



TITOLI

AVVISO DI CONCORSO PUBBLICO, PER TITOLI ED ESAMI, PER LA COPERTURA A TEMPO PIENO E INDETERMINATO PER N 8 POSTI DI DIRIGENTE MEDICO DI MEDICINA LEGALE

GRADUATORIA				
Pos.	Candidato	Codice fiscale	Data nascita	Punteggio
1	ABBRUZZO ANTONINO			1,1600

*[Handwritten signatures and initials in blue ink]*



Titoli

AVVISO DI CONCORSO PUBBLICO, PER TITOLI ED ESAMI, PER LA COPERTURA A TEMPO PIENO E INDETERMINATO PER N 8 POSTI DI DIRIGENTE MEDICO DI MEDICINA LEGALE

GRADUATORIA SPECIALIZZANDI				
Pos.	Candidato	Codice fiscale	Data nascita	Punteggio
1	SCAGLIONE DARIO			4,0400
2	D'ALEO MICHELE			2,9000
3	MALANDRINO GIULIANA			2,8700
4	PALMERI MATTIA			2,8200
5	LA MANTIA MARCO			2,4500
6	GERACI SERENA			2,3100
7	ARDAGNA SALVATORE			1,9800
8	SPINA FEDERICA			1,5900
9	CELESIA DANIELE			1,5500
10	CANNELLA GIOVANNI			1,2700
11	SORRENTINO ERIKA SERENA			0,8200
12	MAMMOLA GIUSEPPE			0,7700
13	TARDA LUCIA			0,6400
14	INDELICATO MIRIAM			0,4600
15	CALANNA LUCA			0,4200
16	CASULA CHIARA			0,3200
17	DI FRANCO SIMONE			0,2300
18	PITINGARO WALTER			0,2200
19	CALASCIBETTA GRAZIANA			0,1000
20	GIGLIO VALERIA			0,0400
21	CALAFIORE JASMINE			0,0300
22	MUSCARNERA GIUSEPPE			0,0000
23	CONTORNO SIMONA			0,0000

*[Handwritten signature]*



AVVISO DI CONCORSO PUBBLICO, PER TITOLI ED ESAMI, PER LA COPERTURA A TEMPO PIENO E INDETERMINATO PER N 8 POSTI DI DIRIGENTE MEDICO DI MEDICINA LEGALE

PROVA ORALE del 04/12/2025

AULA FORMAZIONE/CONVEGNI ASP PALERMO VIA CARMELO ONORATO 6 - PALERMO

CANDIDATI CHE HANNO SUPERATO LA PROVA		
CANDIDATO	DATA NASCITA	PUNTEGGIO
ARDAGNA SALVATORE		16,0000
CALAFIORE JASMINE		15,0000
CALANNA LUCA		18,0000
CALASCIBETTA GRAZIANA		16,0000
CANNELLA GIOVANNI		17,0000
CASULA CHIARA		17,0000
CONTORNO SIMONA		18,0000
D'ALEO MICHELE		19,0000
DI FRANCO SIMONE		18,0000
GERACI SERENA		17,0000
GIGLIO VALERIA		17,0000
INDELICATO MIRIAM		16,0000
LA MANTIA MARCO		19,0000
MALANDRINO GIULIANA		17,0000
MAMMOLA GIUSEPPE		15,0000
MUSCARNERA GIUSEPPE		19,0000
PALMERI MATTIA		16,0000
PITINGARO WALTER		19,0000
SCAGLIONE DARIO		16,0000
SORRENTINO ERIKA SERENA		19,0000
SPINA FEDERICA		14,0000
TARDA LUCIA		17,0000

CANDIDATI CHE NON HANNO SUPERATO LA PROVA		
CANDIDATO	DATA NASCITA	PUNTEGGIO
NESSUN CANDIDATO PRESENTE		

CANDIDATI RITIRATI	
CANDIDATO	DATA NASCITA
NESSUN CANDIDATO RITIRATO	

CANDIDATI ASSENTI	
CANDIDATO	DATA NASCITA
NESSUN CANDIDATO ASSENTE	

CANDIDATI ESCLUSI	
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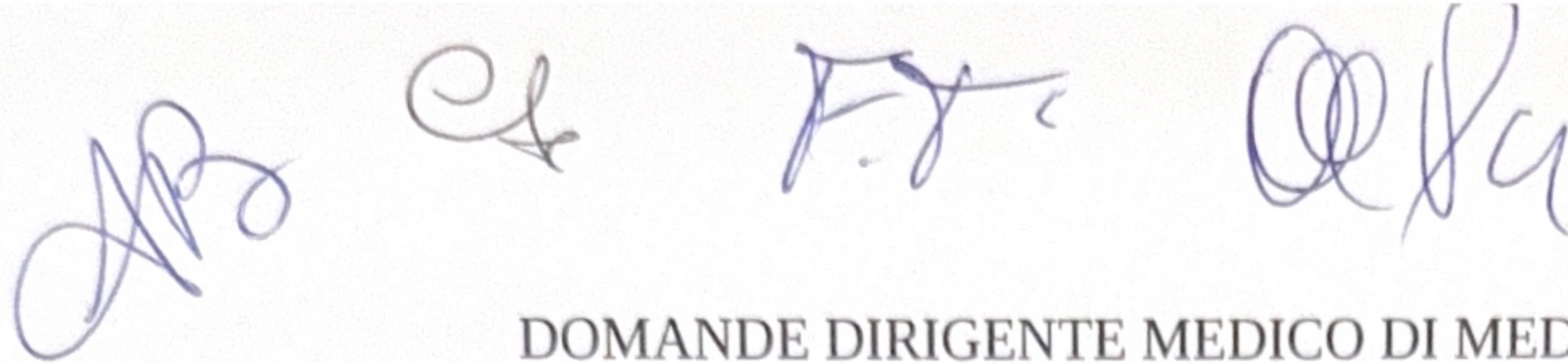


AVVISO DI CONCORSO PUBBLICO, PER TITOLI ED ESAMI, PER LA COPERTURA A  
TEMPO PIENO E INDETERMINATO PER N 8 POSTI DI DIRIGENTE MEDICO DI MEDICINA  
LEGALE

PROVA ORALE del 04/12/2025

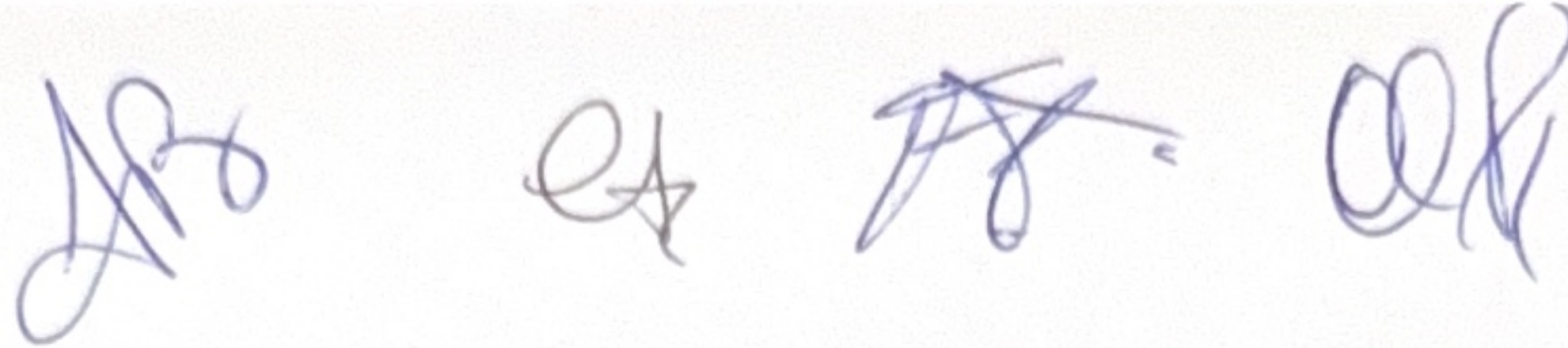
AULA FORMAZIONE/CONVEGNI ASP PALERMO VIA CARMELO  
ONORATO, 6 - PALERMO

CANDIDATO	DATA NASCITA	MOTIVAZIONE
NESSUN CANDIDATO ESCLUSO		

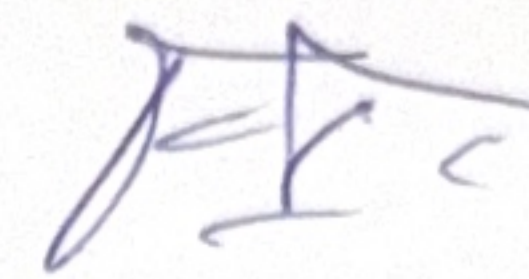


DOMANDE DIRIGENTE MEDICO DI MEDICINA LEGALE  
PROVA ORALE

1. LA MORTE IMPROVVISA
2. IL CERTIFICATO NECROSCOPICO
3. LEGGE 15 ottobre 1990, n. 295 – INVALIDITÀ CIVILE
4. PORTO D'ARMI PER USO SPORTIVO
5. LEGGE 210 DEL 1992;
6. REQUISITI PSICO FISICI PATENTE A E B
7. IL CONSENSO INFORMATO
8. REQUISITI PSICOFICI PATENTE C
9. REQUISITI PSICO FISICI PATENTE NAUTICA
10. I FENOMENI TANATOLOGICI
11. IL CONSENSO INFORMATO
12. ARTICOLO 186 CODICE DELLA STRADA
13. ARTICOLO 187 CODICE DELLA STRADA
14. LEGGE GELLI 8 MARZO 2017
15. LA MORTE DA FOLGORAZIONE
16. PORTO D'ARMI PER DIFESA PERSONALE
17. LA LEGGE 104/92
18. REQUISITI PSICOFISICI PATENTE B
19. IL NESSO DI CAUSALITÀ'
20. ESAME ESTERNO DEL CADAVERE
21. COS'E' LA TANATOLOGIA
22. LE LESIONI DA TAGLIO
23. REQUISITI PSICOFISICI PATENTE D
24. LESIONI PERSONALI GRAVISSIME
25. RINNOVO PATENTE DEI DIABETICI
26. RINNOVO PATENTE DEI SOGGETTI EPILETTICI
27. IL CONSENSO INFORMATO
28. LEGGE 219 DEL 22 DICEMBRE 2017 (DAT)
29. CHI E' IL PUBBLICO UFFICIALE
30. IL CERTIFICATO MEDICO – FALSO IDEOLOGICO E FALSO MATERIALE-
31. L'IMPICCAMENTO
32. IL SEGRETO PROFESSIONALE
33. IL SOPRALLUOGO GIUDIZIARIO



34. I TRAPIANTI
35. IL MEDICO NECROSCOPO
36. LEGGE 68 DEL 1999
37. MALATTIA PROFESSIONALE
38. INFORTUNIO SUL LAVORO
39. LEGGE 222 DEL 1984
40. I GRANDI TRAUMATISMI
41. PASS DISABILI
42. LESIONI GRAVISSIME
43. LESIONI GRAVI
44. LESIONI DA TAGLIO
45. LESIONI DA ARMA DA FUOCO A CANNA CORTA CARATTERISTICHE
46. IL FUNGO SCHIUMOSO
47. LA MUMMIFICAZIONE
48. IL FEMMINICIDIO
49. LA LEGGE 335 DEL 1995
50. LE PERCOSSE



Review

# Postmortem Interval Estimation: New Approaches by the Analysis of Human Tissues and Microbial Communities' Changes

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**Abstract:** There are several methodologies available to estimate time since death based on different changes that a corpse undergoes after death. However, these methods are imprecise due to the decomposition process being affected by several factors, principally temperature and humidity. Current trends for the determination of the Postmortem Interval (PMI) attempt to estimate the PMI in a quantifiable manner, based on chemical changes on and in the body, summarized in the field of "thanatochemistry". Although these methodologies have improved PMI estimates, additional research has been developed to increase the accuracy and precision of this determination. As a result, the fields of "thanatobiology" and "thanatomicrobiome" have emerged. Thanatobiology is based on the estimation of the PMI from DNA/RNA degradation, signaling pathways of cell death, and protein analysis. Thanatomicrobiome refers to changes in the bacterial communities as a consequence of the decomposition process. Although both approaches seem to improve PMI estimates, applications of thanatobiology methodologies are more appropriate in the first phases of decomposition, while thanatomicrobiome analyses are applicable in advanced stages. Further research is needed in these new fields in order to establish their applicability in forensic cases. This is a review of the current state-of-the-art methodology in these two subfields.

**Keywords:** postmortem interval; DNA; RNA; protein analysis; putrefaction; next generation sequencing technologies; bacterial communities



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## 1. Introduction

In forensic science, the accurate determination of the post-mortem interval (PMI), or time since death, is crucial for elucidating possible criminal acts and determining appropriate civil repercussions [1].

The analysis of the PMI is based on changes that a corpse undergoes after death including physical processes (body cooling and hypostasis), metabolic processes (supravital reactions), autolysis (loss of selective membrane permeability, diffusion), physicochemical processes (rigor mortis), bacterial processes (putrefaction), and the effect of insect activity [2–9]. Additionally, the environment in which the body is decomposing and the potential for vertebrate scavenging activity may impact changes in the corpse and, therefore, the estimation of time since death [10].

Traditional methods for estimating PMI are based on changes undergone by a corpse after death, including early changes involving physical processes (e.g., body cooling and hypostasis), metabolic processes (supravital reactions), autolysis (loss of selective membrane permeability, diffusion), and physicochemical processes (rigor mortis) [11].

They produce relatively reliable estimates of time since death for the early post-mortem interval (EPMI), typically only within the first 24 h after physiological death. After this stage, the focus shifts almost exclusively to loss of soft tissue and, later, to changes to the skeletal structures [12]. These methods provide only very rough estimates of PMI, particularly after EPMI. Additionally, these methods are imprecise, due to several factors which may affect their progression, i.e., changes in room temperature (like air conditioning) could alter the algor mortis, and as a result, the time of death could be erroneously determined.

Forensic entomological analyses of insect activity on a corpse are utilized to estimate longer PMIs, in ranges of days or first few months after death, depending on the method (larval development or insect succession). These methods also depend on whether insects had access to the body or were ecologically active at the time of death and deposition [13].

Recent research attempting to improve PMI estimates have considered more predictable and quantifiable biological markers and processes associated with human decomposition, particularly from the field of thanatochemistry, which focuses on post-mortem chemical changes exhibited by the decomposing body [14–16]. This field is mostly based on the quantification of volatile byproducts of different organic decay processes [17,18]. Thanatochemistry considers influencing factors, such as temperature and humidity [19–23].

In addition to the above methods, recent trends, based on the process of autolysis, attempt to determine the PMI using molecular biology by analyzing DNA/RNA degradation, signaling pathways of cell death, and proteins. Collectively, these approaches may be called “thanatobiology” [24–26].

Bacterial community changes throughout the putrefaction process have also been proposed to estimate the PMI.

During life, the human microbiome, that is, the native microorganisms that colonize the human body, coexists in an overall balance under healthy conditions.

There are five major sites of microbial colonization in the human body: the gastrointestinal tract (representing 29% of the total number of bacterial cells in the human microbiome), the oral cavity (representing 26%), the skin (representing 21%), the airways (representing 14%), and the urogenital tract (representing 9%). The other 1% of the total number of bacterial cells in the human microbiome can be found in blood [27].

Upon death, the physical and immunological barriers of the human body start to break down, giving the microorganisms contained in the human microbiome the opportunity to spread and colonize anatomical sites that they could not access during life. After death, and throughout the decomposition process, microbial communities change in a specific sequence. The analysis of these communities has opened a new field known as “thanatomicrobiome” [28].

This article will provide an overview of “thanatobiology” and “thanatomicrobiome” relating to approaches of postmortem interval estimation.

## 2. Thanatobiology

Decomposition begins approximately 4 min after death, with a process called autolysis. During autolysis, cells are progressively destroyed, and there is a consequential release and damage of cellular components and metabolites [1].

### 2.1. DNA

Based on this initial process, some studies have analyzed postmortem DNA degradation in relation to the time since death [29,30]. Cina [29] determined the relationship between the rate of DNA degradation and the time elapsed since death in spleen tissue harvested from a series of autopsies with known PMIs. Subsequently, Di Nunno et al. [30,31] studied samples taken from a deceased person’s spleen, liver, and blood to determine the relationship between degradation of DNA and time since death using flow cytome-



DOMANDE CONCORSO DIRIGENTE MEDICO DI MEDICINA LEGALE  
ABILITA' INFORMATICHE

1. COS'È GOOGLE
2. A COSA SERVE IL MOUSE
3. COS'È INTERNET
4. QUALI MOTORI DI RICERCA CONOSCI
5. A COSA SERVE LO SCANNER
6. ESISTONO SISTEMI DI MEMORIA ESTERNA? DAL COMPUTER
7. COS'È MICROSOFT
8. COS'È OFFICE
9. A COSA SERVE PAWERPOINT
10. LA FIRMA DIGITALE
11. EXEL
12. PDF
13. GOOGLE MEET
14. MICROSOFT TEAMS
15. COSA SONO I PAGAMENTI DIGITALI
16. WORD
17. A COSA SERVE LA TASTIERA
18. QUALI SONO GLI HARDWARE
19. COS'È L'HARD DISK
20. COS'È LA RAM

Four handwritten signatures in blue ink are located at the bottom of the page. From left to right, they appear to be: a stylized signature starting with a large 'O', a signature starting with 'AS', a signature starting with 'el', and a signature starting with 'F'.

DOMANDE CONCORSO DIRIGENTE MEDICO DI MEDICINA LEGALE  
CODICE DI COMPORTAMENTO

1. COS'È IL CODICE DI COMPORTAMENTO AZIENDALE?
2. QUALE LA FINALITÀ DEL CODICE DI COMPORTAMENTO?
3. QUALE L'AMBITO DI APPLICAZIONE DEL CODICE DI COMPORTAMENTO?
4. QUANDO VI È IL CONFLITTO DI INTERESSI
5. SI POSSONO ACCETTARE REGALI? SE SI ESISTE UN VALORE MASSIMO?
6. COMPORTAMENTO IN SERVIZIO: PRINCIPI GENERALI
7. USO CORRETTO DELLE TECNOLOGIE
8. RISERVATEZZA E TRATTAMENTO DEI DATI
9. MOBBING
10. RAPPORTO CON I PAZIENTI ED UTENZA
11. USO DELLE RISORSE PUBBLICHE
12. RESPONSABILITÀ AMMINISTRATIVA
13. CONTRATTI, ACQUISTI E FORNITURE
14. TRASPARENZA E TRACCIABILITÀ

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