the resolution of local crimes, murders linked to religion/tradition and mass graves of war (civil security sector for society).
 - To sensitize the community to donate the body for research purposes, which is currently not widespread in Italy. In light of law 10 of 02/10/2020, containing "rules relating to the directives of one's own body and post-mortem tissues for study, training and scientific research", has already emerged the possibility of organizing, with the participation of the Municipality of Varese, meetings with citizens, a conference about the importance of body donation as a support to research not only in the forensic sector but also in other clinical or surgical specialties (e.g., scientific, social and human sectors).
 - Results on PMI estimation will be published in high-impact peer-reviewed journals. The broad spectrum of application of the results will allow for a large general forensic science audience (e.g., as regards entomologists, proteome and microbiome biologists, but also anatomographers for structural diagenesis degradation). The results will also be presented at specific scientific conferences and symposiums (e.g., SRBR, AAFS, EAFE, FASE). Moreover, they will be publicly presented on social media and in public conferences at the national and international levels. The website of the University of Insubria and the University of Genoa will promote the dissemination of the results.
- Moreover, during the sampling training for young forensic pathologists and PhD students will be organized, transforming the experimental activity also in a training course.

5. Financial aspects: costs of each research unit

n°		Funds of the Ministry of University and Research (euro)
1.	RASPANTI Mario	152.113
2.	VANIN Stefano	146.945
		299.058

6. Bibliography

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7. Time schedule of the research activities (GANTT CHART)

Milestone 1 FIELD PREPARATION

ACTIVITY	ASSIGNED TO	I year						II year					
		BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6	BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6
HEADS BURIAL	RASPANTI M	X											
TRAPS SET UP	VANIN S	X											

Milestone 2 SAMPLING

ACTIVITY	ASSIGNED TO	I year						II year					
		BIM.	BIM.	BIM.	BIM.	BIM.	BIM.	BIM.	BIM.	BIM.	BIM.	BIM.	BIM.

		1	2	3	4	5	6	1	2	3	4	5	6
HEAD COLLECTION	RASPANTI M VANIN S		X	X		X	X			X			
BONE PREPARATION FOR MICROSCOPY	RASPANTI M		X	X		X	X			X			
ENTOMOLOGICAL SAMPLING	VANIN S		X	X		X	X			X			
PROTEOMIC SAMPLING PREPARATION	RASPANTI M		X	X		X	X			X			
MICROBIOME SAMPLING PREPARATION	VANIN S		X	X		X	X			X			
SOIL SAMPLING	VANIN S		X	X		X	X			X			

Milestone 3 INSECTS IDENTIFICATION

ACTIVITY	ASSIGNED TO	I year						II year					
		BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6	BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6
MOLECULAR/MORPHOLOGICAL IDENTIFICATION	VANIN S		X		X	X		X			X		

Milestone 4 DIAGENESIS ALTERATIONS EVALUATION

ACTIVITY	ASSIGNED TO	I year						II year					
		BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6	BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6
MICROSCOPICAL OBSERVATION	RASPANTI M		X		X	X		X			X		

Milestone 5 PROTEIN DEGRADATION EVALUATION

ACTIVITY	ASSIGNED TO	I year						II year					
		BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6	BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6
PROTEOMIC ANALYSES	RASPANTI M		X		X	X		X			X		

Milestone 6 MICROBIOME EVALUATION

ACTIVITY	ASSIGNED TO	I year						II year					
		BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6	BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6
MICROBIOME ANALYSES	VANIN S		X	X	X	X	X	X			X		

Milestone 7 DISPOSAL

ACTIVITY	ASSIGNED TO	I year						II year					
		BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6	BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6
CREMATION OF HEADS AFTER SAMPLING	RASPANTI M		X	X		X	X			X			

Milestone 8 STATISTICAL EVALUATION

ACTIVITY	ASSIGNED TO	I year						II year					
		BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6	BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6
STATISTICAL ANALYSES	VANIN S							X					X

8. Time schedule of the expenses

n°	Research Units	Expenses	I year						II year					
			BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6	BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6
1.	RASPANTI Mario	item A1	X	X	X	X	X	X	X	X	X	X	X	X
2.	RASPANTI Mario	item A2							X	X	X	X	X	X
3.	RASPANTI Mario	item B												
4.	RASPANTI Mario	item C	X	X	X			X			X			X
5.	RASPANTI Mario	item D												
6.	RASPANTI Mario	item E	X	X	X			X			X			X

7.	RASPANTI Mario	item F						X						X
8.	VANIN Stefano	item A1		X	X	X	X	X	X	X	X	X	X	X
9.	VANIN Stefano	item A2	X	X	X	X	X	X	X	X	X	X	X	X
10.	VANIN Stefano	item B	X											
11.	VANIN Stefano	item C		X	X			X			X			X
12.	VANIN Stefano	item D												
13.	VANIN Stefano	item E		X	X			X			X			X
14.	VANIN Stefano	item F						X						X

B.2

1. Scientific Curriculum of the Principal Investigator

- Researcher unique identifier: ORCID Id	0000-0001-6322-1845
- URL for web site:	https://www.uninsubria.it/hpp/mario.raspanti
Academic age (years from the beginning of scientific activity, i.e. years from first publication or from the beginning of PhD or Medical Specialisation School)	43
Previous positions	In 1984, after a short period at the Abteilung fuer Elektronenmikroskopie of the Medizinische Hochschule in Hannover, Germany, he joined the Institute of Human Anatomy in Bologna where he was included in various research projects (MURST 60% and 40%, CNR, Committee Projects). For 15 years he was Technical Assistant (VI level out of VIII) and then in 1989 Technical Officer (VIII level) of the Electron Microscopy Laboratory, taking part actively in all the research carried on in this structure and devising original preparation and investigation techniques in the fields of optical microscopy, TEM, high-resolution SEM, freeze-etching, atomic force microscopy, image analysis and three-dimensional modelling. In 1999 he joined, as an Associate Professor, the Human Morphology Laboratory of the University of Insubria where he opened the new atomic force microscopy unit. Since 2004 he is Full Professor of Human Anatomy (E09/A) in the same Medical School.
Prizes and awards	none
Visiting academic positions	none
Teaching activities and PhD supervision	In 1983-1986 he took part in the examination committee for anatomical practice activities and in seminars in osteology, microscopic anatomy, and neuroanatomy for the graduation course in Biological Sciences of Bologna University. From 1983 to 1989 he oversaw all the anatomical practice activities and some specific seminaries in Gross Anatomy for the graduation course in Medicine and Surgery, and from 1989-90 to the end of 1998 he was part of the examination committee of Anatomy II for the same course. He made tutorial activities for the resident students of Biological Sciences and of Medicine and Surgery and followed their graduation thesis as an official correlator. He is a member of the PhD in Research and life Sciences teaching board of the

Research Centre in Innovative Technology and Engineered Biomaterials (ITEB). He is a member of the Board of Lecturers of the PhD in Life Sciences and Biotechnology and the ITEB, and teaches anatomy in medicine, dentistry, and degree courses.

Other work experience (e.g. consultancy if any)	He has been a consultant for several biomaterials' companies (BTK, Leader). He regularly acts as a referee for several journals; among the others, ACS Nano, Acta Biomaterialia, Acta Biomaterialia, Anatomia Histologia Embryologia, Anatomical Record, Biomacromolecules, Cell and tissue Research, Colloids & Surfaces, Connective Tissue Research, Cytotechnology, European Cells and Materials, Gels, Interface, International Journal of Biological Macromolecules, International Journal of Molecular Sciences, Journal of Cellular Physiology, Journal of Functional Biomaterials, Journal of Marine Sciences and Engineering, Journal of Microscopy, Lasers in Medical Sciences, Materials, Matrix Biology, Matrix Biology Plus, Metabolites, Micron, Microscopy Research & Technique, Microvascular Research, Molecules, Nanomaterials, Pharmaceuticals, PLOS One, Polymers, Soft Matter, Sport Sciences for Health, The Anatomical Record, The World Scientific Journal.
- Administrative role and position responsibility	In 1998 he passed the national competition for Full Professor, announced on 30/1/1996, in the scientific-disciplinary sector E09A (Human Anatomy). In October of the same year, he was called to take up service as Associate Professor of Human Anatomy at the Faculty of Medicine and Surgery of the University of Insubria in Varese, where he took up service on 1/1/1999. In the same year, he established the Atomic Force Microscopy Laboratory, which joined the pre-existing Electron Microscopy Laboratory. On February 21, 2001, he obtained eligibility for full professor in the scientific-disciplinary sector E09/A - Human Anatomy in a contest of the Medical Faculty of Pavia University. On 26 June of the same year, he was called by the Faculty of Medicine and Surgery of the University of Insubria to fill the role of Extraordinary Professor of Human Anatomy, a position which he held since 1 October 2001 and that was later converted into Full Professor. He currently holds the course "Anatomy I" for the master's degree Course in Medicine and Surgery, "Human Anatomy" for the Master's Degree Course in Dentistry and Dental Prosthetics, and the Integrated Course of " Morphological Fundamentals of Life" for the three-year degree courses in Dental Hygiene, Biomedical Laboratory Techniques, Medical Radiology Techniques, Cardio circulatory Pathophysiology Techniques and Cardiovascular Perfusion. In addition to chairing the examination committee of the courses he holds, he is a member of the examination committee of the integrated courses of Histology and Human Anatomy of the three-year degree courses in Motor Sciences, Nursing, Physiotherapy and Obstetrics. Finally, he served as interim departmental director between 2021-2022.
- Scientific organisations/Coordination of academic activities	He is a member of the Italian Society of Anatomy and Histology (SIAI), the Italian Society of Microscopic Sciences (SISM), of which he served two terms as a Board Member, the Italian Society for the Study of the Connective (SISC), of which he served two terms as Vice President, and the International Society of Matrix Biology (ISMB). He is also a member of the teaching staff of the PhD in "Biotechnology and Life Sciences" at the University of Insubria, in which context he collaborated in various activities in particular he was the supervisor of the project "Boring bacteria: a morphological research on bone diagenesis" (XXX cycle) and "Structural biology and dynamic of the adipose tissues" (XXXV cycle). In 2007 he participated in the PRIN "Modulation of proliferation and differentiation of stromal mesenchymal cells in the extracellular matrix in endosseous implants" and in 2011, the CARIPLO Foundation project "Synthesis of a mechano-responsive molecular brush with tuned biomimetic architectures". Every year he gets University Funds for Research (FAR) and was responsible for other research grants financed by the Insubria University.
Editorial activity	He is co-author of five textbooks: "Human Anatomy and Histology" by M.Bentivoglio et al. and "Functional Human Anatomy" by A.Vercelli et al. (Ed. Minerva Medica), "Human Anatomy" by G.Macchiarelli et al. and "Human Anatomy" by Seeley (Ed. Idelson-Gnocchi) and finally "Prometheus - Text Atlas - General Anatomy and Locomotor Apparatus" (Edises).
Membership of scientific societies	Since 1987 he has been a member of the Italian Society for the Study of Connective tissue (SISC), of which he was Vice President from 2011 to 2016; since 1990 he has been a member of the Italian Society of Anatomy and Histology (SIAI) and since 2005 of the Italian Society of Microscopic Sciences (SISM), where he was a member of the Scientific Council from 2007 to 2012. He is affiliated with the International Society for Matrix Biology (ISMB) since its establishment in 1994. He has continuously participated in the relevant national and international congresses, presenting original contributions to each one and receiving invitations to participate in workshops on specific topics, confirming himself as a point of reference at the European level for the ultrastructure of collagen. He is part of the list of Top Italian Scientists (https://topitalianscientists.org).
Funding (current and past)	

	Anno	Project title	Person months	Funding organisation
	2011	Synthesis of a mechano-responsive molecular brush with tuned biomimetic architectures	3	Cariplo
	2007	Modulation of proliferation and differentiation of stromal mesenchymal cells in the extracellular matrix in endosseous implants	24	Ministry of University and Research - PRIN
Significant career breaks	none			
- H-Index (in Scopus):	29			
- Total number of publications in peer-reviewed journals	93			
- Total IF	421,461			
- n. and total IF of publications where the candidate is first author or equivalent (for the disciplines where the position in the list of authors correspond to the role in the work presented)	n. 23, IF 119,276			
- N. and total IF of the publications where the candidate is last or corresponding author (for the disciplines where the position in the list of authors correspond to the role in the work presented)	n. 39, IF 134,803			

2. Scientific Curriculum of the associated PIs

1. VANIN Stefano

- Researcher unique identifier: ORCID Id	0000-0003-1676-5916
- URL for web site:	https://rubrica.unige.it/personale/UkJCX1pq
Academic age (years from the beginning of scientific activity, i.e. years from first publication or from the beginning of PhD or Medical Specialisation School)	22
Previous positions	Previous positions: 2013-2019 Reader (Prof. Associato/Ordinario) in Forensic Biology University of Huddersfield, School of Applied Sciences, Huddersfield (UK) 2011-2013 Senior Lecturer (Prof. Associato) in Forensic Biology University of Huddersfield, School of Applied Sciences, Huddersfield (UK)
	"Premio Eccellenza Entomologia Forense", 2022, Investigation and Forensic Awards, for promoting Forensic Entomology at the National and International level, the high number of publication and the expertise provided in important

Prizes and awards	national cases. “Premio Eccellenza Entomologia Forense”, 2017, Investigation and Forensic Awards, for promoting Forensic Entomology at the National and International level, the high number of publication and the expertise provided in important national cases. “Sesto in Sylvis” (città di Villorba, TV) 2014 for scientific research and cases in Forensic Entomology. “Premio Città Impresa 2012” (North-East Italy) for scientific research and cases in Forensic Entomology.
Visiting academic positions	2018 Visiting Professor May-June (1 month) Università degli studi di Sassari, Research: analysis of entomological elements from funerary/archaeological contexts. 2017 Visiting Professor May-July (3 months) Università di Modena e Reggio Emilia. Module “Entomologia Forense” for BSc and MSc students and module of “Research skills” for PhD students.
Teaching activities and PhD supervision	2022-2023 Biologia applicata alla diagnostica e alla conservazione dei Beni culturali (mod. Zoologia). (cod. 61701) (3CFU); Archeo-Entomologia (cod. 106583) (5CFU); Elementi di Biologia Forense: Molecole, Uomo ed Animali (cod. 105332) (2CFU), Entomologia e Zoologia Forense (6 CFU), Genetica Forense (2 CFU), Patologia Forense (2 CFU), Cronobiologia (3CFU) PhD supervision: at the moment 2 PhD students (PhD School: Scienze e Tecnologie per l'Ambiente e il Territorio (STAT), University of Genoa. In the past supervisor of 7 PhD students at the University of Huddersfield. Member of the Examination Panel for the PhD degree at: University of Huddersfield, University of Central Lancaster, University of Northumbria (UK), University of Las Palmas-Gran Canaria (Spain), University of Lille (France).
Other work experience (e.g. consultancy if any)	Experiences as Forensic Expert (“Perito del Giudice”, “Consulente del PM”, “Ausiliario del Medico Legale”) in cases of Homicides for the following Courts of Law: Padova, Treviso, Milano, Bergamo, Genova, Ascoli, Teramo, Vibo Valentia, Messina, Patti).
- Administrative role and position responsibility	Since 2020, Course Leader (Coordinatore CCS) of Biology (BSc Biological Sciences, MSc Marine Biology and Ecology, MSc Applied and Experimental Biology), DISTAV - University of Genoa Since 2021 Member of the School of Science (MMFFNN) council (Consiglio di Scuola) Since 2021 Member of the Department council (Giunta di Dipartimento) President of the Committees for the BSc and MSc degrees of the Biology Courses National Professional Biology Exam: 2021 Member of the committee, 2022 President of the Committee.
- Scientific organisations/Coordination of academic activities	Organization of the 5th Incontro Nazionale di Entomologia Forense, 2019 Naples, Italy 4th Incontro Nazionale di Entomologia Forense, 2018 Roma, Italy 3rd Incontro Nazionale di Entomologia Forense, 2017 Bologna, Italy 2st International Conference Funerary Archaeoentomology, 2017 Treviso, I 14th Meeting European Association of Forensic Entomology, 2017 Treviso, I 2nd Incontro Nazionale di Entomologia Forense, 2016 Roma, Italy 1st Incontro Nazionale di Entomologia Forense, 2015 Roma, Italy 12th Meeting European Association of Forensic Entomology, 2015 Huddersfield, UK 1st International Conference Funerary Archaeoentomology, 2015 Huddersfield, UK
Editorial activity	Member of the Editorial Boards of: Egyptian Journal of Forensic Sciences (Associated Editor till 2019); International Journal of Criminal Investigation; Science and Justice; Journal of Bioarchaeological Research, Crime, Security and Society (till 2019). Reviewer of several Journal eg.: Insects, Heritage, Forensic Science International, Science and Justice, etc

European Association for Forensic Entomology (EAFE) member of the scientific

Membership of scientific societies	board since 2012, President since June 2019)			
	Higher Education Academy (Fellow), UK Chartered Society for Forensic Science (Member Professional), UK Royal Entomological Society (Fellow), UK Linnean Society, London (Fellow), UK Gruppo Italiano di Entomologia Forense (GIEF) co-funder, President (2015-2022) (Secretary 2011-2014), Italy Ordine Nazionale dei Biologi, Italy Società Italiana di Entomologia (SEI) (member), Italy Accademia Nazionale Italiana di Entomologia (Socio Straordinario), Italy Società Veneziana di Scienze Naturali (SVSN) (member), Italy Ateneo di Treviso, (ordinary member), Italy			
Funding (current and past)	Anno	Project title	Person months	Funding organisation
	2014	Genetic Journeys into History: The Next Generation	10	Leverhulme trust
	2014	Genetic Journeys into History: The Next Generation	10	URF 2014 University of Huddersfield
Significant career breaks	none			
- H-Index (in Scopus):	22			
- Total number of publications in peer-reviewed journals	91			
- Total IF	230,936			
- n. and total IF of publications where the candidate is first author or equivalent (for the disciplines where the position in the list of authors correspond to the role in the work presented)	63,065			
- N. and total IF of the publications where the candidate is last or corresponding author (for the disciplines where the position in the list of authors correspond to the role in the work presented)	40,319			

3. Main Principal Investigator's scientific publications (Max. 20)

1.	Mario Raspanti, Marina Protasoni, Piero Antonio Zecca, Marcella Reguzzoni (2021). Slippery when wet: The free surface of the articular cartilage.. MICROSCOPY RESEARCH AND TECHNIQUE, vol. 84, p. 1257-1264, ISSN: 1097-0029, doi: 10.1002/jemt.23684 - Articolo in rivista
2.	Basso P. R., Carava' E., Protasoni M., Reguzzoni M., Raspanti M. (2020). The synovial surface of the articular cartilage. EUROPEAN JOURNAL OF HISTOCHEMISTRY, vol. 64, p. 194-201, ISSN: 2038-8306, doi: 10.4081/ejh.2020.3146 - Articolo in rivista
3.	Pazzaglia U. E., Reguzzoni M., Casati L., Sibilia V., Zarattini G., Raspanti M. (2020). New morphological evidence of the 'fate' of growth plate hypertrophic chondrocytes in the general context of endochondral ossification. JOURNAL OF ANATOMY, vol. 236, p. 305-316, ISSN: 0021-8782, doi: 10.1111/joa.13100 - Articolo in rivista

4. Pazzaglia U. E., Reguzzoni M., Depero L., Federici S., Bondioni M., Zarattini G., Raspanti M. (2020). The structure of cortical bone as revealed by the application of methods for the calcified matrix study. MICROSCOPY RESEARCH AND TECHNIQUE, vol. 83, p. 853-864, ISSN: 1059-910X, doi: 10.1002/jemt.23477 - **Articolo in rivista**

5. Raspanti, Mario, Reguzzoni, Marcella, Protasoni, Marina, Basso, Petra (2018). Not only tendons: The other architecture of collagen fibrils. INTERNATIONAL JOURNAL OF BIOLOGICAL MACROMOLECULES, vol. 107, p. 1668-1674, ISSN: 0141-8130, doi: 10.1016/j.ijbiomac.2017.10.037 - **Articolo in rivista**

6. Pazzaglia, Ugo E, CONGIU, TERENCE, BASSO, PETRA RITA, Alessandri, Ivano, Cucca, Lucia, RASPANTI, MARIO (2016). The application of heat-deproteinization to the morphological study of cortical bone: A contribution to the knowledge of the osteonal structure. MICROSCOPY RESEARCH AND TECHNIQUE, vol. 79, p. 691-699, ISSN: 1059-910X, doi: 10.1002/jemt.22686 - **Articolo in rivista**

7. RASPANTI, MARIO, CARAVA', ELENA, Sgambato, Antonella, Natalello, Antonino, Russo, Laura, Cipolla, Laura (2016). The collaggrecan: Synthesis and visualization of an artificial proteoglycan. INTERNATIONAL JOURNAL OF BIOLOGICAL MACROMOLECULES, vol. 86, p. 65-70, ISSN: 0141-8130, doi: 10.1016/j.ijbiomac.2016.01.051 - **Articolo in rivista**

8. RASPANTI, MARIO, REGUZZONI, MARCELLA, PROTASONI, MARINA, CONGIU, TERENCE (2015). Mineralization-related modifications in the calcifying tendons of turkey (Meleagris gallopavo). MICRON, vol. 71, p. 46-50, ISSN: 0968-4328, doi: 10.1016/j.micron.2015.01.003 - **Articolo in rivista**

9. RASPANTI, MARIO, REGUZZONI, MARCELLA, PROTASONI, MARINA, Martini D. (2011). Evidence of a discrete axial structure in unimodal collagen fibrils.. BIOMACROMOLECULES, vol. 12, p. 4344-4347, ISSN: 1525-7797, doi: 10.1021/bm201314e - **Articolo in rivista**

10. Franchi M, RASPANTI, MARIO, DELL'ORBO, CARLO, Quaranta M, De Pasquale V, Ottani V, Ruggeri A. (2008). Different crimp patterns in collagen fibrils relate to the subfibrillar arrangement. CONNECTIVE TISSUE RESEARCH, vol. 49, p. 85-91, ISSN: 0300-8207, doi: 10.1080/03008200801913635 - **Articolo in rivista**

11. RASPANTI, MARIO, VIOLA, MANUELA, FORLINO A, TENNI R, GRUPPI C, TIRA M. E. (2008). Glycosaminoglycans show a specific periodic interaction with type I collagen fibrils. JOURNAL OF STRUCTURAL BIOLOGY, vol. 164, p. 134-139, ISSN: 1047-8477, doi: 10.1016/j.jsb.2008.07.001 - **Articolo in rivista**

12. FRANCHI M, FINI M, QUARANTA M, DE PASQUALE V, RASPANTI, MARIO, GIAVARESI G, OTTANI V, RUGGERI A. (2007). Crimp morphology in relaxed and stretched rat Achilles' tendon. JOURNAL OF ANATOMY, vol. 210, p. 1-7, ISSN: 0021-8782, doi: 10.1111/j.1469-7580.2006.00666.x - **Articolo in rivista**

13. RASPANTI, MARIO, PROTASONI, MARINA, MANELLI A., GUIZZARDI S., MANTOVANI, VITTORIO, SALA, ANDREA ANTONIO (2006). The extracellular matrix of the human aortic wall: Ultrastructural observations by FEG-SEM and by tapping-mode AFM.. MICRON, vol. 37, p. 81-86, ISSN: 0968-4328, doi: 10.1016/j.micron.2005.06.002 - **Articolo in rivista**

14. RASPANTI, MARIO, MANELLI A, FRANCHI M, RUGGERI A. (2005). The 3D structure of crimps in the rat Achilles tendon.. MATRIX BIOLOGY, vol. 24, p. 503-507, ISSN: 0945-053X - **Articolo in rivista**

15. OTTANI V, MARTINI D, FRANCHI M, RUGGERI A, RASPANTI, MARIO (2002). Hierarchical structures in fibrillar collagens. MICRON, vol. 33, p. 587-596, ISSN: 0968-4328 - **Articolo in rivista**

16. OTTANI V, RASPANTI, MARIO, RUGGERI A. (2001). Collagen structure and functional implications. MICRON, vol. 32, p. 251-260, ISSN: 0968-4328 - **Articolo in rivista**

17. RASPANTI, MARIO, CONGIU, TERENCE, GUIZZARDI S. (2001). Tapping-mode atomic force microscopy in fluid of hydrated extracellular matrix. MATRIX BIOLOGY, vol. 20, p. 601-604, ISSN: 0945-053X - **Articolo in rivista**

18. RASPANTI, MARIO, ALESSANDRINI A, OTTANI V, RUGGERI A. (1997). Direct visualization of collagen-bound proteoglycans by tapping-mode atomic force microscopy. JOURNAL OF STRUCTURAL BIOLOGY, vol. 119, p. 118-122, ISSN: 1047-8477 - **Articolo in rivista**

19. RASPANTI, MARIO, ALESSANDRINI A, GOBBI P, RUGGERI A. (1996). Collagen fibril surface: TMAFM, FEG-SEM

and freeze-etching observations. MICROSCOPY RESEARCH AND TECHNIQUE, vol. 35, p. 87-93, ISSN: 1059-910X - **Articolo in rivista**

20. RASPANTI, MARIO, GUIZZARDI S, STROCCHI R, RUGGERI A. (1996). Collagen fibril patterns in compact bone: Preliminary ultrastructural observations. ACTA ANATOMICA, vol. 155, p. 249-256, ISSN: 0001-5180 - **Articolo in rivista**

4. Main scientific publications of the associated PIs (Max. 20, for each associated PI)

1. VANIN Stefano

1. Franceschetti, Lorenzo, Pradelli, Jennifer, Tuccia, Fabiola, Giordani, Giorgia, Cattaneo, Cristina, Vanin, Stefano (2021). Comparison of Accumulated Degree-Days and Entomological Approaches in Post Mortem Interval Estimation. INSECTS, vol. 12, p. 264-274, ISSN: 2075-4450, doi: 10.3390/insects12030264 - **Articolo in rivista**
2. Pradelli J., Tuccia F., Giordani G., Vanin S. (2021). Puparia cleaning techniques for forensic and archaeo-funery studies. INSECTS, vol. 12, p. 1-9, ISSN: 2075-4450, doi: 10.3390/insects12020104 - **Articolo in rivista**
3. Giordani G., Erauw C., Eeckhout P. A., Owens L. S., Vanin S. (2020). Patterns of camelid sacrifice at the site of Pachacamac, Peruvian Central Coast, during the Late Intermediate Period (AD1000-1470): Perspectives from funerary archaeoentomology. JOURNAL OF ARCHAEOLOGICAL SCIENCE, vol. 114, p. 105065, ISSN: 0305-4403, doi: 10.1016/j.jas.2019.105065 - **Articolo in rivista**
4. Giordani G., Grzywacz A., Vanin S. (2019). Characterization and Identification of Puparia of Hydrotaea Robineau-Desvoidy, 1830 (Diptera: Muscidae) from Forensic and Archaeological Contexts. JOURNAL OF MEDICAL ENTOMOLOGY, vol. 56 (1), p. 45-54, ISSN: 0022-2585, doi: 10.1093/jme/tjy142 - **Articolo in rivista**
5. Pradelli J., Rossetti C., Tuccia F., Giordani G., Licata M., Birkhoff J. M., Verzeletti A., Vanin S. (2019). Environmental necrophagous fauna selection in a funerary hypogeal context: The putridarium of the Franciscan monastery of Azzio (northern Italy). JOURNAL OF ARCHAEOLOGICAL SCIENCE: REPORTS, vol. 24, p. 683-692, ISSN: 2352-409X, doi: 10.1016/j.jasrep.2019.02.028 - **Articolo in rivista**
6. Tuccia F., Zurgani E., Bortolini S., Vanin S. (2019). Experimental evaluation on the applicability of necrobiome analysis in forensic veterinary science. MICROBIOLOGYOPEN, vol. 8 (9), p. e00828-1-e00828-16, ISSN: 2045-8827, doi: 10.1002/mbo3.828 - **Articolo in rivista**
7. Viero A., Montisci M., Pelletti G., Vanin S. (2019). Crime scene and body alterations caused by arthropods: implications in death investigation. INTERNATIONAL JOURNAL OF LEGAL MEDICINE, vol. 133 (1), p. 307-316, ISSN: 1437-1596, doi: 10.1007/s00414-018-1883-8 - **Articolo in rivista**
8. Giordani G., Tuccia F., Floris I., Vanin S. (2018). First record of Phormia regina (Meigen, 1826) (Diptera: Calliphoridae) from mummies at the Sant'Antonio Abate Cathedral of Castelsardo, Sardinia, Italy. PEERJ, vol. 2018 (e4176), p. 1-21, ISSN: 2167-8359, doi: 10.7717/peerj.4176 - **Articolo in rivista**
9. Lo Pinto S., Giordani G., Tuccia F., Ventura F., Vanin S. (2017). First records of Synthesiomia nudiseta (Diptera: Muscidae) from forensic cases in Italy. FORENSIC SCIENCE INTERNATIONAL, vol. 276, p. e1-e7, ISSN: 0379-0738, doi: 10.1016/j.forsciint.2017.05.003 - **Articolo in rivista**
10. Bostock E., Green EW, Kyriacou CP, Vanin S (2016). Chronobiological studies on body search, oviposition and emergence of Megaselia scalaris (Diptera, Phoridae) in controlled conditions.. FORENSIC SCIENCE INTERNATIONAL, vol. 275, p. 155-159, ISSN: 0379-0738, doi: 10.1016/j.forsciint.2017.03.002. - **Articolo in rivista**
11. Tuccia F., Giordani G., Vanin S. (2016). A general review of the most common COI primers for Calliphoridae identification in forensic entomology. FORENSIC SCIENCE INTERNATIONAL: GENETICS, vol. 24, p. e9-e11, ISSN: 1872-4973, doi: 10.1016/j.fsigen.2016.07.003 - **Articolo in rivista**
12. Bugelli V., Forni D., Bassi L. A., Di Paolo M., Marra D., Lenzi S., Toni C., Giusiani M., Domenici R., Gherardi M., Vanin S. (2015). Forensic Entomology and the Estimation of the Minimum Time Since Death in Indoor Cases. JOURNAL OF FORENSIC SCIENCES, vol. 60 (2), p. 525-531, ISSN: 1556-4029, doi: 10.1111/1556-4029.12647 - **Articolo in rivista**
13. Green, Edward W., O'Callaghan, Emma K., Hansen, Celia N., BASTIANELLO, STEFANO, Bhutani, Supriya, VANIN, STEFANO, Armstrong, James Douglas, COSTA, RODOLFO, Kyriacou, Charalambos P. (2015). Drosophila circadian rhythms in seminatural environments: Summer afternoon component is not an artifact and requires TrpA1 channels. PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA, vol. 112, p. 8702-8707, ISSN: 0027-8424, doi: 10.1073/pnas.1506093112 - **Articolo in rivista**
14. Marchetti D., Arena E., Boschi I., Vanin S. (2013). Human DNA extraction from empty puparia. FORENSIC SCIENCE INTERNATIONAL, vol. 229, p. e26-e29, ISSN: 0379-0738, doi: 10.1016/j.forsciint.2013.03.043 - **Articolo in rivista**
15. Vanin S., Zanotti E., Gibelli D., Taborelli A., Andreola S., Cattaneo C. (2013). Decomposition and entomological colonization of charred bodies-a pilot study. CROATIAN MEDICAL JOURNAL, vol. 54, p. 387-393, ISSN: 0353-9504, doi: 10.3325/cmj.2013.54.387 - **Articolo in rivista**

16. Vanin S, Bhutani S, Montelli S, Menegazzi P, Green EW, Pegoraro M, Sandrelli F, Costa R, Kyriacou CP (2012). Unexpected features of *Drosophila* circadian behavioural rhythms under natural conditions. *NATURE*, vol. 484, p. 371-375, ISSN: 0028-0836 - **Articolo in rivista**
17. Vanin S, Gherardi M, V Bugelli, Di Paolo M (2011). Insects found on a human cadaver in central Italy including the blowfly *Calliphora loewi* (Diptera, Calliphoridae), a new species of forensic interest. . *FORENSIC SCIENCE INTERNATIONAL*, vol. 207, p. e30-e33, ISSN: 0379-0738 - **Articolo in rivista**
18. VANIN S, CAENAZZO L, ARSENI A, CECCHETTO G, CATTANEO C, TURCHETTO M (2009). Records of *Chrysomya albiceps* in Northern Italy: an ecological and forensic perspective. *MEMORIAS DO INSTITUTO OSWALDO CRUZ*, vol. 104, p. 555-557, ISSN: 0074-0276 - **Articolo in rivista**
19. VANIN S, TASINATO P, DUCOLIN G, TERRANOVA C, ZANCANER S, M. MONTISCI, P. FERRARA TURCHETTO M (2008). Use of *Lucilia* species (Diptera: Calliphoridae) for forensic investigations in Southern Europe. *FORENSIC SCIENCE INTERNATIONAL*, vol. 177, p. 37-41, ISSN: 0379-0738 - **Articolo in rivista**
20. Turchetto M, Vanin S (2004). Forensic evaluations of a crime case with monospecific necrophagous fly population infected by two parasitoid species. *ANIL AGGRAWAL'S INTERNET JOURNAL OF FORENSIC MEDICINE AND TOXICOLOGY*, vol. 5, p. 15-18, ISSN: 0972-8074 - **Articolo in rivista**

5. Main staff involved (max 10 professors/researchers for each research unit, in addition to the PI or associated PIs), highlighting the expected time commitment

List of the Research Units

Unit 1 - RASPANTI Mario

Personnel of the research unit

n°	Surname Name	Qualification	University/ Research Institution	e-mail address	Months/person expected
1.	RASPANTI Mario	Professore Ordinario	Università degli Studi INSUBRIA Varese-Como	mario.raspanti@uninsubria.it	8,0
2.	REGUZZONI Marcella	Ricercatore confermato	Università degli Studi INSUBRIA Varese-Como	marcella.reguzzoni@uninsubria.it	6,0
3.	PROTASONI Marina	Professore Associato (L. 240/10)	Università degli Studi INSUBRIA Varese-Como	marina.protasoni@uninsubria.it	4,0
4.	ZECCA Piero Antonio	Ricercatore a t.d. - t.defin. (art. 24 c.3-a L. 240/10)	Università degli Studi INSUBRIA Varese-Como	pieroantonio.zecca@uninsubria.it	2,0
5.	BATTAGLIA Paolo	Professore Associato (L. 240/10)	Università degli Studi INSUBRIA Varese-Como	mail.paolobattaglia@gmail.com	2,0
6.	BORGESE Marina	Ricercatore a t.d. - t.pieno (art. 24 c.3-a L. 240/10)	Università degli Studi INSUBRIA Varese-Como	m.borgese@uninsubria.it	2,0
7.	PICOZZI Mario	Professore Associato confermato	Università degli Studi INSUBRIA Varese-Como	mario.picozzi@uninsubria.it	4,0
8.	GARBERI Cesare	Ricercatore confermato	Università degli Studi INSUBRIA Varese-Como	cesare.garberi@uninsubria.it	4,0

9.	BIRKHOFF Jutta Maria	Professore Associato confermato	Università degli Studi INSUBRIA Varese-Como	jutta.birkhoff@uninsubria.it	2,0
10.	ROSSETTI Chiara	Dottorando	Università degli Studi INSUBRIA Varese-Como	c.rossetti1@studenti.uninsubria.it	6,0

Unit 2 - VANIN Stefano

Personnel of the research unit

n°	Surname Name	Qualification	University/ Research Institution	e-mail address	Months/person expected
1.	VANIN Stefano	Professore Associato confermato	Università degli Studi di GENOVA	stefano.vanin@gmail.com	8,0
2.	CARTA Giuseppina	Dottorando	Università degli Studi di GENOVA	giuppycarta@gmail.com	2,0

6. Information on the new contracts for personnel to be specifically recruited

n°	Associated or principal investigator	Number of expected research contracts	Number of expected PhD scholarships	Overall expected time commitment (months)
1.	RASPANTI Mario	1	0	12
2.	VANIN Stefano	1	0	24
	Total	2	0	36

7. PI "Do No Significant Harm (DNSH)" declaration, in compliance with article n. 17, EU Regulation 852/2020. (upload PDF)

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"The data contained in the application for funding are processed exclusively for carrying out the institutional functions of MUR. The CINECA, Department of Services for MUR, is data controller. The consultation is also reserved to universities, research institutes and institutions (each for its respective competence), MUR - Directorate-General Research- Office III, CNVR, CdV, and

the reviewers in charge of the evaluation peer review.

MUR also has the right to the dissemination of the main economic and scientific data related to the funded projects.”.

Date 30/11/2022 ore 14:30

Sistema Socio Sanitario



Regione
Lombardia

ASST Sette Laghi

**AZIENDA SOCIO SANITARIA TERRITORIALE DEI SETTE LAGHI
POLO UNIVERSITARIO**

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DELIBERAZIONE DEL COMMISSARIO STRAORDINARIO n. 614 del 20/10/2023

OGGETTO: CONVENZIONE CON L'UNIVERSITA' DEGLI STUDI DELL'INSUBRIA E IL COMUNE DI VARESE PER ATTIVITA' DI COLLABORAZIONE NEL PROGETTO "STIMA EPOCA DECESSO". DURATA DUE ANNI DALLA SOTTOSCRIZIONE.

RELATA DI PUBBLICAZIONE

Si certifica che la presente deliberazione è pubblicata all'albo pretorio sul sito aziendale così come previsto dall'art. 32, comma 1, L. 69/2009, dal 20/10/2023 e vi rimane per quindici giorni consecutivi.

Elenco Firmatari

Questo documento è stato firmato da:

Confente Laura - Responsabile del procedimento S.C. AFFARI GENERALI E LEGALI

Pelliccia Clara - Direttore S.C. AFFARI GENERALI E LEGALI

Palaoro Ugo - Direttore Direzione Amministrativa

Calicchio Giuseppe - Direttore DIREZIONE SOCIO SANITARIA

Iadini Anna Maddalena - Direttore F. F. Direzione Sanitaria

Micale Giuseppe - Commissario Straordinario Direzione Generale

Bortolato Claudia - Incaricato alla pubblicazione Delibere

Istruttoria redatta da: Confente Laura