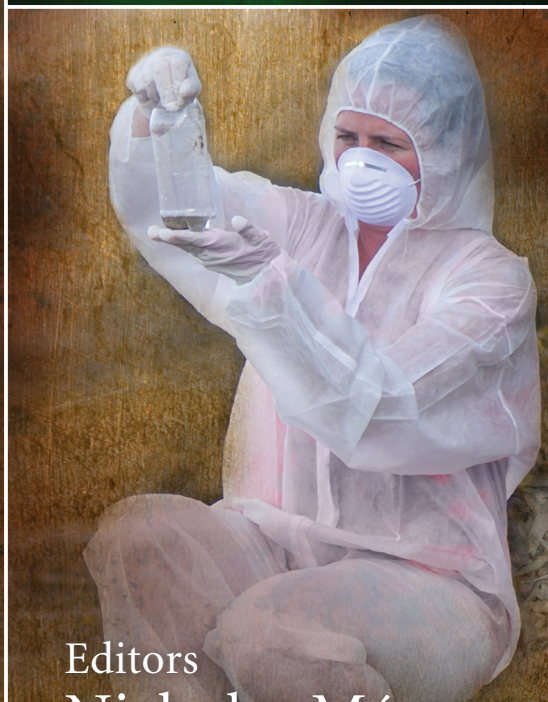
# FORENSIC ECOLOGY HANDBOOK

## From Crime Scene to Court



Editors
Nicholas Márquez-Grant
Julie Roberts

Developments in Forensic Science

WILEY-BLACKWELL

# Forensic Ecology Handbook

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## From Crime Scene to Court

Edited by

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WILEY-BLACKWELL

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# About the Editors

**Dr Nicholas Márquez-Grant** is a Forensic Anthropologist and Archaeologist at Cellmark Forensic Services (UK), having worked previously for other forensic science providers and commercial archaeological units. He is also a Research Associate of the Institute of Human Sciences, School of Anthropology and Museum Ethnography, University of Oxford. Having worked as a specialist in human skeletal remains from archaeological sites for over 15 years, he has considerable experience in the excavation and study of cremated and unburnt bone from prehistoric sites to twentieth-century conflict sites and from a variety of geographical areas in Europe, and in particular Spain. Dr Márquez-Grant has taught biological anthropology since 2001 at the University of Oxford where he was awarded his doctoral degree in archaeology and physical anthropology in 2006. In recent years he has worked full-time as a forensic anthropologist and archaeologist in cases from a large number of police forces in the United Kingdom, dealing with the search, recovery, location and identification of human remains, and has acted as an expert witness. He also trains crime scene investigators from a number of forces in the United Kingdom and abroad.

**Dr Julie Roberts** is Scientific Lead and Team Leader for the Anthropology, Archaeology and Ecology Department at Cellmark Forensic Services (UK). She is a biological anthropologist and archaeologist by background with over 15 years' experience working in archaeology and at crime scenes, excavating and examining decomposed, skeletonised, fragmented, burnt and commingled human remains. Her forensic experience includes deployment as forensic anthropologist with the British Forensic Team in Kosovo in 1999, 2000 and 2002, exhumation and examination of murder victims in Iraq in 2003, and lead anthropologist following the London bombings in 2005 and the Nimrod air crash in 2006. Recent casework includes successfully locating, recovering and assisting in the identification of human remains in Lebanon and mass fatality deployments to Afghanistan. Dr Roberts has attended numerous crime scenes of different types across the United Kingdom, specialising in the excavation and analysis of burnt and fragmented remains. She is one of only two forensic anthropologists who sit in the expert panel for UK Disaster Victim Identification. She is registered with the National Policing Improvement Agency (NPIA) as an expert advisor in anthropology and archaeology, and has been involved in instructing police officers and crime scene investigators for over 10 years.

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# Series Foreword

## Developments in forensic science

In the past few years the development of teaching, research and knowledge exchange activities associated with forensic science policy and practice have increased almost exponentially. Technological innovations, the pursuit of new knowledge and the interpretation of analytical and other data as it is applied within forensic practice is to be welcomed as we move to a phase where our profession is striving towards gaining a foothold on maturity as a science. Practising forensic scientists are constantly striving to deliver the very best in their service to the judicial process and as such need a reliable and robust knowledge base within their diverse disciplines.

As we develop new knowledge and address the research and practical application issues within the field, the consolidation and dissemination of new methdodologies relevant to forensic science practice becomes essential. It is the objective of this book series to provide a valuable resource for forensic science practitioners, educators and others in that regard. The books developed and published within this series come from some of the leading researchers and practitioners in their fields and will provide essential and relevant information to the reader.

Professor Niamh Nic Daéid
*Series Editor*

# Foreword

**Jonathan Smith**
*National Forensic Specialist Adviser*
*National Policing Improvement Agency, UK*

Traditionally forensic science has been organised in terms of the scientific disciplines, for example biology, chemistry, drugs and toxicology, and firearms.

The scientists involved in the examination of casework exhibits in many instances have extended their expertise across the disciplines giving a more integrated view of the sciences that can be applied to the varying situations appearing in police investigations.

Taking the biology specialism of forensic science as an example, this has mostly dealt with the wide range of biological materials that might be transferred during the commission of a crime. This could be the transfer of blood and body fluids, hair, textile fibres and botanical material. It is fair to say that the examination of transferred botanical material has in the past not really featured as a major consideration in many investigations.

Over the last decade there is no doubt that the focus of the science applied to forensic science cases has centred on developments in DNA technologies. Some of the other scientific skills applied to forensic science have to a large extent been less well supported. This situation at one stage led to the development of sciences such as botany, entomology, archaeology and anthropology being centred on academic institutes, or in some instances experts acting alone.

Consequently this resulted in an almost peripheral group of experts, who were seen as detached from mainstream forensic science, confined by the boundaries of their discipline, and who relied upon their individual reputation rather than a corporate assurance implied by the traditional forensic science providers.

The situation now is distinctly different, with a greater integration of these specialist disciplines into forensic science.

In this volume the expertise in these various disciplines is brought together for the use of investigators, specialists and those working within the criminal justice system. The structures that are in place within a major crime investigation, and the roles and responsibilities of the investigation team are outlined, and there is an explanation of how the various elements of the team interact. Also included in

the text is some specific detail for the practitioner outlining sampling procedures, packaging and exhibit examination practices.

There is recognition by the contributors of the ultimate responsibility of the expert to present to the court the scientific findings in a balanced manner, mindful of the need for quality, peer review and an assurance that the science being applied is based on published data and tested principles. In this way the confidence in the application of these scientific disciplines into an all-encompassing forensic science response to crime investigation is greatly enhanced.

# Foreword

**Richard T. Shepherd**
*Consultant Forensic Pathologist, UK*

One of the many changes that has occurred during the 30 years that I have been practising forensic pathology is the rise of forensic science. To cite but one example, blood serology, which relied upon the visual identification of antibody agglutination of red blood cells which determine the major and minor blood groups present, has been swept away by DNA analysis. This has resulted in an increase in the specificity and accuracy of blood analysis by a factor of many millions. However, this apparent 'certainty' has meant that if there was a mistake it would in all probability be a big one. Instead of the accepted 'possible error' of blood serology, DNA resulted in statements approximating to certainty which may have reflected the science but they did not allow for fundamentally faulty practice.

And there were setbacks when enthusiasm exceeded reliable, scientific analysis and sound forensic practice. When those results and opinions were robustly tested by other practitioners in the laboratory and then by the lawyers in the courts, parts were exposed to be flawed and the whole edifice collapsed. These moments are salutary lessons for us all, for they inform us that just because we think that something might be right that does not in itself make it right. We must build our skills and our expertise and our evidence on the solid foundations of knowledge, experience and adherence to strict forensic practices.

The process of scene examination has also progressed in ways that simply could not have been anticipated in the 1980s. At one time, the forensic pathologist did just about everything at the scene – seldom even wearing overshoes – and now everyone wears full protective clothing and the pathologist gets to do very little indeed because they no longer have the full set of skills that are needed, but they have to be aware of the whole spectrum of specialist skills and experience that the forensic scientists can bring to a scene or a post-mortem examination.

As the apparent accuracy of forensic science increases, the subject in all its many forms is becoming increasingly important in this modern, litigatious world. The interface between science and the law, whether civil or criminal, is becoming more challenging and it is essential that there are forensic science practitioners available to the police, to the defence and above all to the courts. Those practitioners

must have the requisite knowledge, skills, and also the experience to perform the highly complex, specialist scene and laboratory examinations in a forensically satisfactory manner. They must also be able to produce and give reliable, science-based evidence that will enable the court to reach their verdict with a full understanding of the facts and confidence in their source.

Despite the longevity of forensic science as a whole, the subject continues to develop new specialist areas in response to scientific advances combined with pressure from the police and the criminal justice system. The over-arching speciality of Forensic Ecology that is the subject of this book covers both the well-established fields of archaeology and anthropology and also extends into rather more recently developed fields such as forensic botany.

This textbook emphasises the need for a methodical, careful and precise approach to all problems. It accepts that not all practitioners will have all of the precise skills that may eventually be needed in any particular case and it emphasises that the adoption of the correct approach will allow others – possibly someone with greater specialist skills or maybe just the expert acting for the defence – to understand and to rely on the processes by which the information was obtained so that opinions will be based on reliably obtained evidence.

Those who choose to practise forensic science must now move their subjects forward. They must ensure that current and future practitioners are both skilled and experienced in all the relevant areas of practice and they must ensure that the police, the courts and the public insist on that professionalism and expertise. The authors have ensured that this present volume is specifically designed to be practical and they have included useful, focused and reliable advice on the handling of casework throughout the text. The case histories that are also included provide a superb basis for learning and for the understanding of both basic and more advanced forensic concepts. However the practice of forensic medicine does not stop at the examination of a scene or the examination of the victim or perpetrator and this handbook recognises these crucial aspects and also deals with the task of report writing and the giving of evidence in court.

This excellent volume is a thorough and complete overview of this speciality and provides a reliable and comprehensive textbook that is suitable both for practitioners already working within this field and for those seeking to develop a specialist interest and skill in Forensic Ecology. Julie Roberts and Nicholas Márquez-Grant have extensive knowledge and skill and have worked for many years in their own fields. To bring to one book such experience and expertise is rare and their joint efforts in producing this book reflects their immense knowledge and enthusiasm for their subject.

# 1

# Introduction

**Nicholas Márquez-Grant[1] and Julie Roberts[2]**
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This volume stems from the editors' experience in archaeology and anthropology as applied to criminal investigation. Archaeologists have always been familiar with sampling for soils, pollen and other environmental sources to provide information about ancient landscapes and for their contribution to our understanding of the past. Likewise, physical anthropologists specialising in human skeletal anatomy have studied demographic profiles, disease patterns and funerary practices in past societies with the purpose of understanding the lifestyles and environment of pre-modern populations.

The disciplines of archaeology and anthropology (whether under the same umbrella or as separate fields of study), are closely interlinked with environmental sciences such as palynology, botany, pedology, geology and entomology. This applies in both modern and ancient contexts, although the way in which they are used will vary according to the questions being asked. For example, the physical anthropologist and palynologist working on an Iron Age settlement site might be utilising their skills to assess the life expectancy, health, diet and nutritional status of the people who once lived there, whereas at a crime scene the same expertise might be used to establish the identity of the deceased and to link a suspect to a scene. In both cases, the science and the principles behind it remain the same, although the specialists engaged in forensic casework need to have a good working knowledge of the criminal justice system of the country they are working in, and an awareness of their place within it.

The anthropologist or archaeologist dealing with human remains of forensic or medico-legal interest, should be familiar, prior to recovery of the remains, with a wide range of other forensic disciplines. This includes a general awareness of biomolecular and biological trace evidence and body fluids such as DNA, saliva, blood and semen, as well as other forensic evidence types including fibres, fingerprints and footwear marks. They should have a more detailed knowledge of pollen,

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plants, diatoms and insects, which in our experience can often provide vital information relating to post-mortem interval (time-since-death), the manner in which the victim was disposed of, seasonality and even cause of death.

Whilst environmental evidence requires the attention of highly specialised scientists it is important that the anthropologist or archaeologist, who will often take the scientific lead on complex cases where remains are extensively decomposed, has a good appreciation of the potential applications of the related scientific techniques. It is also vital that they are trained and experienced in the collection of pollen, soil, insect and plant specimens in case the appropriate specialist is unable to attend the scene (although attendance by the appropriate specialist is always recommended as best practice).

Conversely it is important that police and crime scene investigators understand the role of the archaeologist, anthropologist and environmental scientist at the crime scene and how their specific areas of expertise can benefit a criminal investigation.

The disciplines of archaeology, anthropology, palynology, botany and entomology among others, can be used together to assist in the search, location, recovery and identification of human remains (and other buried evidence such as firearms or drugs). They can be utilised to indicate how much time has passed since the body was left at the scene and link suspects to scenes and victims, and they can be used to answer specific questions such as: Who is the victim? How long has the victim been dead? Is there a third party involved? How long has the victim been at a particular deposition or burial site? How did he or she die? And what happened after the death of the individual, for example did the suspect re-visit the scene, did animals damage the remains, or was the body moved? It should also be noted that the work of these specialists is not restricted to outdoor scenes and anthropologists and entomologists in particular may frequently be required to attend deaths in houses, garages or other indoor locations.

In this volume we encompass the environmental sciences within the term 'Forensic Ecology'. This is a broad description and its use can be extended to areas such as wildlife and environmental crime incorporating a wide range of applications. However, in this book we restrict ourselves largely to major crime, focusing on how anthropology, archaeology and ecology can aid in the investigation of missing persons, suspicious and unexplained deaths.

Many books have been published on the individual subjects of forensic anthropology, forensic archaeology, forensic entomology, forensic botany or forensic geology (e.g. Hunter and Cox, 2005; Blau and Ubelaker, 2009; Schmitt, Cunha and Pinheiro, 2006; Komar and Buikstra, 2008; Byrd and Castner, 2009; Gennard, 2007; Miller Coyle, 2005; Ruffell and McKinley, 2008). These volumes provide an introduction to each discipline, background information on the science, provide case studies and explain the methods involved, as do many of the thousands of scientific papers that have been published throughout the years. There are also volumes that include these areas of expertise in general introductory texts to forensic science or criminalistics (e.g. Saferstein, 2011; White, 2004; Anadón and Robledo, 2010; Gunn, 2006; James and Nordby, 2005). This book, however, focuses on drawing

together disciplines specifically related to environmental sciences, victim recovery and identification. It is aimed at forensic science practitioners and police officers currently involved in crime scene investigation as well as those still studying or working as trainees. It will provide them with an awareness of the potential applications of these disciplines and hopefully give them the confidence to decide when to call out the appropriate specialist and how to best preserve the evidence at the scene until they get there. The practical information relating to collection of ecological samples will ensure that police officers and crime scene investigators are in the best position to ensure that good practice is being utilised by the specialist they have invited to the scene. They may also have to follow the guidelines themselves in emergency situations where, for example, there is a long delay before the scientist can attend, the scene is remote or cannot be secured for any length of time. Forensic ecology is a discipline rarely taught in standard police or crime scene investigator training and as such this book can fill a potentially wide knowledge gap.

In addition to focusing on environmental evidence types, victim recovery and identification, we have set out to clarify aspects of crime scene management and police procedures which relate directly to the specialist at the scene. The importance of continuity and integrity of evidence is reiterated in a number of chapters throughout the book as it is vital for the practitioner to understand that whilst their specialist knowledge, expertise and results might be first class, if they fail to follow proper procedure (for example failing to sign an exhibit label or seal an item at the scene) their evidence may be rendered inadmissible with potentially disastrous results for a case. This was illustrated in the recent re-trial of two men accused of the murder of Stephen Lawrence in South London in 1993 (Daily Mail, 2012). The case for the prosecution almost fell apart not because of flaws in the scientific analysis and findings, but because some of the evidence had been stored in exhibit bags that had not been sealed, thereby providing the defence with an ideal opportunity to allege that the forensic evidence was in fact contamination which had occurred after the event.

The contributors in this book are extremely experienced forensic practitioners with a wealth of knowledge. The volume is structured in a way that provides a useful guide to forensic scientists and practitioners about the evidence types involved in the recovery and identification of human remains from forensic contexts.

Each chapter provides background information on the discipline it is concerned with and is structured in a logical sequence progressing through preparation prior to attending a scene (What questions should the scientist ask when receiving a call from a police force? What equipment do they need to prepare before attending a scene?), the scene attendance itself (including protocols at the scene, sampling strategies, recording), scientific examination and analysis of the evidence in the laboratory, and finally the production of an expert witness statement and court testimony.

In Chapter 2, aspects of crime scene management written by Forensic Practitioners from the Metropolitan Police Service in London are discussed. This relates primarily to roles and procedures employed in England and Wales, but the key personnel involved in crime scene investigation and the principles adhered to at the

scene are standard in most developed countries. Chapter 3 deals with forensic archaeology. This volume perceives archaeology and anthropology to be separate, albeit inter-related, disciplines, although in some countries archaeology may be seen as a subdiscipline of anthropology. Chapter 4 describes the role of the anthropologist in victim identification and in the assessment of post-mortem interval. It also summarises how the anthropologist's knowledge of skeletal anatomy can assist the pathologist in determining cause of death by physical reconstruction of remains and trauma analysis. It is followed by chapters on the use of radiography (Chapter 5) and sampling for DNA (Chapter 6) in victim identification. Other techniques that might be of assistance in determining post-mortem interval or the identity of the deceased include radiocarbon dating and isotope analysis (Chapter 7). Entomology is covered in Chapter 8, primarily with the aim of inferring post-mortem interval, whilst Chapters 9 to 12 deal with other ecological evidence types: diatoms, palynology, botany and geology. Chapter 13 provides an in-depth discussion on Police Exhibits including clear guidelines on what constitutes an exhibit, how to produce, label, document and store them. It also provides vital information relating to avoidance of the pitfalls that can so easily beset the practitioner if the correct procedures are not followed. Finally, Forensic Photography is a fundamental part of crime scene investigation and forms the primary record for attendance at any scene or examination. Chapter 14 describes the standard techniques used in Forensic Photography and guidelines for best practice to ensure that any images taken are relevant, include all the required information (for example a means of orientation, scale and exhibit number depending on the subject matter), and are of an acceptable standard to be presented in court.

We hope this book will be of some value to practitioners, police staff, academics and students, who may be required to attend crime scenes where human remains and ecological evidence types are present. We anticipate that it will enable them to realise the potential applications surrounding the disciplines of anthropology, archaeology and environmental science and give them a broader awareness of how a wide range of related scientific techniques can assist in victim recovery, identification and criminal investigation.

This volume would not have been possible without the tireless effort of our contributors, who we greatly thank for their time and their expertise. They are all experienced practitioners who have written their chapters whilst working full-time in their chosen fields. We are grateful for the support given by colleagues at Cellmark Forensic Services, UK, as well as friends and relatives during the process of editing this book. We would also like to express our gratitude to the staff at Wiley-Blackwell, especially Rachael Ballard and Fiona Seymour.

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# 2

# Aspects of crime scene management

**Ruth Buckley and Andy Langley**
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## 2.1 Introduction

This chapter is divided into two parts. The first will review specific police roles and professionals working at major crime scenes such as homicide. This aims to provide the reader with an understanding of the structure and roles within an investigative team and its associated personnel. The second part of this chapter will focus on working at crime scenes from basic procedures and the employment of specialists to the conclusion of work and provision of statements. This aims to provide sufficient background and forensic awareness to enable the reader to work confidently at a crime scene in conjunction with police personnel. The experience of both authors is based on their work within the Metropolitan Police Service (MPS). Therefore it must be acknowledged that the protocols and practices to be discussed here may vary elsewhere in the United Kingdom and will be different abroad.

## 2.2 Professionals within the investigation

A great number of individuals are involved in the investigation of serious crime and homicide from its initial reporting through to the collation and presentation of evidence at court. It would be impractical to list every role performed and in terms of crime scene examination and management, not every position requires explanation here. The individual roles to be discussed form by no means an exhaustive list and do not seek to belittle other essential positions within an investigation by their exclusion. Therefore those selected for discussion are the most pertinent with reference to working at crime scenes, the mortuary and within the forensic examination of exhibits.

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