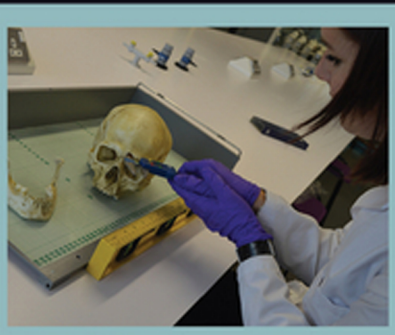
FORENSIC SCIENCE
EDUCATION AND TRAINING



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Forensic Science Education and Training

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A Tool-kit for Lecturers and Practitioner Trainers

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This book is dedicated to Dave Rogers who sadly passed away before the publication and never got to see the fruits of his efforts.

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Foreword

I am particularly pleased to write the Foreword to this book, because it addresses the crux of the whole scientific investigative process. The effectiveness of that process is completely dependent on education and knowledge, simply because it's a truism that 'you do not know what you do not know.' So if you have no idea that pond water contains diatoms you would never see the significance of their absence in a drowning victim. If you do not know that the diatom population changes from month to month, you would never see the possibility of determining how many months ago a person drowned in a river. Nor would you be able to produce the analytical diatom results in the first place unless you knew how to retrieve and analyse the samples.

This book is a comprehensive and authoritative treasure trove of how to teach both principles and practice.

Of course one change in forensic science education over the last 15 years has been the greatly heightened profile of the subject due to the popularity of TV programmes such as CSI – which in turn has led to an almost exponential increase in the number of courses and students. I have no reservations about saying this is a very good thing–indeed it raises the public understanding of science and has the major advantage of increasing the number of undergraduates studying science. It also provides a feed of excellent students into forensic science research in academia, a role which they have taken over from the Forensic Science Service (FSS). Of course, there are hardly any jobs available as court going forensic scientists, but this is not a new problem–it was exactly the same when I started in the early 1970s. And in fact this is not a problem at all, as it turns out that forensic science graduates possess the very attributes sought by employers of all types–logic and assessment, using a scientific method, communication skills and of course scientific skills.

At school, I always wanted to be Sherlock Holmes, although my initial interest simply lay in the delight of solving logical puzzles. Of course, Sherlock Holmes had the serious advantage that he knew the solution in advance, so that the logic simply involved assembling the building blocks of an already known solution; however that advantage was not immediately apparent to a fascinated ten-year-old.

Towards the end of a long career in forensic science I eventually became a forensic investigator as head of physical evidence at National Crime Faculty (NCF), and my overall aim was still very Sherlock Holmes like, but the process was indeed completely opposite. My job was to think of all the possible explanations for the facts, thus creating multiple hypotheses, which often confused matters further as far as the investigators went. By then analysing the micro-sequence of events, that is the actions and

interactions between the offender and victim and environment that must have taken place, we could use physical evidence to prove or disprove that particular hypothesis: pretty well back to Sherlock Holmes and his 'when you have eliminated the impossible etc., etc.'

At Crime Faculty my primary role was to review undetected and cold case murders and rape series. The initial casework experience was horrific, a word I use advisedly. Crucial observations and inferences that would have detected crimes simply (and cheaply!) were being overlooked. It quickly became apparent that the main problem in using forensic science effectively in the United Kingdom was simply a lack of shared knowledge. The scientists thought in terms of evidence and simply did not appreciate the value of intelligence to investigations–the potential impact of their observations and results over the dozens of investigative lines of enquiry. Equally the police could define their problems but had insufficient knowledge to see which of the myriad techniques available would be most appropriate. The situation was compounded because forensic science is inherently context dependant–often investigators would demand inappropriate tests simply because they had worked previously, under different circumstances.

Progress was made–NCF and the FSS introduced specialist advisors, generalist scientists attached to the investigative team, a role designed to enhance the thinking process in investigations. And the UK Parliamentary Select Committee (PSC) Report on Forensic Science (2004) stated unequivocally that the real benefit of forensic science lay in the provision of intelligence during the investigative phase, not hard evidence for use in court.

That overarching view of techniques and processes is particularly necessary because as new scientific instrumentation expanded throughout the 1970s and 1980s, forensic scientists themselves became more and more specialised. By the 1990s it became increasingly unreasonable to expect the police to second guess all the scientific solutions, and thus counterproductive for investigators to choose items to send to the laboratory to answer specific questions, as they traditionally had. The questions were still fine but the laboratory increasingly had more and more and better and better ways of answering them–or answering completely different, and more useful questions, which were completely unknown to individual detectives.

The Chair of the Association of Chief Police Officers (ACPO) (now National Police Chiefs Council) Homicide once described my NCF role as 'asking stupid questions.' He meant (I hope!) asking questions that had not occurred to the specialist scientists or investigators. However, forensic science (and forensic intelligence) is not really about DNA or other clever test results but about the significance of those analytical results and observations in any particular context. So forensic science educators need to teach scientific techniques, process and logical thought and apply these skills across a wide range of instrumental techniques and crime types. A glance down the chapter list will demonstrate that this aim has been admirably fulfilled.

Less easy to define and engender are attributes such as a questioning approach and especially the need to encourage a 'Bayesian thinking' mind-set, which will lead students to think automatically 'what other possible explanation can there be for that result.' Undergraduate courses will provide a bedrock of factual information as well, but students really need to link that questioning mind-set to a wide breadth of factual knowledge of their own. As an example, scientists all know that you just cannot ignite petrol with a cigarette end, but the public who watch films and TV don't. This means

the criminals don't either, and giving an impossible explanation for criminal events is often quite a good clue!

If only this book had been available when I was giving evidence in Court! Because whilst it is designed as a resource for educators and trainers, it provides a wealth of information that should also underpin our discussions with lay audiences, whether in Court or when trying to convince a Senior Investigating Officer (SIO) to authorise tests s/he believes irrelevant. Or to explain anything remotely scientific to members of the legal profession…

In summary, it is impossible to provide effective forensic science without a good knowledge of the known context, and an excellent and broad education as to the methods and processes available to clarify that context and to assess significance. That educative resource is exactly what is provided by this book, and I commend it to you unreservedly.

Dave Barclay
Fellow of the Forensic Science Society
Honorary/Emeritus Professor
November 2016

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We would also like to express our thanks to all the contributors whose expertise, experience and diligence has made this book possible, and to the students who have inspired us to produce this text. We hope that the knowledge, experience and enthusiasm accumulated in these pages will benefit forensic science lecturers and trainers and in turn, generations of future students and forensic scientists.

Anna Williams would like to thank her husband Graeme for his unwavering support.

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1

Forensic Science Education – The Past and the Present In and Out of the Classroom

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Introduction

This chapter aims to reflect upon and to consider the 'where are we now' aspect of forensic science education and training. Despite the rhythms and reflective cycle that academia requires, it is surprising how little time the *on-the-ground* academics and practitioners involved in education and training get to truly reflect upon the curriculum and assessment of what they deliver. Of course what is specifically taught depends upon many variables; the interests, skills and experiences of those academics delivering the material coupled with the requirement of the industry to teach it. Whilst such criteria are of importance to say 'art' colleagues in their curriculum design, they are not as crucial as they are to a subject such as forensic science. This offers limited latitude for what is taught and requires industry professionals and accreditation boards to drive the expectations of the curricula to a greater degree. What is apparent over the coming pages is the change and the rate of change that has taken place in the forensic science profession at all levels, technical, practical and academic and its use within the Courtroom is now greater than ever, demanding higher and higher levels of skill, competence and understanding of what is useful in a police investigation and criminal trial.

> Forensic science is a 'critical and integral part' of any judicial system in the 21st Century because forensic science is one of the primary means through which 'democratic governments fulfill one of the most fundamental obligations to their citizens: public safety insurance in a just manner'.
>
> *Houck, 2006*

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Well over a decade ago, in 2000, in the United Kingdom (UK), the educational landscape for forensic science was very different to today's current situation.

The changes that have occurred in the past decade not only in the forensic science area but also within policing (Neuroyd, 2011) are the greatest since either forensic science or indeed policing came into being. A number of key national and international events have occurred and documents have been published that have aimed to examine the status quo and to offer direction for future developments within forensic science and hence its delivery and education. Some of these early key events and the documentation resulting from them include:

- The report by the UK House of Commons Science and Technology Committee – Forensic Science on Trial, published in 2005.
- The UK SEMTA Report (Science, Engineering, Manufacturing Technologies Alliance (SEMTA) Sector Skills Council, Forensic Science: Implications for Higher Education 2004, UK) of 2004 on the forensic science implications for Higher Education institutions.
- The UK Skills for Justice Report in 2009 for the Forensic Science Occupational Committee in 2009 into the provision of forensic science degree programmes in UK Higher Education institutions (HEIs).
- The National Academy of Sciences (USA) report (2009) into strengthening forensic science in the United States.
- The publication of the Silverman report on UK Forensic Science Research published in 2011.
- The 'paradigm shift for UK Forensic Science' (Royal Society Meeting) in 2015 … and the list could go on.

As a result of the field's prominence and popularity (Mennell, 2006), the number of education providers offering forensic science courses and the number of students enrolling in these courses increased exponentially (Engber, 2005; NIFS, 2006) but the subjective observation is that there is now a downward trend in recruitment in forensic science courses in favour of policing based education.

The expansion in forensic science education worldwide driven by university consumer forces and popular demand, in addition to the inconsistency and lack of clarity in the huge range of forensic science courses on offer, have led to inconsistencies in skills and competencies acquired by the graduates seeking employment in the field. Whilst this has clearly been addressed through accreditation by the laudable attempts of learned societies in their host countries (such as the UK Chartered Society of Forensic Sciences) to harmonise the content of delivery, this has worked within countries to some extent, but less so across countries, which reflects the relationship of forensic science with the law and the wider Criminal Justice System within that particular country.

In 2004 that may have been the case, but the situation is now somewhat improved. The question concerning the variety and the value of the many publications and reports on this topic into forensic science provision and education and the legacies and the recommendations that they have offered will be considered further within this chapter and indeed as a paradigm throughout this book. There is, however, much still to be done as forensic science education enters the second decade in the UK HEIs. As Samarji (2012)

observed, forensic science academic programmes are still characterised by a great deal of randomness and uncertainty.

Burnett *et al*. (2001) had argued that little research has been undertaken and published on forensic science education; it is reasonable to surmise that this issue of a paucity of literature at the turn of the twenty-first century has long since been redressed with a myriad of documents, investigations and recommendations at national and international level into all levels and aspects of forensic science. Four years later, Lewis *et al*. (2005) concluded that the random expansion in forensic science education worldwide, in addition to an inconsistency and lack of clarity in the wide range of forensic science courses on offer, led to variations in the skills and the competencies acquired by trainees and graduates seeking employment in the forensic field. Moreover, forensic science education departments still lack formal arrangements with practitioners and employers to discuss course content, delivery and assessment. Currently in the HEI sector, at best there is a 'Memorandum of Understanding' but more often there is a reliance upon the good will of management level staff from both the academic and practitioner organisations involved. Instead 'what exists is a series of *ad hoc* arrangements' (with a couple of notable exceptions), which occur on an individual basis between employers or individuals and UK universities through which 'employers liaise with universities about particular courses' (SEMTA, 2004) and how they should or could develop their courses.

Forensic science suffers a non-consensus within the academic community on whether it is a stand-alone and distinct applied field of knowledge, an associate field of study, or merely a technical derivative of existing arenas. Moreover, some scholars and practitioners argue in the public domain in the extreme as to whether or not forensic science education is a necessity *at all* within Higher Education.

Despite this dialogue, criticisms by potential employers (Lewis *et al*., 2005) abound more than a decade after the first courses were introduced. Forensic science (education) departments still lack formal arrangement or requirements with employers and national level organisations, for example, the College of Policing (CoP), Chartered Society of Forensic Sciences (CSFS) and Skills for Justice (SfJ), offering endorsement programmes to discuss course content in a meaningful fashion and certainly not at a national, European-wide or international level.

These inconsistencies have resulted, particularly in forensic science education courses because of the lack of dialogue between the various contexts, cultures and mind-set, in a field of shifting but unconfirmed reigning paradigms. This lack of dialogue, compounded by the lack of Quality Assurance Agency (QAA) guidance (until 2012), had resulted in a set of competencies determined to a large degree by the skill set of the academics from the university at the time that the course was first designed. This has been offset in part by up-skilling of HEI academics in the realisation, from advice given by forensic practitioners from industry when attending university forensic science course 'validation events,' that the course *must* be more than 'forensic' in name. Whilst this has been achieved to varying levels across the HEI sector, most, if not all institutions involved, are guilty (in part) of not fully entering into dialogue with legal or policing colleagues. The closure of the UK Forensic Science Service (FSS) in 2012 had one positive effect upon HEIs as an industry, in that it offered a willing pool of highly qualified individuals who could join the academic teams. Previously, such individuals had only entered this pool at retirement on a visiting lecturer basis.

Despite the prominence and high stature that forensic science has gained within the general public consciousness and the consequent expansion it has achieved within Higher Education institutions, forensic science 'has not enjoyed a similar rise in stature within the academic community' (Jonakait, 1991). Garrison (1991) asserted that forensic science identity is complex because it is the 'product of an uneasy and unholy mating of science, the objective seeker of truth and knowledge, and forensics, the argumentative persuader of courtroom advocacy'; competency compounded by its association with the Police Service in the UK undergoing one of the most radical changes in over 100 years (Neyroud, 2011).

Forensic science remains a relatively new and developing field in terms of its education, practice and stature. It is the proverbial Cinderella to chemistry, physics and biology and is likely to be so for the foreseeable future, until its importance in both an educational and employment context are fully recognised and appreciated. The reasons for this are still being debated, however, the relative youthfulness of such educational courses may in part explain the attitudes of employers to such courses when compared with the much more established sciences such as physics, chemistry and biology.

Therefore, complexity and uncertainty issues are experienced at the epistemological level of forensic science, in the nature of the actual practice and within a wide grasp of images, profiles, impressions, expectations and perceptions that attempt to shape the identity of this field.

In the eyes of the media, UK educational establishments that were given university status in 1992 (and beyond) are criticised as being only devoted to responding to either government's wishes or fulfilling businesses' obsession with income, whilst giving up their historic fundamental role as a 'civilising force' and a source of moral development (Cullingford and Blewitt, 2004). Forensic science education has sometimes been used by universities for business reasons, where the word 'forensic' is used as a popular term to attract enrolments and polish the perceived less attractive conventional subjects, such as chemistry and physics, which are subject to closure (SEMTA, 2004).

Despite the levelling-off (in fact a clear decline) of the number of HEIs validating forensic science based courses, the initial rapid growth in forensic science education over the last decade continues to raise concerns about the quality of many of the forensic science programmes offered (Daéid and Roux, 2010; Quarino and Brettell, 2009; Mennell, 2006). This rapid growth is argued to be the cause of the inconsistencies and the lack of clarity reflected in the huge range of forensic science courses on offer (Lewis *et al*., 2005). This inconsistency in education has resulted in the lack of agreement on the 'appropriate' competencies acquired by forensic science graduates, which have led to further criticisms from potential employers (Lewis *et al*., 2005; Hanson and Overton, 2010). The CSFS accreditation process has done much to level the playing field in terms of quality and content but as this is still not a requirement for course delivery it has not been taken up by all HEI providers.

Reviews have been conducted to study the current status of this education and establish some recommendations for the future (Daéid and Roux, 2010). With this in mind, the following studies are pertinent to consider.

The Sector Skills Council for Science, Engineering and Manufacturing in the UK conducted a study on forensic science (2004) which recommended that: (1) forensic science degree content be monitored for quality assurance and be set-up in close cooperation with the forensic industry; (2) professional technical/laboratory skills

training programmes should be established; (3) pure science disciplines (e.g. chemistry) in Higher Education should receive more government funding (SEMTA, 2004). This study was supplemented by a study in 2009 presented in a 'Skills for Justice' report in response to the on going debate and concerns of the UK Government about the employability and postgraduate 'value' of many of the forensic science courses offered within the UK (Daéid and Roux, 2010). The Skills for Justice's report observed that a number of the issues raised years previously in SEMTA's 2004 report remain a concern over a decade later, including the failure of large numbers of forensic science graduates to secure employment in the forensic sector. At the time of the SEMTA report in 2004, the forensic landscape was very different for both practitioner and educators, and it was indeed very different for students within a university environment; the questions remain as to the success or not of the levels of employment of forensic science graduates.

The USA National Institute for Forensic Science (NIFS) criticised the United States educational establishments in 2006, in that forensic content was present sometimes 'by name only' in their US curricula, in order to add or associate the adjective 'forensic' with the title of the offered courses; hence, the courses became more attractive and enrolled more students.

We now have the UK Forensic Science Regulators' role in Quality Assurance (Codes of Practice and Conduct) (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/118949/codes-practice-conduct.pdf) within the industry and their role in related areas in practice that is well entrenched within the Home Office and Criminal Justice structures. The closure of the Council for the Registration of Forensic Practitioners and the Skills for Justice, Skillsmark process, has since been initiated. The CSFS 'Education and Industry Liaison Forum' was formed to facilitate forensic practitioners engagement in a more structured manner with education and research in HEIs.

This development represents a landmark shift in the way that practitioners and HEIs engage – this is something that has taken a decade to bring to fruition and demonstrates the significant changes in the attitudes of stakeholders, practitioners and drawbridge keepers that has made this possible with HEIs.

The R v T, where in October 2010, the English Court of Appeal overturned a murder conviction on the basis of, as it saw it, severe flaws in the generation and presentation of the prosecution's forensic shoe-print evidence (see Hamer, 2012) report and the closure of the Forensic Science Service in the UK in 2012, was a stern wake-up call to the whole forensic industry, not just in the United Kingdom but indeed globally. Equally, the United States National Academy of Sciences (the national research council of the national academies), report make very clear statements about directions for moving forward for their forensic science community and sent a Tsunami warning to the United Kingdom in terms of policy and practice in 2011, and yet the FSS closure went ahead with little or no published plan of what would replace the void it left behind.

Hannis and Welsh (2009) published the 'Skills for Justice – Fit for Purpose – Research into the provision of forensic science degree programmes in UK HEIs' and reported that 'a number of areas of forensic education needed improving to be truly fit for purpose.'

In 2006 the United Kingdom Forensic Science Education Group (UKSFEG) was established as a forum in part to provide careers information and more general career advice to potential and current forensic science students. It comprised a number of highly influential and high-ranking individuals and groups including: the Association of Chief Police Officers (ACPO), the Home Office Forensic Science & Pathology Unit, Forensic Science

Service, Scottish Forensic Science Service, Northern Ireland Forensic Service, Laboratory of the Government Chemist (LGC) Forensics, Centrex NTC, Metropolitan Police Service, Strathclyde Police, Derbyshire Police, Cleveland Police, the Chartered Society of Forensic Sciences, UK Higher Education Academy and a number of UK universities in which forensic science degrees were delivered. Part of its remit was to encourage links with forensic science employers and academia. The group's aim is to continue to promote recognisable and relevant degrees in 'forensic practice.'

Its wider remit has been to establish forensic science employer Higher Education (HE) requirements and priorities for new and existing staff by agreeing a framework for forensic science users and providers to work collaboratively with HE to influence the design, content and delivery of courses, to ensure graduates are well equipped to meet the needs of the forensic science community. For a time, UKSFEG assisted in influencing forensic science degree courses and working with forensic science users and providers to identify key priority areas for the future, such as Crime Scene Science and Digital Forensics. Through this, it facilitated providers with a pool of high quality graduates to recruit from; it produces undergraduates and postgraduates with realistic career expectations and opportunities and a framework of Higher Education professional development activities for forensic practitioners. In achieving these aims, the group complemented the work of existing organisations such as the Chartered Society of Forensic Sciences, Higher Education Academy and the Association of Chief Police Officers 'Forensic Science Sector Training Strategy Group.'

At a meeting of UKSFEG in 2011, a representative of the National Policing Improvement Agency (NPIA) gave an overview of the Association of Chief Police Officers (ACPO) remit regarding research in forensic science into the next decade. Building on the publication of the 'Science and Innovation Strategy for Policing' document, published in 2011 (https://connect.innovateuk.org/documents/3144739/3824722/Live-time+Forensics+brochure(draftv6LR).pdf/a65350a2-683d-4476-9a1e-99c1883ae33e), this presentation outlined the ACPO Forensic Strategy as a framework for national research, with the more immediate timescale of 2011–2015. Arising from this framework, three work streams were to be commissioned to provide an initial focus for the needs of the Police with respect to developments in forensic science. These work streams were:

(a) Improving the custody process with respect to forensic evidence and database information.
(b) Digitising crime scenes, both with respect to recording the crime scene and using on-site tests.
(c) Personal identification.

What became clear was the discordant understanding between the policing and HEI forensic aims and objectives for research into the next decade. The 2012 ACPO document 'Harnessing Science Innovation for Forensic Investigation in Policing' (https://connect.innovateuk.org/documents/3144739/3824722/Live-time+Forensics+brochure(draftv6LR).pdf/a65350a2-683d-4476-9a1e-99c1883ae33e) has offered the opportunity for dialogue and development of research plans between HEIs and organisations such as the UK Home Office 'Centre for Applied Science and Technology.'

In 2011 the 'Lowering the Drawbridges' report (McCartney *et al.*, 2011) into the interrelationship of education between the legal and scientific communities demonstrated

the desperate need for pedagogic harmonisation for those entering into a criminal justice framework in education as students or in practice as graduates. The imperative is for law educators and science educators to 'lower their drawbridges' and seek mutually beneficial solutions to common educational problems, not only to reap benefits for students, but also to contribute towards developing the legal/forensic science professions of the future, and ultimately, assist the Criminal Justice System in realising its ideals and objectives.

In part, this issue is confirmed by an earlier report by Samarji (2012), who suggested that forensic science education is arbitrarily organised, as the forensic science courses considered in his study possessed no clear pattern(s) of:

(a) The knowledge fields that should be incorporated (e.g. chemistry, biology, mathematics, physics, law and/or forensic subjects).
(b) The place and extent of practice, the non-consensus on the academic level at which forensic science education should start (non-award, undergraduate and/or postgraduate).

In the United States, the American Academy of Forensic Sciences (AAFS) website revealed over 155 undergraduate forensic science programmes, nearly 70% of which lead to bachelor's degrees in forensic science or in forensic science associated with other disciplines such as chemistry, biology, criminal justice, anthropology and/or psychology (AAFS, https://www.aafs.org/).

The non-award programmes (~30%) distribute between associate degrees, certificate programmes and training programmes mainly in forensic DNA profiling. In the United Kingdom, forensic science education is no less popular. The number of students studying forensic science degrees increased from 2191 in 2002–2003 to 5664 in 2007–2008 (Skills for Justice, 2009).

At one point in time there were over 500 listed combinations of undergraduate courses with 'forensic' in the title being offered by over 70 British universities (Daéid and Roux, 2010).

The picture that emerges from what has been described from forensic science and its education is a long way from 'rosy.' The changing climate of the introduction of student fees, the increased pressure upon academic staff with the industrialisation of their roles and the burdens of ever increasing administrative responsibilities being placed upon them do nothing to foster a climate of enthusiastic experimentation and innovation to change the status quo in the arena of forensic Higher Education in the United Kingdom.

The bleakness of the forensic and general sciences job market globally, the expectations of students, increasing student numbers and increasing pressure upon the academic community generally, have led to a rethink of *who, what, why, when and how* we do our jobs as educationalists.

A quote from Woods (2010), a former CEO of Science for Justice, demonstrates the recognition of the requirement for HEI–practitioner partnerships:

> …lead the way globally in the delivery of higher education in forensic science… bringing together the universities and forensic science employers to work in partnership.
>
> *Woods, 2010*

In June 2011, Professor Bernard Silverman (Silverman, 2011) the Chief Scientific Adviser to the Home Office reported that:

> There are several factors, in addition to the managed closure of a major provider (the FSS), which make it timely to carry out this review. These include the distributed nature of forensic science provision, the rapid pace of scientific and technological advances in various areas, and the changing nature of public sector research funding and accountability.
>
> Overall the research landscape [in forensic science research] that has developed is varied and in some ways fragmented, and improvement in the degree of linkage and communication would drive forward innovation most effectively.
>
> *Silverman, 2011*

Whereas in the past academia concerned themselves mainly with science and the law, there are now courses inculcating policing and policing science into the equation.

This strengthens, not dilutes, what we have to teach, but we now have to be mindful of the changing landscape of policing and of intelligence and evidence gathering. The changing manpower structures as outlined in the Neuroyd report (2011) require a more efficient and transparent police service at a much cheaper cost, and this adds a new layer to what academics have to deliver on many of the HEI courses, for example, business protocols, budgetary awareness, working with constraints, systematic and strategic thinking.

There has, to date, been no single place in which all of these changes have been recorded, dialogued or even vignetted, so that those new to the profession, interested in the subject, or just plain 'nosey' about CSI-UK, can come and drink from the huge well of knowledge that has been created since forensic science undergraduate degrees exploded on the educational landscape in the mid-1990s. Now over two decades on, it is time for a retrospective and a prospective dialogue to map-out and to create a 'road map' of the way forward for the next decade.

It is also very important to be able to educate and prepare teachers and instructors to deal with teaching in an area such as this, requiring non-traditional methods. Some excellent classroom instructors and teachers struggle adjusting to the use of computer-based teaching, virtual formats and social networking tools, because the dynamics between the instructor and the student are very different and require more forethought and create different challenges than traditional teaching methods. All of these changes have taken place in the face of social changes in learning style and structure impacted upon by technology. 'Clicker technology' and Twitter, Instagram, Snapchat, Skype, Facebook, tablet technology and indeed perniciously invasive mobile phone technology have changed the way students engage with each other and with academics in their teaching and learning strategies. We will look to the **best aspects** of these to determine how we can more fully engage with students to facilitate their autonomous, deep and self-directed learning without damaging the pedagogic experience to produce forensic scientists with a continuing drive to learn and develop once in forensic practice.

Innovative teaching methods are required to deal with increased numbers of students, diverse student populations and the demand for value for money, as well as increased