

# **FORENSIC INVESTIGATION HANDBOOK**

## ABOUT THE AUTHORS



Dr. Karagiozis and Mr. Sgaglio with Dr. Cyril Wecht after being awarded the ACFEI's *Distinguished Member Award 2004* at the October 2004 General Meeting in Chicago.



Mr. Sgaglio and Dr. Karagiozis perform an overview of a toxic spill before entering the scene.

Dr. Michael Fitting Karagiozis is recognized as a medical expert in both State and Federal jurisdictions. Dr. Karagiozis served as Medical Director for the Nevada Department of Prisons prior to opening his private medicolegal consulting practice. He has additional Board Certifications in Family Practice, HIV Medicine, Forensic Investigation and pain medicine.

Dr. Karagiozis is a national speaker on a variety of medical issues and disease states. Since 1992 he has acted as medical expert for KVVU Fox 5 in Las Vegas for which he makes weekly television appearances on the FOX 5 morning news.

Mr. Richard Sgaglio holds his Master's degree from Fordham University in New York City and is currently completing his Ph.D. in Health Administration. Mr. Sgaglio is also a Certified Medical Investigator and serves as a national guest lecturer for ACFEI's Certified Medical Investigator courses.

On October 15, 2004, the American College of Forensic Examiners International bestowed the organization's *Distinguished Member 2004 Award* upon Dr. Karagiozis and Mr. Sgaglio for their educational contributions to the ACFEI's Certified Medical Investigator program.

# FORENSIC INVESTIGATION HANDBOOK

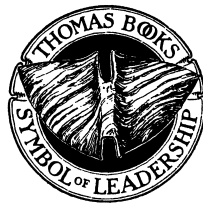
An Introduction to the Collection,  
Preservation, Analysis and Presentation  
of Evidence

*By*

MICHAEL FITTING KARAGIOZIS, D.O., CMI

*and*

RICHARD SGAGLIO, M.A., CMI



CHARLES C THOMAS • PUBLISHER, LTD.  
*Springfield • Illinois • U.S.A.*

*Published and Distributed Throughout the World by*

CHARLES C THOMAS • PUBLISHER, LTD.  
2600 South First Street  
Springfield, Illinois 62704

This book is protected by copyright. No part of  
it may be reproduced in any manner without written  
permission from the publisher. All rights reserved

© 2005 by CHARLES C THOMAS • PUBLISHER, LTD.

ISBN 0-398-07579-4 (hard)  
ISBN 0-398-07580-8 (paper)

Library of Congress Catalog Card Number: 2005041720

*With THOMAS BOOKS careful attention is given to all details of manufacturing  
and design. It is the Publisher's desire to present books that are satisfactory as to their  
physical qualities and artistic possibilities and appropriate for their particular use.  
THOMAS BOOKS will be true to those laws of quality that assure a good name  
and good will.*

Printed in the United States of America  
R-3-CAMRDY

**Library of Congress Cataloging-in-Publication Data**

Karagiozis, Michael.

Forensic investigation handbook : an introduction to the collection, preservation,  
analysis and presentation of evidence / by Michael Karagiozis and Richard Sgaglio.

p. cm.

Includes bibliographical references and index.

ISBN 0-398-07579-4 -- ISBN 0-398-07580-8 (pbk.)

1. Forensic sciences--Handbooks, manuals, etc. 2. Criminal investigation--Handbooks,  
manuals, etc. 3. Evidence, Criminal--Handbooks, manuals, etc. I. Sgaglio, Richard.

II. *Title*

HV8073.K235 2005

363.25--dc22

2005041720

## IN MEMORIAM

*This work is dedicated to the many forensic specialists who toiled in the horrific aftermath of September 11, 2001. These specialists sifted through the rubble to find the most minimal fragments of evidence in the hope of identifying victims whose bodies had been all but obliterated. Without their dedicated and relentless work, thousands of survivors would have had suffered their loss without closure.*

*Mr. Sgaglio would like particularly to extend personal recognition to Gabrielle Machinist and their mutual friend Bob Parente. Bob was scheduled to be working in the World Trade Center on September 11, 2001. Twenty minutes before arrival, his train developed mechanical problems, and his commute was delayed. By the time the train became operational, the World Trade Center had been razed to the ground. Believing that Bob had died in the disaster, Gabrielle—who owned a catering service near Ground Zero—began delivering food and drink to the weary rescue workers, unasked and unpaid. Even after discovering that Bob had survived the holocaust, “Gaby” and her staff continued to walk more than a mile every day to Ground Zero, sustaining those still working the disaster site.*

*If the events of September 11 have taught us anything about the forensics sciences, it is this:*

Forensic Science is not about taking down the bad guys.  
Forensic Science is about helping the good guys.



September 11, 2001: Rescue workers stand in shock and awe after the largest forensic disaster in U.S. history.



## FOREWORD

Forensics is the science of explaining what happened, not of proving guilt or innocence. Accordingly, the duty of forensic specialists of all types is not to find or arrest a suspect, but to secure and process evidence. Police officers make arrests, and attorneys prosecute crimes. Forensic examiners focus on establishing what is evidence, preserving that evidence, and maintaining it in such a manner that when the time comes for warrants to be served or prosecutions to be made, the evidence is unimpeachable. This process is vital to our nation's judicial system, as evidence that cannot be properly entered into and presented in a court of law directly alters and impedes the course of justice.

Forensic investigation was once the sole realm of pathologists, but with the scientific advancements of recent years the spectrum of professionals involved in forensic investigation has broadened dramatically. A forensic investigation now begins when first responder personnel arrive at the scene of an incident, and critical forensic evidence can be irrevocably lost if those working the scene don't recognize and secure that evidence immediately and flawlessly. This has been proven time and time again, as many high-profile court cases have failed over the past decade, not because the prosecution didn't have a good case or because the police arrested the wrong person, but because critical evidence was judged inadmissible due to mishandling.



Seal of the American College of Forensic Examiners International, the membership body of the American College of Forensic Examiners Institute.

#### The ACFEI

The American College of Forensic Examiners Institute (ACFEI) is an independent, scientific and professional society. Founded in 1992, the ACFEI is the largest professional membership association representing forensic examiners. The general membership is composed of almost 10,000 members from forty countries.

Multi-disciplinary in its scope, the society actively promotes the dissemination of information regarding the forensic sciences. The association's purpose is the continued advancement of forensic examination and consultation across the many professional disciplines within its membership. ACFEI provides professionals with education, training and networking opportunities in forensic science. ACFEI also circulates information through the official journal, *The Forensic Examiner*.

All types of professionals involved in forensic investigation must become educated in the forensic process to prepare them to recognize and preserve critical and often fragile evidence before it is lost. The core of the forensic and legal process remains the same for all of these professionals, encompassing a firm understanding of and competency in forensic investigation, evidence collection and preservation, and the presentation of testimony in a court of law. In an effort to provide this type of training to the wide range of professionals bow involved in the forensic process, the American College of Forensic Examiners Institute developed its Certified Medical Investigator, CMT, program.

The American College if Forensic Examiners Institute (ACFEI) is an independent, scientific, and professional society. Multi-disciplinary in its scop, the society actively promotes the dissemination of forensic information. Th association's purpose is the continued advancement of forensic examination and consultation across the many professional fields of its membership. ACFEI serves as the national center for this purpose and circulates information and knowledge through its official journal, *The Forensic Examiner*, and through conferences, workshops, continuing education courses and other educational programs, like the Certified Medical Investigator, CMI program.

ACFEI's Certified Medical Investigator, CMI, program teaches professionals from a diverse range of specialties and disciplines to conduct superior, independent medical investigations; to interpret relevant case law, reports, analyses, and evidence in order to write comprehensive, accurate, unbiased reports; to provide credible, defensible testimony in a court of law; and to develop critical thinking skills that are crucial to forensic investigation. The CMI program incorporates diverse topics including law, forensics, and toxicology into one intensive course, providing participants with an



understanding of the many disciplines that they will interface with in a forensic engagement, such as law enforcement, the legal profession, crime scene investigation, and pathology. The course also reinforces the basics of evidence gathering and teaches foundational anatomy and physiology, providing a strong understanding and skill base critical to forensic scene evaluation.

CMI course instructors Dr. Michael Karagiozis and Richard Sgaglio have made invaluable contributions to the CMI program. Their work has helped make the CMI course the dynamic, fascinating, and vital educational experience that it is today. Now Dr. Karagiozis and Mr. Sgaglio have applied their extensive knowledge and background to produce a text that provides an in-depth overview of medical investigation presented in their signature captivating and dynamic style, making this book an important tool that is sure to enhance the capabilities of all professionals working in the forensic arena.

Brent McCoy, Chief Administrative Officer  
American College of Forensic Examiners Institute  
August 27, 2004



## ACKNOWLEDGMENTS

The authors are deeply indebted to the following people without whom the *Forensic Investigation Handbook* would never have been conceived, created, or published. As Archimedes would have said: *Ευχαριστώ!*

**Bob Miller**, Governor of Nevada, 1989-1999: Governor Miller was the man who appointed Dr. Karagiozis to the position of Medical Director for the [then] Nevada Department of Prisons, beginning the long and occasionally bizarre odyssey into forensic science and legal medicine. **Frankie Sue Del Papa**, Nevada Attorney General, 1991-2003: Ms. Del Papa spent many hours working with Dr. Karagiozis to defend the State against lawsuits ranging from tragic to ridiculous. **John Slansky**, Assistant Director, Nevada Department of Prisons, 1995-2001: Mr. Slansky provided Dr. Karagiozis with mentorship and friendship throughout his tenure with the Department. Mr. Slansky never failed to identify the humanistic perspective in any situation. **Brent McCoy**, Chief Administrative Officer of the American College of Forensic Examiners International: Mr. McCoy entrusted Dr. Karagiozis with the organization and teaching of the ACFEI's Certified Medical Investigator program, from which and for which this book was ultimately created. Without Brent's generosity, confidence, and constant assistance, neither the current CMI program nor this text would have been possible.

In addition to the aforementioned individuals who have created the life path and opportunities that made this text possible are a number of other who, even if they were not aware of their influence at the time, their mentorship, trust, and associations have created the essential foundations for this work. Among these *save not but for* are:

Cyril Wecht, M.D. , JD  
Dennis Richardson, Esq.  
Janis de Longchamps, R. N.  
Jorge Ramirez, Esq.  
Kathleen Boutin

Henry Lee, Ph.D.  
Carol Roland, R. N.  
Valaire I. Fujii, Esq.  
Gary Manson, Esq.  
Marie Sgaglio

Done Molde, M.D.  
Laura Hunt, Esq.  
Marianne Schmidt  
Seetal Tejura, Esq.  
Nicholas Athos Karagiozis

### **PHOTOGRAPHIC CREDIT**

No scientific text would be complete without some visual aids to assist the reader to comprehend the author's meaning. We extend thanks and credits to *Rob Crowetz*, BA, CLPE, CSA, Crime Scene Chair, Florida Division of the International Association for Identification, West Palm Beach Police Department, West Palm Beach, Florida; *Anthony Hershey*, Crime Scene Investigator, North Miami Police Department, North Miami, Florida; and *Allen Miller*, Armor Forensics, Jacksonville, Florida. Their contributions are designated in the photographs respectively by the notations [RC], [AH], [AF]. Additional photographs are similarly identified in the text: Dr. Karagiozis, [MK], Richard Sgaglio, [RS]; and finally, Dr. Kargiozis' son, the budding young forensic photographer, Michael Christopher Karagiozis, [MCK].

## CONTENTS

	<i>Page</i>
<i>Foreword</i> .....	v
<i>Chapter</i>	
1. FORENSIC SCIENCE .....	3
2. THE AMERICAN JUDICIAL SYSTEM.....	15
3. CRIMES AND OFFENSES .....	27
4. THE FORENSIC EXPERT .....	49
5. EVIDENCE .....	63
6. BIOLOGICAL EVIDENCE .....	88
7. FORENSIC INVESTIGATION .....	112
8. FORENSIC PHOTOGRAPHY .....	123
9. DEATH AND THE FORENSIC SPECIALIST .....	130
10. CRIMINAL PROFILING .....	140
11. DEATH SCENE INVESTIGATION .....	162
12. SUBSTANCES AND ABUSE .....	176
13. NUCLEAR AND BIOHAZARDOUS AGENTS .....	199
Appendix A: U.S. SUPREME COURT RULINGS .....	221
Appendix B: DEATH PENALTY STATUTES IN THE UNITED STATES .....	325
Appendix C: FORENSIC SCIENCE DEGREE PROGRAMS .....	333
Appendix D: TABLES AND REFERENCES .....	337

<i>Selected Bibliography</i> .....	339
<i>Glossary of Forensic Terms</i> .....	341
<i>Index</i> .....	383

# **FORENSIC INVESTIGATION HANDBOOK**





## 1

## FORENSIC SCIENCE

The term *forensic* is derived from the Latin construction *forum + ensis*, indicating the public forum in which the Romans debated their legal cases and where verdicts were announced. The Biblical account of Jesus of Nazareth's trial before Pontius Pilate is a classic example of Roman law being dispensed in open forum. Though significantly more structured, the legal system today still rightly employs the term *forensic* to any matter which has relevance to a criminal or civil issue before the court.

Forensic Science is the application of the natural sciences to matters of law. The term *Forensic Examiner* refers to a professional who performs an orderly analysis, investigation, inquiry, test, inspection or examination of a piece of evidence. The core of every forensic investigation relies on the painstaking recognition, identification and individualization of physical evidence, so that the Forensic Examiner can offer an expert opinion on the nature and relevance of the evidence in question.

### History of Forensic Medicine

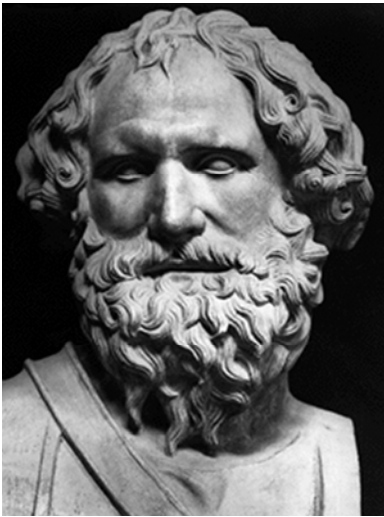
Forensic Science, sometimes erroneously used synonymously as *Legal Medicine*, has a venerable history. Through the centuries police agencies have found themselves in need of physicians and other scientists to complete the investigation of a crime. In 1248 the book *Hsi Duan Yu* appeared in China. Interestingly, like many

#### Forensic Firsts

*A Chinese book written in 1248, Hsi Duan Yu [The Washing Away of Wrongs], contains a description of how to distinguish a drowning death from strangulation. This is the first known treatise on forensic science, and many of its observations remain true today.*

important texts in human history, it is believed that this text was based on a lost original written six hundred years earlier. This probably represents the first formalized text on the association of medicine and law. *Hsi Duan Yu* offered instruction on forensic observations that are still part of modern forensic pathology: it teaches that water in the lungs indicates death by drowning, and that strangulation leaves telltale pressure marks on the throat or damaged cartilage in the neck.

But forensic science has even earlier roots—starting in Ancient Greece, when the king suspected the royal jeweler had defrauded him in the making of his crown. Suspecting the jeweler had stolen some of the gold and used an alloy adulterated with silver to create the crown, the King turned to Archimedes to answer the seemingly impossible question.



**IMAGE 1.1** Archimedes, 287-212 B.C., from a photo of his bust in the National Museum, Naples.

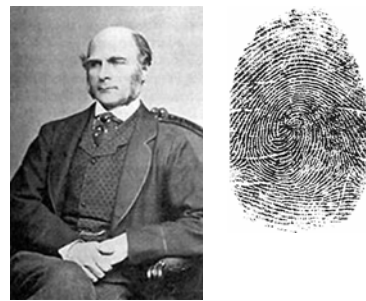
**Archimedes** [287-212 B.C.] was a renowned Greek mathematician, inventor and physicist. The king trusted Archimedes but did not want him to harm the crown in his analysis. The question seemed impossible to answer, and it appeared that—if he had indeed defrauded the king—the jeweler had committed the perfect crime. In a tale known to college physics students across the world, Archimedes, perplexed at this problem, went home and took a bath to soothe his mind. His servants had overfilled the tub, and as he sat down the water overflowed. In a moment of insight, Archimedes recognized the dual phenomenon of displacement and buoyancy. According to legend he ran naked into the streets shouting *Eureka!* usually translated as *I have found it!* Testing the displacement of pure gold against the displacement of the crown, Archimedes proved that the crown was mostly silver, and that the goldsmith had cheated the king—thus becoming the first forensic expert to present scientific evidence at trial.

**Mathieu Orfila** [1787-1853] the Father of Toxicology though born a Spaniard worked in Paris. In 1813 he

published the landmark work, *Treatise of General Toxicology* With James Marsh, another early toxicologist, Orfila was able to credibly establish the presence of arsenic in human tissue. Arsenic was a common poison of the age, because its symptoms of stomach pain and vomiting mimicked cholera, which was endemic at the time. He was called to testify in a criminal trial in 1840 in which arsenic was suspected. A brilliant forensic scientist, Orfila used a test developed by Marsh to test the soil around the graves of suspected poisoning victims to exclude the possibility of contamination when the body was exhumed.

In the 1830s, physiologist **Johannes Purkinje** became the first person to devise a fingerprint classification system when he defined nine basic fingerprint types. Recognizing the individuality of fingerprints, in 1858 **William Herschel** began using them for contracts with illiterate workers. Scottish Physician **Henry Fauld** discovered that the perspiration from the fingerprints could be made visible with powders by 1880. Fauld used this new forensic technique at a crime scene to eliminate a wrongly accused suspect and identify the actual perpetrator. Twelve years later **Sir Francis Galton** published the first book about fingerprints—creatively entitled *Fingerprints*, in which he expounded their unique place in forensic investigation. Working with **Sir Edward Henry** of Scotland Yard, a fingerprint classification system was developed that still influences the science today. The capstone for fingerprinting technology in the United States came when Thomas Jennings murdered Clarence Hiller. Jennings was convicted based upon a fingerprint left at the scene. Jennings' defense team challenged the validity of the fingerprinting technology. After review of the facts, a 1910 appeals court affirmed Jennings' conviction and declared that fingerprint technology had a scientific basis

**Alexandre Lacassagne** (1844-1921) is generally regarded as the founder of modern forensic science. Appointed



**IMAGE 1.2** Sir Francis Galton published the first scientific text about fingerprints, titled fittingly enough, *Fingerprints*. Of the six billion people living on the planet, this fingerprint belongs to only one. With the many advances in trace evidence analysis, DNA analysis, and computer assisted criminalistics, fingerprinting remains a critical cornerstone in modern forensic investigation. Indeed, many of the most important advances in criminalistics have been refinements of basic fingerprinting. Formerly invisible prints are now routinely collected, and computers perform pattern matches at megahertz speed where criminalists once took days to compare prints visually, one at a time.