

Chapter 14 Lab Using DNA to Identify Human Remains

Problem

How can pedigrees help scientists identify human remains?

Introduction

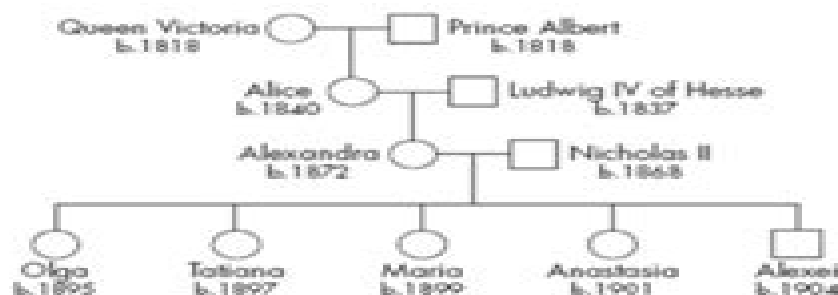
DNA has helped solve countless crimes and some intriguing mysteries—including the fate of the Romanovs. For 300 years the Romanov family ruled Russia. The last Romanov ruler was Tsar Nicholas II. His wife, Tsarina Alexandra, was descended from Queen Victoria of England, as shown in Figure 1.

In 1917, revolution swept through Russia. The royal family was captured and held prisoner until they were killed on July 16, 1918. The official report said that all the bodies were burned and then buried in a single grave. However, some witnesses said that one or two of the children were not buried with the others, and for many years there were rumors that Anastasia had survived.

The new government did not allow any research into the fate of the Romanovs. The house in which they were killed was destroyed, and the burial site was kept secret. In 1991, after the breakup of the Soviet Union, scientists were at last allowed to examine the burial site and remove the bones.

In this lab, you will investigate how the scientists classified the skeletons that they found. You will also figure out how pedigrees helped the scientists find living relatives whose DNA could be compared with DNA extracted from the bones.

Figure 1 Simplified pedigree for Tsarina Alexandra



Using Dna To Identify Human Remains Worksheet Answers

SL. Rennick,TW. Fenton,DR. Foran

Using Dna To Identify Human Remains Worksheet Answers:

Forensic Genetic Approaches for Identification of Human Skeletal Remains Angie Ambers, 2022-11-15 Forensic Genetic Approaches for Identification of Human Skeletal Remains Challenges Best Practices and Emerging Technologies provides best practices on processing bone samples for DNA testing The book outlines forensic genetics tools that are available for the identification of skeletal remains in contemporary casework and historical archaeological investigations Although the book focuses primarily on the use of DNA for direct identification or kinship analyses it also highlights complementary disciplines often used in concert with genetic data to make positive identifications such as forensic anthropology forensic odontology and forensic art sculpting Unidentified human remains are often associated with tragic events such as fires terrorist attacks natural disasters war conflicts genocide airline crashes homicide and human rights violations under oppressive totalitarian regimes In these situations extensive damage to soft tissues often precludes the use of such biological samples in the identification process In contrast bone material is the most resilient viable sample type for DNA testing DNA recovered from bone often is degraded and in low quantities due to the effects of human decomposition environmental exposure and the passage of time The complexities of bone microstructure and its rigid nature make skeletal remains one of the most challenging sample types for DNA testing Provides best practices on processing bone samples for DNA testing Presents detailed coverage of proper facilities design for skeletal remains processing selection of optimal skeletal elements for DNA recovery specialized equipment needed preparation and cleaning of bone samples for DNA extraction and more Highlights complementary disciplines often used in concert with genetic data to make positive identifications such as forensic anthropology forensic odontology and forensic art sculpting Forensic Anthropology: Identifying Human Remains Amy Sterling Casil, Forensic anthropologists sometimes call themselves speakers for the dead They study human remains to help solve crimes identify missing persons and discover the identity of unidentified remains Forensic anthropologists can work with law enforcement and other government agencies They can also travel around the world to recover and analyze remains They can work as part of archaeological teams to discover what happened at the site of an ancient battle help to confirm the identity of a famous person from historical times or help to identify people who have lost their lives in a plane crash or other disaster Forensic anthropology began in the early 20th century and continues to evolve today using DNA analysis and data to reveal the appearance the identity and potentially the cause of death of human remains Recovery, Analysis, and Identification of Commingled Human Remains Bradley J. Adams, John E. Byrd, 2008-02-23 Mass fatality events can result in the intermixing or commingling of human remains Commingling of human remains presents an added challenge to all phases of the forensic process As the number of individuals increases so does the complexity of the forensic investigation and the skills needed for case resolution In Recovery Analysis and Identification of Commingled Human Remains top professionals illustrate successful techniques for sorting and determining the number of individuals the role of

DNA ethical considerations and data management Instrumental to the forensic community Recovery Analysis and Identification of Commingled Human Remains provides case examples and an in depth review of experiences methods and research related to commingling *Biological Affinity in Forensic Identification of Human Skeletal Remains* Gregory E. Berg, Sabrina C Ta'ala, 2014-12-13 Ancestry determination in the identification of unknown remains can be a challenge for forensic scientists and anthropologists especially when the remains available for testing are limited There are various techniques for the assessment of ancestry ranging from traditional to new microbiological and computer assisted methods *Biological Affinity in Forensic Identification of Human Skeletal Remains Beyond Black and White* presents a range of tools that can be used to identify the probable socio cultural race category of unknown human remains Gathering insight from those who have made recent improvements and scientific advances in the field the book begins with the historical foundations of the concept of biological affinity and the need for increased research into methods for determining ancestry of skeletal remains The contributors cover a range of topics including Ancestry estimation from the skull using morphoscopic and morphometric traits and variables Innovative methods from metric analyses of the postcrania and new approaches to dental non metric variation The biological diversity of Hispanic populations and use of discriminant function analysis and 3D ID software to determine ancestry Methods of age progression and facial reconstructions to create two dimensional 2D and three dimensional 3D facial composites for missing people The preparation of skeletal remains for DNA extraction and sampling and mtDNA methods that are available for identification of haplogroups e g ancestral populations No single method or technique is adequate in the assessment of ancestry For accurate determinations the use of traditional and new techniques combined yields better results This book demonstrates the large repertoire of tools available to those tasked with these challenging determinations *The Use of Forensic Anthropology* Robert B. Pickering, David Bachman, 2009-01-22 A forensic investigation requires a team of specialists from many different scientific fields of study along with legal and law enforcement specialists In recent years the range of cases on which forensic anthropologists have been consulted has expanded dramatically The Use of Forensic Anthropology provides these professionals with guidelines for DNA Assay Development and Validation for Pigment-related Features to Assist in the Identification of Missing Persons and Human Remains Elisa Wurmbach, 2013 Just recently the seven plex system was improved by adding one SNP rs12896399 which is located in the 5' region of SLC24A4 and by changing the instructions Hart Kimura et al 2013 More precise predictions were achievable by including blue to the eye colors brown green not blue and not brown and light to the skin colors not dark and not light The number of positive descriptions was also significantly increased while keeping the error rates low as approximately 5% Hart Kimura et al 2013 These eight SNPs were integrated into a forensic kit that is easy fast and inexpensive This test has potential for upgrading A multiplex SNP assay fitting these criteria would involve a multiplex PCR followed by a multiplex primer extension reaction leading to fluorescently labeled oligonucleotides of distinct length

Multicolor capillary electrophoresis separates and detects these oligonucleotides. It is possible to apply this assay on degraded DNA typically found in decomposed human remains due to the design of small PCR products. This is important for forensic applications. Furthermore, development and validation were cost efficient since all required equipment including the software was already available in house. The utilization of this multiplex SNP assay to predict pigment related features will greatly enhance current efforts of collecting data from human remains to facilitate identification. It may be incorporated into the Office of Chief Medical Examiner DNA Missing Persons Group and the Forensic Anthropology Unit's multidisciplinary effort to reduce the number of unidentified human remains in New York City and New York State. A project funded by the National Institute of Justice Using DNA Technology to Identify the Missing

Human Skeletal Remains Teresa A. White, Hillary R. Parsons, Samuel S. White, 2025-09-12 Human Skeletal Remains is a step by step field guide to teach proper recovery techniques when a forensic anthropologist is unavailable for immediate scene responses. In the absence of a forensic anthropologist, the investigator assumes the responsibility of ensuring the complete and accurate recovery of skeletal materials from scenes. This could be problematic if the investigator has not had specialized training in human remains recoveries. To help investigators carry out this task, the authors developed this guide using 328 full color demonstrative photos with easy to follow instructions on how to identify and recover human skeletal remains using scientifically defensible methods. It is an excellent resource for law enforcement, medicolegal death investigators, CSIs, anthropologists, medical examiners, coroners, evidence recovery technicians, students, and other forensic professionals. Features: Side by side photographic comparisons of adult and juvenile human remains with nonhuman bones. Start to finish demonstration of proper recovery techniques involving scenes with surface scattered and buried human remains. Preservation considerations with respect to cultural sensitivity and ethical practices. Human Skeletal Remains is an illustrative tool designed to accompany you on scene. Use it to identify the bones you locate, then follow the instructions to recover them. Get it dirty

Effects of Processing Techniques on the Forensic DNA Analysis of Human Skeletal Remains J.L. Arismendi, L.E. Baker, K.J. Matteson, 2004 Human remains processed by forensic anthropologists may potentially be used for genetic analysis. Therefore, the condition of the deoxyribonucleic acid (DNA) in processed remains may become an issue for future analysis. Processing techniques employed by anthropologists are highly variable, and scanning electron microscopy reveals significant alterations to the bone surface depending upon the technique used. Such damage to the bone indicates differences may exist in quality and quantity of DNA extracted. This study assessed how five processing procedures used by major forensic anthropology laboratories around the country affect the amounts of DNA extracted from human rib bones and the subsequent DNA analysis. The DNA was analyzed using the short tandem repeat (STR) locus CSF1PO and amelogenin. The findings indicate processing procedures used by forensic anthropologists do not adversely affect DNA analysis, but prolonged exposure to heat during processing may decrease the yield of information from the DNA

Commingle Human Remains Bradley

Adams, John Byrd, 2014-06-04 Commingled human remains are encountered in situations ranging from prehistoric ossuaries to recent mass fatality incidents Commingled Human Remains Methods in Recovery Analysis and Identification brings together tools from diverse sources within the forensic science community to offer a set of comprehensive approaches to resolving issues associated with commingled remains This edition focuses on forensic situations although some examples from prehistoric contexts are also addressed Commingling of bones and other body parts is a major obstacle to individual identification that must be addressed before other forensic determinations or research can proceed Regardless of the cause for the commingling transportation disaster terrorist attack natural disaster genocide etc it is critical that the proper experts are involved and that the proper techniques are employed to achieve the greatest success in making identifications Resolution of commingling nearly always requires consideration of multiple lines of evidence that cross the disciplinary lines of modern forensic science The use of archaeology DNA and forensic anthropology are several areas that are critical in this process and these are core topics presented in this book Even a relatively simple mass fatality event can become very complicated once body fragmentation and commingling occur Expectations associated with all phases of the process from recovery of remains to their final identification and release to next of kin must be managed appropriately A powerful resource for those working in the forensic sciences who need to plan for and or address the complex challenges associated with commingled and fragmentary human remains Written by an international group of the foremost forensic scientists presenting their research and candid experiences of dealing with commingled human remains offering recommendations and providing lessons learned which can be invaluable to others who find themselves facing similar challenges Contains chapters on remains recovery laboratory analysis case studies and broader topics such as mass fatality management and ethical considerations

New Perspectives in Forensic Human Skeletal Identification Krista E. Latham, Eric J.

Bartelink, Michael Finnegan, 2017-07-27 New Perspectives in Forensic Human Skeletal Identification provides a comprehensive and up to date perspective on human identification methods in forensic anthropology Divided into four distinct sections the chapters will reflect recent advances in human skeletal identification including statistical and morphometric methods for assessing the biological profile sex age ancestry stature biochemical methods of identification DNA analysis stable isotope analysis bomb curve analysis and use of comparative radiography The final section of this book highlights advances in human identification techniques that are being applied to international populations and disaster victims The contributing authors represent established experts in forensic anthropology and closely related fields New Perspectives in Forensic Human Skeletal Identification will be an essential resource for researchers practitioners and advanced students interested in state of the art methods for human identification A comprehensive and up to date volume on human identification methods in forensic anthropology Focuses on recent advances such as statistical and morphometric methods for assessing the biological profile biochemical methods of identification and use of comparative radiography

Includes an entire section on human identification techniques being applied to international populations and disaster victims

The Effects of Skeletal Preparation Techniques on DNA from Human and Non-Human Bone SL. Rennick,TW. Fenton,DR. Foran,2005 The forensic pathologist increasingly relies on the forensic anthropologist to be the consulting expert in human identification Likewise if identification is not possible from visual inspection of skeletal remains the forensic biologist may be called upon to conduct DNA analysis The possibility of downstream DNA testing needs to be considered when skeletal preparation techniques are employed to deflesh human remains as they have the potential to strongly impact genetic analyses and subsequent identification In this study three cleaning techniques boiling bone in water in bleach and in powdered detergent sodium carbonate were tested for their effect on nuclear and mtDNA recovery from a variety of human and non human bones A statistically significant reduction in DNA yields occurred in non human bones cleaned with bleach and DNA degradation was apparent electrophoretically The human bones also showed much lower yields from bleach cleaning while the detergent carbonate method allowed the largest segments of DNA to be amplified indicating it may have a less degradative effect on bone DNA than either of the other cleaning processes

Burnt Human Remains Sarah Ellingham,Joe Adserias-Garriga,Sara C. Zapico,Douglas H. Ubelaker,2023-05-31 BURNT HUMAN REMAINS An all encompassing reference and guide designed for professionals involved in the forensic analysis of burnt remains Burnt Human Remains Recovery Analysis and Interpretation presents an in depth multidisciplinary approach to the detection recovery analysis and identification of thermally altered remains Bridging the gap between research and practice this invaluable one stop reference provides detailed coverage of analytical techniques in forensic medicine and pathology forensic anthropology forensic odontology and forensic chemistry and forensic biology Contributions from a panel of expert authors review the newest findings in forensics research and discuss their applicability to forensic case work Opening with a historical overview of the discipline the book covers the search and recovery aspects of burnt human remains medico legal investigations determination of the post mortem interval of burnt remains structural changes of burnt bone and teeth DNA extraction from burnt remains and much more Throughout the text the authors emphasize the importance of understanding the changes undergone by bodies when subjected to fire for establishing identity reconstructing the events leading up to incineration and determining the cause and manner of death Provides a systemic framework that integrates established forensic methods and state of the art analytical approaches Describes different forensic analyses from the macroscopical microscopical biochemical and molecular level Features international case studies of challenging individual cases as well as natural or man made mass fatalities requiring the identification of incinerated remains Demonstrates how changes to the macro and microstructure of burnt remains can reveal information about incineration conditions Discusses organizations and programs focused on developing standards and best practice for the recovery and analysis burnt remains Burnt Human Remains Recovery Analysis and Interpretation is an indispensable resource for all practitioners engaged in the interpretation of burned human tissue

including pathologists forensic chemists forensic biologists forensic anthropologists forensic odontologists and archaeologists

DNA Analysis for Missing Person Identification in Mass Fatalities Amanda C Sozer, 2014-01-28 Advances in DNA technology have expanded such that forensic DNA profiling is now considered a routine method for identifying victims of mass fatalities Originating from an initiative funded by a grant from the U S Department of State DNA Analysis for Missing Person Identification in Mass Fatalities presents a collection of training modules that supply comprehensive instruction in these complex techniques The book begins with a concise overview of DNA analysis methods and their use in identifying victims of mass fatalities It then goes on to explore Mass fatality response operations including body recovery mortuary operations family assistance the identification of human remains and psychosocial support for families Best practices in DNA sample collection and the different types of reference samples that can be used to identify a reported missing RM individual Autosomal short tandem repeat STR DNA profile analysis and interpretation and procedures to ensure data accuracy Major steps involved in generating a DNA profile and the complex aspects of data analysis and interpretation The importance of data management using information technology tools and tips for maintaining quality operations Accreditation and standards and the major elements of a DNA quality program Setting up a laboratory operation including planning staffing identifying types of equipment and supplies and the procedures for ensuring that laboratory equipment performs appropriately The book includes a discussion of the key steps in the preparation delivery and evaluation of training sessions for personnel responding to a mass fatality human identification event It also provides a comprehensive vocabulary list with terms related to mass fatality DNA identification This text is a must read for organizations contemplating the use of DNA in human identification initiatives following mass fatalities It is also a tremendous value to emergency manager planners medical legal authorities and forensic DNA laboratories

Mitochondrial DNA Sequence Analysis of Human Skeletal Remains MM.

Holland,DL. Fisher,LG. Mitchell,WC. Rodriquez,JJ. Canik,CR. Merril,VW. Weedn,1993 Deoxyribonucleic acid DNA sequence analysis of the control region of the mitochondrial DNA mtDNA genome was used to identify human skeletal remains returned to the United States government by the Vietnamese government in 1984 The postmortem interval was thought to be 24 years at the time of testing and the remains presumed to be an American service member DNA typing methods using nuclear genomic DNA HLA DQ alpha 1 and the variable number of tandem repeat VNTR locus D1S80 2 were unsuccessful using the polymerase chain reaction PCR 3 Amplification of a portion of the mtDNA control region was performed and the resulting PCR product subjected to DNA sequence analysis The DNA sequence generated from the skeletal remains was identical to the maternal reference sequence as well as the sequence generated from two siblings sisters The sequence was unique when compared to more than 650 DNA sequences found both in the literature and provided by personal communications The individual sequence polymorphisms were present in only 23 of the more than 1300 nucleotide positions analyzed These results support the observation 4 that in cases where conventional DNA typing is unavailable mtDNA

sequencing can be used for human remains identification

Utilizing Forensic Technologies for Unidentified Human

Remains George W. Adams, 2015-11-23 In missing and unidentified investigations an abyss of dissonance seems to exist between law enforcement and the community they serve that all too often creates grating wounds that may never heal Utilizing Forensic Technologies for Unidentified Human Remains Death Investigation Resources Strategies and Disconnects bridges this abyss This is th

Physical and Biochemical Factors Affecting the Recovery and Analysis of DNA from Human Skeletal Remains Laura Gaydosh Combs, 2016 There are approximately 4 400 sets of unidentified human remains recovered each year nearly a quarter of which are not identified within the year following recovery Obtaining genetic information through DNA testing of bone samples has become a critical element to identifying missing persons and recovered human remains DNA is preserved within the structure of bone for vast amounts of time surviving environmental and microbial insults yet bone is one the most challenging sample types encountered by forensic scientists This is due to the resilient structure of bone and the prevalence and variety of materials which co isolate with DNA during extraction and function as inhibitors of the polymerase chain reaction PCR Bone associated PCR inhibitors include native components and environmental materials acquired as a consequence of the porous composition of bone Quality assurance requirements governing DNA testing laboratories do not mandate direct evaluation of the product of the DNA extraction process coupled with poor characterization of PCR inhibitors the forensic community has not adequately demonstrated the efficiency of methods used to extract DNA from bone samples The primary hypothesis is failure of PCR based testing of DNA from skeletal remains is frequently encountered due to inefficient extraction methods and PCR inhibition This dissertation project has 1 demonstrated an approach for identifying and characterizing putative PCR inhibitors emphasizing those originating from the mineral contents of bone and 2 assessed the efficiency of current methods used for extracting DNA from bone samples in terms of quality and quantity of the recovered template Control genomic DNA bone samples from adjudicated forensic cases obtained from the University of North Texas Center for Human Identification and cadaver bone samples obtained from the Willed Body Program at University of North Texas Health Science Center were used for experiments Laboratory experiments included DNA extraction analysis of DNA fragmentation quantification of DNA amplification of short tandem repeat STR forensic loci genetic analysis and elemental analyses that were conducted in collaboration with the University of North Texas Department of Chemistry and Forensic Science Program

Identification of Decomposed Human Remains by

Deoxyribonucleic Acid (DNA) Profiling WD. Haglund, DT. Reay, SL. Tepper, 1990 After routine methods failed to establish positive identification of a decomposed homicide victim deoxyribonucleic acid DNA typing techniques using blood from the victim and putative parents of the victim were used This is the first report in the literature of a case using DNA fingerprinting in a parentage context to establish identity of unidentified decomposed human remains

Improved Analysis of DNA Short Tandem Repeats with Time-Of-Flight Mass Spectrometry U.s. Department of Justice, 2014-07-25 The advent of DNA typing

and its use for human identity testing has revolutionized law enforcement investigations in recent years by allowing forensic laboratories to match suspects with minuscule amounts of biological evidence from a crime scene Equally important is the use of DNA to exclude suspects who were not involved in a crime or to identify human remains in an accident The past decade has seen numerous advances in the DNA testing procedures most notably among them the development of PCR polymerase chain reaction based DNA typing methods **Forensic DNA Analysis** Jaiprakash G. Shewale,Ray H.

Liu,2013-08-19 The field of forensic DNA analysis has grown immensely in the past two decades and genotyping of biological samples is now routinely performed in human identification HID laboratories Application areas include paternity testing forensic casework family lineage studies identification of human remains and DNA databasing Forensic DNA Analysis Current Practices and Emerging Technologies explores the fundamental principles and the application of technologies for each aspect of forensic DNA analysis The book begins by discussing the value of DNA evidence and how to properly recognize document collect and store it The remaining chapters examine The most widely adopted methods and the best practices for DNA isolation from forensic biological samples and human remains Studies carried out on the use of both messenger RNA and small micro RNA profiling Real time polymerase chain reaction PCR methods for quantification and assessment of human DNA prior to genotyping Capillary electrophoresis CE as a tool for forensic DNA analysis Next generation short tandem repeat STR genotyping kits for forensic applications the biological nature of STR loci and Y chromosome STRs Y STRs Mitochondrial DNA mtDNA sequence analysis Single nucleotide polymorphisms SNPs and insertion deletion polymorphisms indels in typing highly degraded DNA Deep sequencing technologies The current state of integrated systems in forensic DNA analysis The book concludes by discussing various aspects of sample processing training and the entities that provide such training programs This volume is an essential resource for students researchers teaching faculties and other professionals interested in human identification forensic DNA analysis Bones Sara L. Latta,2012-01-01 All bones tell a story you just have to know how to read them Forensic anthropologists can tell if found bones are from a human or an animal are male or female and how a person lived and died Readers will discover the techniques forensic anthropologists are using to solve both modern and ancient crimes

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