

**THE WINSTON CHURCHILL MEMORIAL TRUST OF AUSTRALIA**

**Report by Soren Blau - 2013 Churchill Fellow**

**The Sir William Kilpatrick Churchill Fellowship to study  
technical aspects of analysis and interpretation of skeletal  
trauma in medico-legal investigations – USA and Colombia**

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Signed:

Dated:



Soren Blau

10<sup>th</sup> September 2014

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### *Central Identification Laboratory, Hawaii*

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- Dr Robert Mann, Director, Forensic Science Academy
- Mr Cortland Sciotto, Project Support Specialist for the Forensic Science Academy
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- Dr Miranda Jans , Forensic Anthropologist
- Dr Ivett Kovari, Forensic Anthropologist
- Dr Carrie LeGarde, Forensic Anthropologist
- Dr Mary Megyesi, Forensic Anthropologist
- Dr Marin Pilloud, Forensic Anthropologist

### *University of Mercyhurst, Erie*

- Dr Steve Symes, Forensic Anthropologist

### *Department of Anthropology, University of Tennessee*

- Dr Amy Mundorff, Forensic Anthropologist
- Dr Dawnie Steadman, Forensic Anthropologist

### *Instituto Nacional de Medicina Legal y Ciencias Forenses, Bogotá, Colombia*

- Dr Andres Rodriguez Zorro, Forensic Pathologist
- Dr Liliana Moreno, Forensic Pathologist
- Dr Jairo Hernando Vivas Diaz, Chief Forensic Pathologist
- Dr German Beltram, Forensic Pathologist
- Dr Jorge Andres Franco, Forensic Pathologist
- Angelica Maria Guzman, Forensic Anthropologist
- Dr Claudia Elena Vega Uruena, Forensic Odontologist
- Dr Cesar Sanabria Medina, Forensic Anthropologist
- Danielle Castellanos Gutierrez, Forensic Anthropologist
- Dr Javier Coello, Medical Examiner
- Dr Manuel Paredes, head of DNA
- Edgar Bernal, Forensic Anthropologist
- Isla Campo, Forensic Anthropologist
- Angela Sanchez
- Johan Tijaro

In addition, I would like to acknowledge Professor Stephen Cordner (former Director of the Victorian Institute of Forensic Medicine - VIFM) and the Honourable John Coldrey QC (former Justice of the Supreme Court of Victoria) who wrote the references to support my application for a Churchill Fellowship. I am grateful to the VIFM for supporting me to undertake this fellowship as part of professional development. Finally, but by no means least, I am extremely grateful to my family for the ongoing support they provide me.

## Executive Summary

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### Project Description

To study technical aspects of analysis and interpretation of skeletal trauma in medico-legal investigations.

### Fellowship Highlights

1. Visiting the Joint POW/MIA Accounting Command (JPAC) Central Identification Laboratory (CIL) which is the world's largest forensic anthropology laboratory and having the opportunity to work on cases and discuss findings with a range of forensic anthropologists.
2. Attending a five day course on the *Analysis of Bone Trauma and Pseudo-Trauma in Suspected Violent Deaths* provided by Dr Steven Symes one of the most reputable experts in the analysis of skeletal trauma.
3. Spending a week at the University of Tennessee examining a range of cases of skeletal trauma from the William M. Bass Donated Skeletal Collection.
4. Visiting National Institute of Legal Medicine and Forensic Sciences (Instituto Nacional de Medicina Legal y Ciencias Forenses) in Bogota, Colombia where I had the opportunity to work with a number of forensic anthropologists, pathologists and odontologists on different types of trauma cases both in the mortuary and the forensic anthropology laboratory.
5. Building a network of contacts for future case work discussions.

### Major Lessons and Conclusions

While forensic anthropologists must have skills in developing a biological profile from a skeleton, it is vital that practitioners are also proficient in the analysis and interpretation of skeletal trauma.

While it is possible to obtain the theoretical foundations skeletal trauma analysis from textbooks, true expertise in this field can only be developed through a detailed understanding of biomechanics and exposure to a range of different types of trauma cases.

Taking a holistic approach to the interpretation of skeletal trauma is beneficial for case reports. Skeletal trauma should be assessed and reported in relation to the soft tissue and body as a whole rather than by specific skeletal element.

Forensic anthropologists benefit from working closely with forensic pathologists in a mortuary environment because a contextual approach to trauma interpretation is facilitated.

Future training programs for students of forensic anthropology in Australia should focus on a practical approach to the analysis and interpretation of skeletal trauma.

Developing a reference library of casts of skeletal trauma taken from real case examples would significantly augment the teaching and practice of forensic anthropology in Australia.

## **Programme**

### **Honolulu, Hawaii, USA: 6<sup>th</sup> – 14<sup>th</sup> June 2014**

The Joint POW/MIA Accounting Command (JPAC) Central Identification Laboratory (CIL).

- Dr Thomas Holland, Scientific Director
- Dr Robert Mann, Director, Forensic Science Academy
- Mr Cortland Sciotto, Project Support Specialist for the Forensic Science Academy
- Dr Heather Backo, Forensic Anthropologist
- Dr Paul Emanovsky, Forensic Anthropologist
- Dr Laurel Freas, Forensic Anthropologist
- Dr Jo Hefner, Forensic Anthropologist
- Dr Miranda Jans, Forensic Anthropologist
- Dr Ivett Kovari, Forensic Anthropologist
- Dr Carrie LeGarde, Forensic Anthropologist
- Dr Mary Megyesi, Forensic Anthropologist
- Dr Marin Pilloud, Forensic Anthropologist

### **Erie, Pennsylvania, USA: 15<sup>th</sup> - 21<sup>st</sup> June 2014**

Applied Forensic Sciences Department, Mercyhurst University.

- Dr Steve Symes, Forensic Anthropologist

### **Tennessee, USA: 22<sup>nd</sup> - 29<sup>th</sup> June 2014**

Department of Anthropology, University of Tennessee.

- Dr Amy Mundorff, Forensic Anthropologist
- Dr Dawnie, Steadman, Forensic Anthropologist

### **Bogota, Columbia: 29<sup>th</sup> June - 10<sup>th</sup> July 2014**

Department of Forensic Pathology, National Institute of Legal Medicine and Forensic Sciences, Bogota, Colombia.

- Dr Andres Rodriguez Zorro, Forensic Pathologist
- Dr Liliana Moreno, Forensic Pathologist
- Dr Jairo Hernando Vivas Diaz, Chief Forensic Pathologist
- Dr German Beltram, Forensic Pathologist
- Dr Jorge Andres Franco, Forensic Pathologist
- Angelica Maria Guzman, Forensic Anthropologist
- Dr Claudia Elena Vega Uruena, Forensic Odontologist
- Dr Cesar Sanabria Medina, Forensic Anthropologist
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## **Introduction**

The traditional role of the forensic anthropologist involves analyses of the skeleton to develop a biological profile, that is, information about a person's ancestry, sex, age and stature (Byers 2011). Whilst useful for identification in cases where scientific identification is no longer possible (e.g., highly traumatized, decomposed and skeletonized individuals), this information is not commonly presented in courts. Increasingly, the medico-legal system requires evidence from forensic anthropologists that contributes to establishing the cause and manner of death.

In addition, the analysis of skeletal trauma often plays a pivotal role in the investigation of cases of political, ethnic and/or religious violence. Typically, such cases are investigated many years after the atrocity was committed (and therefore the human remains are skeletonised) with the perpetrators often denying violent acts occurred (e.g., Blau and Fondebrider 2010; Ferllini 2007; Fondebrider 2004; Fondebrider 2012). The role of the forensic anthropologist with excellent analytical skills in the area of skeletal trauma is paramount.

The discipline of forensic anthropology in Australia compared to that in the United States of America (USA) and Latin America is relatively new and subsequently, has comparatively few practitioners<sup>1</sup>. While the formation in 2006 of a Scientific Advisory Group (SAG) which includes forensic anthropologists (as well as mortuary managers, forensic odontologists and forensic entomologists) has contributed to augmenting the professionalism of the practice of forensic anthropology in Australia (Donlon 2009), most Australian forensic anthropology practitioners continue to work in isolation and rarely have the opportunity to develop and improve their technical skills with peer review.

The aim of applying for a Churchill Fellowship was to develop my existing professional skills in skeletal trauma analysis and in turn contribute to improving the quality of Australian forensic anthropology case work. In order to achieve this aim I visited three centres of excellence with a high caseload of skeletal trauma cases to work with forensic anthropology and pathology practitioners who are the world's leading experts in skeletal trauma analysis. In addition, I undertook a training course in the analysis of bone trauma and pseudo-trauma in suspected violent deaths.

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<sup>1</sup> The USA has some 100 board certified forensic anthropology practitioners. In contrast, Australia only has about 10 practitioners and at present there is no certification process.

## **Joint Prisoners of War, Missing in Action Accounting Command (JPAC), Central Identification Laboratory (CIL)**

The Department of Defense, Joint Prisoner of War (POW)/Missing in Action (MIA) Accounting Command (JPAC) Central Identification Laboratory (CIL) is the world's largest forensic anthropology laboratory. Located on the Joint Base Pearl Harbor-Hickam, on the island of Oahu, Hawaii, the aim of the JPAC is to "to achieve the fullest possible accounting of United States service personnel missing from past wars and conflicts" (Holland *et al.* 2008). The first identification laboratories (one in France and one in Hawaii) were created at the end of the World War II by the US Army as a means of dealing with the tens of thousands of US war dead on foreign soils. These laboratories employed professors in anatomy and anthropology, some of whom in their work on the unidentified human remains developed many of the standards that are still employed by forensic anthropologists today.

The laboratories in Hawaii and France were decommissioned in 1949 but another facility was established by the US Army in Japan as a result of the loss of US service men in the Korean War (1950-1953). Following the Vietnam War (1962-1975), the identification laboratory in Hawaii was re-opened. This lab saw increased funding in the 1990s and in 2003 the US Army relinquished control over the lab as it was incorporated into JPAC. Today, the CIL is the world's largest forensic skeletal identification laboratory.

The CIL employs over 400 staff including 40 forensic anthropologists, 13 forensic archaeologists, and three forensic odontologists who are responsible for the search, recovery analysis and intended identification of American citizens (predominantly young men) killed while serving in the US military. The CIL has a restricted primary analytical area<sup>2</sup> with bench space to accommodate up to 20 individual skeletal cases simultaneously. There is a separate lab where all the associated material and personal items such as clothing, dog tags etc are analysed.

During the week I spent at the CIL I met with Dr Tom Holland (Director of the CIL) who authorized full access to the evidence room after I provided a DNA sample. The majority of individuals that are recovered by the CIL staff were killed in the context of war.

Consequently, in addition to gunshot injuries, a high proportion of skeletal trauma observed by forensic anthropologists at the CIL involves blunt force as a result of aviation accidents/incidents.

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<sup>2</sup> Access to the laboratory is via a swipe card system. Personnel are only allowed in once they have provided a DNA sample.

I had the opportunity to work on a case which involved the death of 85 individuals as a result of a cargo plane crash in Vietnam in 1965. A C-123 Provider was transporting 81 South Vietnamese Army of the Republic of Vietnam (ARVN) soldiers and four American crew when it crashed. The remains were not recovered until 1974. There were 12 boxes of what were initially commingled skeletal remains which had subsequently been separated into skeletal elements. This case provided the opportunity to observe patterns of skeletal trauma across multiple individuals. I examined trauma on the upper (humeri, radii and ulnae) and lower extremities (femora, tibiae, fibulae and calcanei). While I did not complete a systematic recording of each of the numerous skeletal elements, I was able to observe and record (with permission from Dr Holland) a number of different types of fractures and interesting fracture patterns. Nearly all of the long bones exhibited one or more fractures. Interestingly there appeared to be no evidence of trauma on the calcanei. This is more than likely because the individuals were seated sideways in the plane (as opposed to facing forwards like in a jet plane or motor vehicle) and there was high energy, rapid deceleration, producing axial force through the pelvis (i.e., seated), femur and seatbelts (which secured across the lap).

While the textbook approach to the recording of skeletal trauma involves first describing the skeletal changes followed by interpretation (Blau and Fondebrider 2011), little is written on how interpretations are undertaken, what forms the basis of conclusions and what provides the limits to what can be concluded. During the time I spent examining the remains from this case, I had the opportunity to discuss the approach to the analysis and interpretation of skeletal trauma with 10 different highly experienced analysts. Not surprisingly some practitioners were more confident in providing a detailed interpretation while others rested more with detailed description.

In a review of a forensic case report it was interesting to note that the practitioner made a very specific interpretation: that two of the blunt force injuries had been caused by a hammer and in the report included a photograph of the trauma with an image of a hammer (which was not the weapon located at the scene). Some practitioners may suggest that while being able to conclude the individual had evidence of blunt force trauma to the head, it would be going too far to state the implement was 'a hammer', let alone include an image in the report. Deciding how to word interpretations of skeletal trauma and which images to include in forensic anthropology reports is important because of the significant consequences such decisions potentially have when presented to a jury.

In addition to conversations with practitioners, I also had access to the CIL library which houses all of the identification reports. I was able to review a number of different practitioner reports to observe layout and reporting style. All forensic anthropologists who start at CIL, regardless of their experience, have to pass a competency test and then have to strictly follow a forensic anthropology standard operating procedure (SOP). I was given a copy of the SOP which is useful to assess methodology employed at the Victorian Institute of Forensic Medicine (VIFM). If a specific method is not in the SOP then it cannot be employed. Forensic anthropology practitioners at CIL have about two months to complete a case which means they have time to consider the detail of their interpretations. All cases are peer reviewed.

Despite not having competency testing at the VIFM, I was pleased to observe that the standard of my forensic anthropology reports is not dissimilar to those produced at CIL. The forensic anthropologists tend to spend considerably more time measuring skeletal remains (particularly the skulls for ancestry assessment). While the focus of the analyses is identification, all defects are described. Peri-mortem trauma is listed under “trauma” while ante-mortem trauma is described under “observations”. One analyst, however, told me that they did not go into too much detail in the description of trauma because the families of the deceased have access to the reports.

In addition to focusing on skeletal trauma, I also had the opportunity to spend time with DNA and histology specialists. Due to the often fragmentary and poorly preserved nature of the skeletal remains received at the CIL, DNA plays a significant role in the identification process. In some cases all skeletal elements, regardless of their size are sampled for DNA. In cases of commingling, the results of DNA have been useful for pair matching. Histology is used for differentiating human from non-human skeletal remains.

I also had the opportunity to see presentations on the fieldwork undertaken by the staff at the CIL for the recovery of remains and associated evidence. Since 1976, JPAC has undertaken recoveries in more than 40 countries including Iraq, South America, Southeast Asia, Siberia, Greenland, Solomon Islands, and Nepal. JPAC has significant infrastructure for recovery missions including 18 Recovery Teams with between 12 and 14 members per team. A typical recovery team includes archaeologists, military personnel, medics, linguists and explosive experts. The team leader is always a forensic anthropologist.

Also located on the military base is the Forensic Science Academy which is an excellently resourced teaching lab run by Dr Robert Mann<sup>3</sup>. I spent an afternoon with Dr Mann who reviewed a number of high profile trauma cases with me that he had worked on over his 24 year career. We discussed in detail the approaches he takes to the analyses of skeletal trauma and some of the pertinent things to avoid.

One of the big differences between practice in Australia and the USA is that in some States of the USA the forensic pathologists and anthropologist can retain parts of the skeletal case (e.g. trauma) without permission from the family for evidentiary purposes and these can then be used for teaching.

I visited the National Memorial Cemetery of the Pacific (informally known as the “Punchbowl Cemetery”) where approximately 53,000 veterans and dependants are buried. I also visited the Medical School at the University of Hawaii and looked through their dissecting and plastination rooms.

### **Summary of key points and reflections**

- The level of detail of the analysis and interpretation of skeletal trauma depends on the practitioner’s level of experience and exposure to cases.
- Given the potential implications of the findings of a forensic anthropologist, the wording of skeletal trauma interpretations in case reports must be well considered and appropriately justified.

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<sup>3</sup> Dr Mann is the co-author (with David R. Hunt) of the well referenced textbook: *Photographic Regional Atlas of Bone Disease: A Guide to Pathologic and Normal Variation in the Human Skeleton* (2005) (2<sup>nd</sup> ed.). Springfield: Charles C. Thomas.

## **Applied Forensic Sciences Department, University of Mercyhurst**

From the 16th- 20th June, I undertook a course offered by the Applied Forensic Sciences Department at the University of Mercyhurst (Erie, Pennsylvania) in the *Analysis of Bone Trauma and Pseudo-Trauma in Suspected Violent Deaths*. The course was run by Dr Steve Symes, one of the most reputable experts in the analysis of skeletal trauma. The class was relatively big with a total of 29 students and included people from the USA, Canada, Australia, Spain and Cyprus.

The course covered:

- Documentation of trauma evidence at autopsy
- Differentiation of antemortem and peri-mortem trauma
- Biomechanical interpretations of skeletal trauma
- Analysis of taphonomic (postmortem) factors including burning
- Characteristics of blunt force trauma
- Characteristics of projectile trauma
- Characteristics of sharp force trauma: including knife and saw marks
- Significance of contextual information

The course consisted predominantly of lectures based on case studies to illustrate examples of a range of skeletal trauma. The final day was a practical session which provided participants with the opportunity to observe real examples of different types of trauma and attempt to interpret the mechanism. In addition to a review of traditional approaches to skeletal trauma, Dr Symes provided alternate views on some aspects of biomechanics and interpretation.

During the course, participants had the opportunity to visit the Erie Forensic Mortuary Facility (shared with the local police) to watch Dr Symes process and prepare a case of multiple injuries: significant bilateral fracturing of the pelvis, femora, and humeri presumed to have been caused by a boat propeller. Participants also had a guest lecture from Chris Rainwater on his work (specifically skeletal trauma cases) at the New York Medical Examiners' Office. Following the completion of the course I spent a day with Dr Symes looking over his collection of trauma cases and discussing his approach to observation and interpretation.

## **Summary of key points and reflections**

- The training ground for a good understanding of skeletal trauma is in the mortuary;
- Detailed analysis of trauma requires proper light;
- Ideally, a light microscope should be used to examine details of skeletal trauma;
- The examination of skeletal remains and the formation of opinion about skeletal trauma takes time and should not be rushed;
- When reconstructing fragmentary remains, masking tape should ideally be used prior to glue to allow for errors in placing fragments and warping to be addressed;
- When reconstructing fragmentary remains it can be helpful to outline fragments on butcher's paper to know where they came from;
- Wooden skewers painted red can be helpful to highlight direction of trauma;
- Radiating fractures occur first followed by concentric fractures;
- Teaching aids: strike hard boiled eggs with different objects (fist, corner of table, flat surface of table, point of the pen etc.) and photograph fracture lines; the egg can be struck more than once to look at how fracture lines progress – i.e. to determine the sequence of which fracture came first;
- Edges of fragments should be carefully examined to determine if evidence of things such as hair or soil are in the bone matrix;
- Smaller fragments indicate the point of impact. The larger fragments indicate the extent of the force being dissipated;
- The use of a back light can be helpful to determine if there are any fractures that have been missed;
- Always look inside the skull;

### **Reporting:**

- Language in reports: better to use “no apparent” vs. “no evidence”. This means it is possible for the practitioner or someone else reviewing the report to alter opinion if subsequent analyses are undertaken;
- When reporting on interpretation of number of events include the word “minimum” e.g., “sustained a minimum of two of blunt force injuries”. Also state “no apparent evidence of healing is present”. Use of the word “apparent” is important unless a histological analysis has been undertaken;
- Option to use a photo the actual skull (vs. a schematic representation) and trace the fracture lines in different colours – only do this when you are sure;

- 6 views of the skull schematic diagram: should state not to scale; can use black shade to indicate not present and red lines for peri-mortem damage;
- When considering number of blows (events), consider how the point or edge of an implement can strike but then the long axis can come down on the bone in the same event – i.e. may appear like two events but actually the two defects are from one event – this is what the Spanish refer to as *corto-contundente* (sharp-blunt);
- Fall from a height can result in upper and lower jaw being pushed together and buccal aspect of crown “popping” off;
- Bone is viscoelastic, a property you may not see in other materials (e.g., glass, eggshell etc.);
- Always consider whether it is realistic to make a comment about the specific implement which caused the skeletal trauma;
- Impact sites are more accurately detected on skin than bone because not every skin wound is reflected on the bone. Therefore, the forensic anthropologist can only ever comment on the minimum number of blows;
- In cases of blunt force trauma forensic anthropologists are limited:
  - Exact impact site: maybe can comment
  - Angle of impacts: perhaps can comment
  - Order of impacts: possibly can comment
  - Number of impacts: minimum only! (NB: bone minimum number of incidents is less than or equal to skin)
  - Shape of impacting surface: dismal at best. The shape of the wound may not reflect the shape of the implement
- Always consider the interpretation of skeletal trauma in the context of the individual’s age, presence of underlying disease, presence of existing anatomical structures such as sutures.
- 5 factors of bone injury (Symes modified Gozna 1982)

*Extrinsic* (outside of traumatic event)

- 1) Type (5 modes) of load applied – tension, etc.
- 2) Magnitude of load or impact
- 3) Rate of application of load or impact
- 4) Duration
- 5) Other: variables indicating patterns

### *Intrinsic*

1. Material properties of bone
  2. Structural properties of bone
    - a. Which bone was hit?
    - b. Where on the bone was hit
    - c. Kind of bone: cortical vs. cancellous bone
- The internal and external surfaces of the bony defect should always be examined as fractures look different internally and externally;
  - Expression of fractures will differ from one side to the other side of the body;
  - Skeletal trauma is typically a reflection of differences in force (low magnitude in a motor vehicle accident vs. high energy in a gunshot wound);
  - When a projectile does not exit (as in cases of gunshot trauma), biomechanically this resembles blunt force trauma; e.g. may enter through the mouth, lose energy and never exit;
  - In cases where there is poor preservation it may only be possible to describe the fractures and not comment on whether it was entry, exit etc;
  - Vital to see skeletal trauma in the perspective of the entire body;
  - Trauma is directly associated with:
    - force (or load ): any mechanical disturbance that causes an object to deform, change its state of motion, or both;
    - magnitude : the area (and possibly weight, and possibly speed) of the force being applied; the property of relative size or extent ;
    - direction : the line along which the magnitude of the load travels;
    - stress: force per unit of area;
    - strain: the relative deformation (change in length, volume, or angle).
  - Consider how much speed is behind the implement (hammer vs. piece of wood, etc.) being used, and contact area (compare point of knife vs. point of pen), and duration of impact. Bones will react differently depending on the speed of the implement making contact with it;
  - Question the term “ballistic trauma” because the speed of a spear, arrow etc. is completely different to a bullet; you need to account for description of energy, magnitude and velocity;
  - Always examine and photograph fracture margins before reconstructing;

- Rib trauma is complicated: ribs are both flat and oval as well as being part of a circle (rib cage) which influences how they break. Pay special attention to edges (tops) of ribs – because they do show changes;
- Terminology to use in court for degrees of force:
  - Minimal
  - Tremendous
  - Extraordinary
- Under blunt force - bone acts like bone; under ballistic force – bone acts like a brittle material like glass;
- Bullet goes through bone, shocks the bone, may start radiating fractures or may get inside “container” and act like a watermelon (explodes);
- Radiating fractures occur in ballistic trauma for a different reason to blunt force trauma because the entire thing is expanding as the energy is so high and produces concentric heaving fractures (look like pieces of pie);
- Blunt trauma is not predictable whereas ballistic trauma is much more ordered and the fractures look orderly;
- Practitioners get gunshot interpretation wrong because they do not understand guns.

## **Department of Anthropology, University of Tennessee**

The Department of Anthropology at the University of Tennessee is best known for one of its senior staff members Dr William (Bill) Bass. Dr Bass is a forensic anthropologist for the state of Tennessee and the author of a widely cited textbook *Human Osteology* (now its fifth edition) (2012). Bass is also famous for his research on human decomposition and the establishment of the Anthropology Research Facility (formerly known as the “Body Farm”). A core component of the Research Facility is the donation program which facilitates systematic study on human decomposition in a range of different environments. Once skeletonisation is complete, the remains of each individual are collected and are curated in the Bass Donated Skeletal Collection. This collection consists of over 1300 individuals of known age, sex, ancestry and cause of death, the largest collection of contemporary human skeletons in the United States.

A series of cases with known peri-mortem trauma were selected by one of the curators of the Bass Collection for me to examine. I analysed 30 cases without knowing the contextual information. Following the completion of my analysis, I was provided with the cause of death and was able to review my analysis to assess the detail of the interpretations I had made.

Cases I examined included individuals who had died as a result of: gunshot wounds (single, multiple, low and high energy, homicide; suicide), motor vehicle accidents (pedestrian, driver), suicides (train, jumping) and stabbing.

During the week I discussed trauma analysis (including specific recording forms) with Dr Amy Mundorff and Dr Dawnie Steadman. Both practitioners agreed that it is very important to be conservative in the interpretation of skeletal trauma and not to speculate, particularly when presenting evidence in court.

I had the opportunity to visit the Bass Facility and look at the research being conducted on location mass graves being undertaken by Dr Mundorff. I also observed the collection of data for a research project looking at decomposition rates for humans, pugs and rabbits. The aim of the project is to acquire data that challenges decomposition studies that use animal (pig and rabbit) for modelling human decomposition.

### **Summary of key points and reflections**

- Reference collections of human skeletal remains with known cause and manner of death are excellent resources for teaching the analysis and interpretation of skeletal trauma.
- Detailed written and photographic descriptions are essential for the analysis and interpretation of skeletal trauma. Such descriptions are vital to facilitate effective peer review.
- There remains a need to develop trauma-specific recording forms for each anatomical region.
- It is vital to know the limits of what can be gleaned from the analysis of skeletal trauma. It is always better to be conservative in the interpretation of skeletal trauma and avoid speculation.

## **The National Institute of Forensic Medicine and Science (Instituto Nacional de Medicina Legal y Ciencias Forenses), Bogota, Colombia**

As a result of nearly 50 years of complex armed conflict<sup>4</sup>, Colombia is among the most violent countries in the world. In 2012, the annual homicide rate per 100,000 was 30.8 in Colombia compared to 4.8 in the USA and 1.1 in Australia (UNODC 2013). In addition, there are in the order to 30,000 registered disappearances (although the number is likely to be higher) (Anon. 2010).

Colombia has a long history of forensic medicine: in August 2014 the National Institute of Forensic Medicine and Science celebrates 100 years of operation. The Institute is housed in a seven story building and similar to the Victorian Institute of Forensic Medicine (VIFM), employs forensic pathologists, anthropologist, odontologists and DNA specialists. Fingerprint and ballistic experts also operate in the Institute in Bogota whereas these experts in Australia are employed by police forensic science laboratories. The Institute in Bogota has a relatively large mortuary with 11 tables and x-ray facilities and undertakes approximately 5000 autopsies per year (Andres Rodriguez Zorro pers. Comm.). This number is similar to that undertaken in Melbourne which is surprising given the significant differences in population: 6.8 million in Bogota compared to 4.25 million in Melbourne.

Forensic anthropology in Colombia is relatively new. In 2005, the President of Colombia implemented the Justice and Peace Law which seeks to find a balance between obtaining peace as well as seeking justice (Theidon 2007). As a result of the implementation of this law there was an increasing demand for forensic anthropologists. There were numerous training programs supported by the USA and the International Committee of the Red Cross (ICRC) and today there are about 50 practising forensic anthropologists throughout Colombia which include nine forensic anthropologists in the National Pathology Group and three in the Justice and Peace Group at the Institute in Bogotá. While the majority of forensic anthropologists do not have higher degrees (Masters or PhD), they are extremely proficient because of the exposure to and experience with high numbers of complex cases.

I was provided with a complete introduction to the management and running of the Institute and met with a number of forensic pathologists, odontologists, anthropologists, fingerprint, ballistic and DNA specialists. My exposure to a range of different activities undertaken at the

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<sup>4</sup> The conflict changed from what was initially a Marxist revolution against a political system to a bloody struggle over resources. All groups involved (government, military, guerrilla, and paramilitary) have committed various human rights violations (Richani 2013).

Institute was generously facilitated by staff in the National Group of Forensic Pathology and Justice and Peace.

Staff spent a significant amount of time with me discussing dismemberment, gunshot wounds allegedly in combat, child abuse, disputes over a fall, and actual fall cases, and sharing their expertise both in the mortuary and in the forensic anthropology laboratories. The Institute strongly promotes a collaborative team approach to the analysis including interpretation of trauma on recently deceased individuals. All skeletonised cases include a forensic pathologist, anthropologist and odontologist as part of the analysis, interpretation and report writing and the forensic anthropologist is commonly called into the mortuary to assess cases of recent trauma.

In Bogotá forensic anthropologists report on trauma using headings based on mechanism - e.g., ballistic, gunshot wound, sharp force trauma and undetermined. This is different to the approach taken, for example, in the USA where a description of the defect is provided prior to an interpretation of the mechanism. The approach taken in Bogotá reflects the fact that often the circumstances of death are already known.

Since 2004, the Institute has been developing a human skeletal remains reference collection. To date, there are approximately 600 individuals in the collection all with accompanying information about the age, sex and cause of death as well as ante-mortem photographs. Criteria for inclusion in the collection include identification with no claim by a family member within eight years of identification. The human skeletal remains collection in the Institute in Bogotá not only facilitates research to validate population specific methods for casework in Colombia but also adds to the collections of contemporary skeletal reference material (Ubelaker 2014) available for research generally. I had the opportunity to look through some of this collection and discuss an incredible range of different types of pathology and trauma.

On my last day at the medico-legal institute I was invited to deliver a presentation providing an introduction to the work undertaken at the Victorian Institute of Forensic Medicine and the nature of the Churchill Fellowship. Following the lecture I had a meeting with the Dr Carlos Eduardo Valdés, Director of the Instituto Nacional de Medicina Legal y Ciencias Forenses who was interested in organising a formal agreement between the Institute in Bogota and the VIFM to facilitate case reviews and ongoing professional collaboration.

### **Summary of key points and reflections**

- There are significant differences between theory and practice when it comes to the analysis and interpretation of skeletal trauma.
- While it is possible for the practitioner to learn the principles of how bone should behave under specific circumstances, high level expertise in the analysis and interpretation of skeletal trauma is best obtained through practical hands of experience with a range of different cases.
- A collaborative approach which includes the forensic pathologist and forensic anthropologist working together on trauma cases provides more detailed and robust results.

## Conclusions and Recommendations

The opportunity provided by the Churchill Fellowship to spend five weeks at four different centres of excellence working with experts in the field has been professionally rewarding. It is hoped that the exposure to different approaches to the analysis and interpretation of skeletal trauma will not only augment my practise at the VIFM but also in turn enhance the quality of forensic anthropology evidence provided in courts and augment future national post graduate training programs in this field.

Disseminating the information obtained during the fellowship will include:

- A presentation to colleagues at the Victorian Institute of Forensic Medicine (VIFM) entitled *An anthropologist abroad: Details of a Churchill Fellowship*;
- A report to the VIFM council on the findings/outcomes of the Churchill Fellowship;
- A presentation to forensic anthropology colleagues at the Medical Sciences Scientific Working Group (SWG);
- Development of the *Atlas of Skeletal Trauma in Medico-Legal Investigations*. Since completing the Churchill Fellowship I have been awarded the *Oscar Rivers Schmalzbach Foundation Forensic Sciences Research Fellowship* which will be used to assist in the writing of the textbook.
- Information obtained during the Churchill Fellowship will be incorporated into subject material presented in lectures to undergraduate and post-graduate students of forensic medicine, dentistry and law.

### Recommendations

#### *Training*

- Develop a training program for students of forensic anthropology in Australia that focuses on a practical approach to the analysis and interpretation of skeletal trauma.
- Develop a reference library of casts of skeletal trauma taken from real case examples to significantly augment the teaching and practice of forensic anthropology in Australia.

#### *Practice*

- Advocate for forensic anthropologists to work closely with forensic pathologists in a mortuary environment so that a contextual approach to the interpretation of skeletal trauma is encouraged.
- Develop trauma recording forms for anatomical specific parts of the body (ribs, head etc).

#### *Reporting*

- Wording used in reporting skeletal trauma must be well considered and appropriately justified despite the fact the layout of reports will vary depending on the individual practitioner.

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