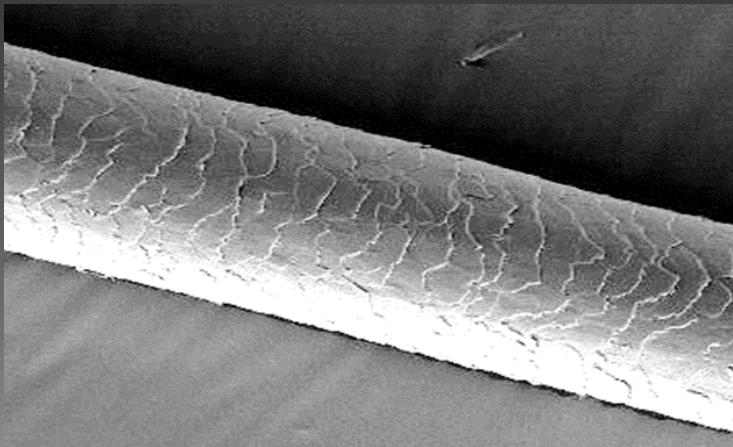
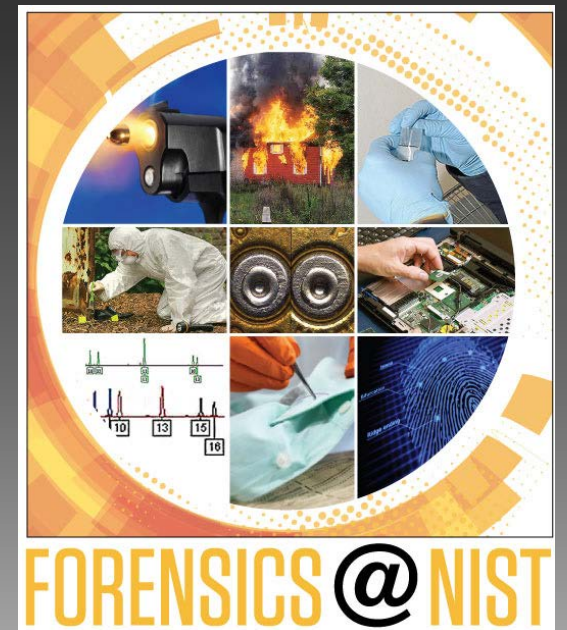


Hair analysis: Historical overview and current research collections

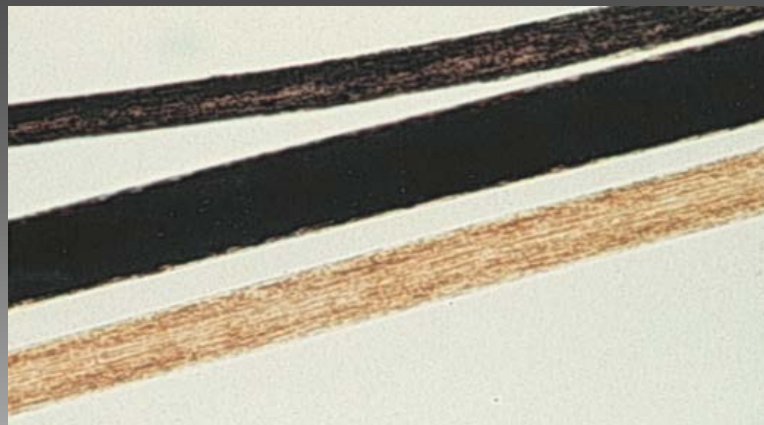


Sandra Koch, F-ABC
NIST Trace Workshop 2016



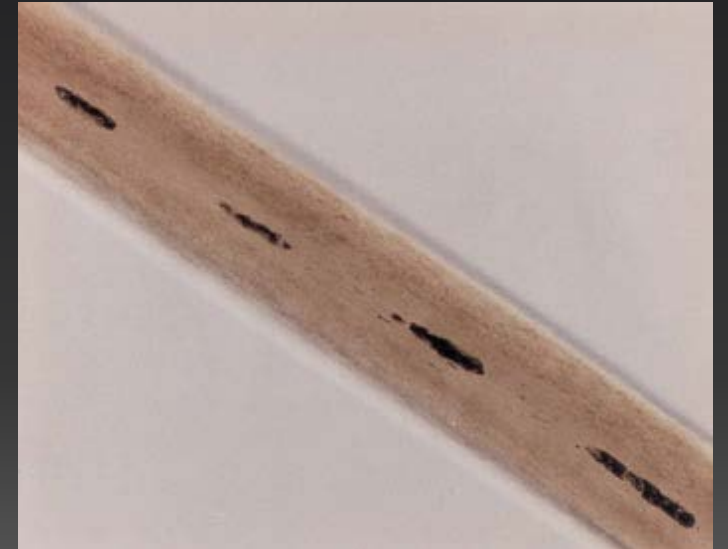
Hair Analysis

- ◇ Disciplines involved in hair analysis
- ◇ Development of forensic microscopical hair analysis
- ◇ Resources and collections
- ◇ Other techniques used to research hair



Research from many disciplines

- ◆ Anthropology
- ◆ Developmental Biology
- ◆ Dermatology
- ◆ Cosmetic science
- ◆ Forensic science



Collections

- ◆ Museums
- ◆ Universities
- ◆ Forensic laboratories
- ◆ Private Industry/Commercial laboratories



Collections from early anthropologists

- ◆ Mildred Trotter

- ◆ Washington University, Dept of Anatomy

- ◆ Leon Augustus Hausman

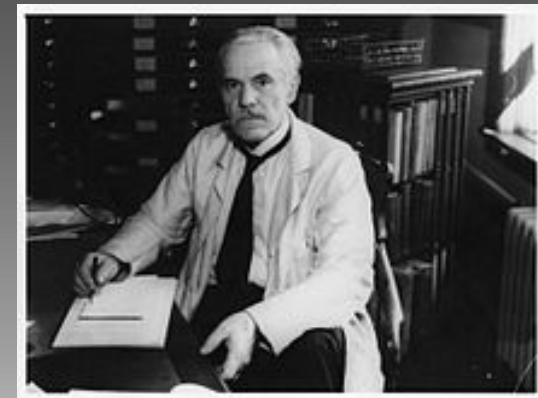
- ◆ Rutgers University, Dept of Zoology

- ◆ Morris Steggerda

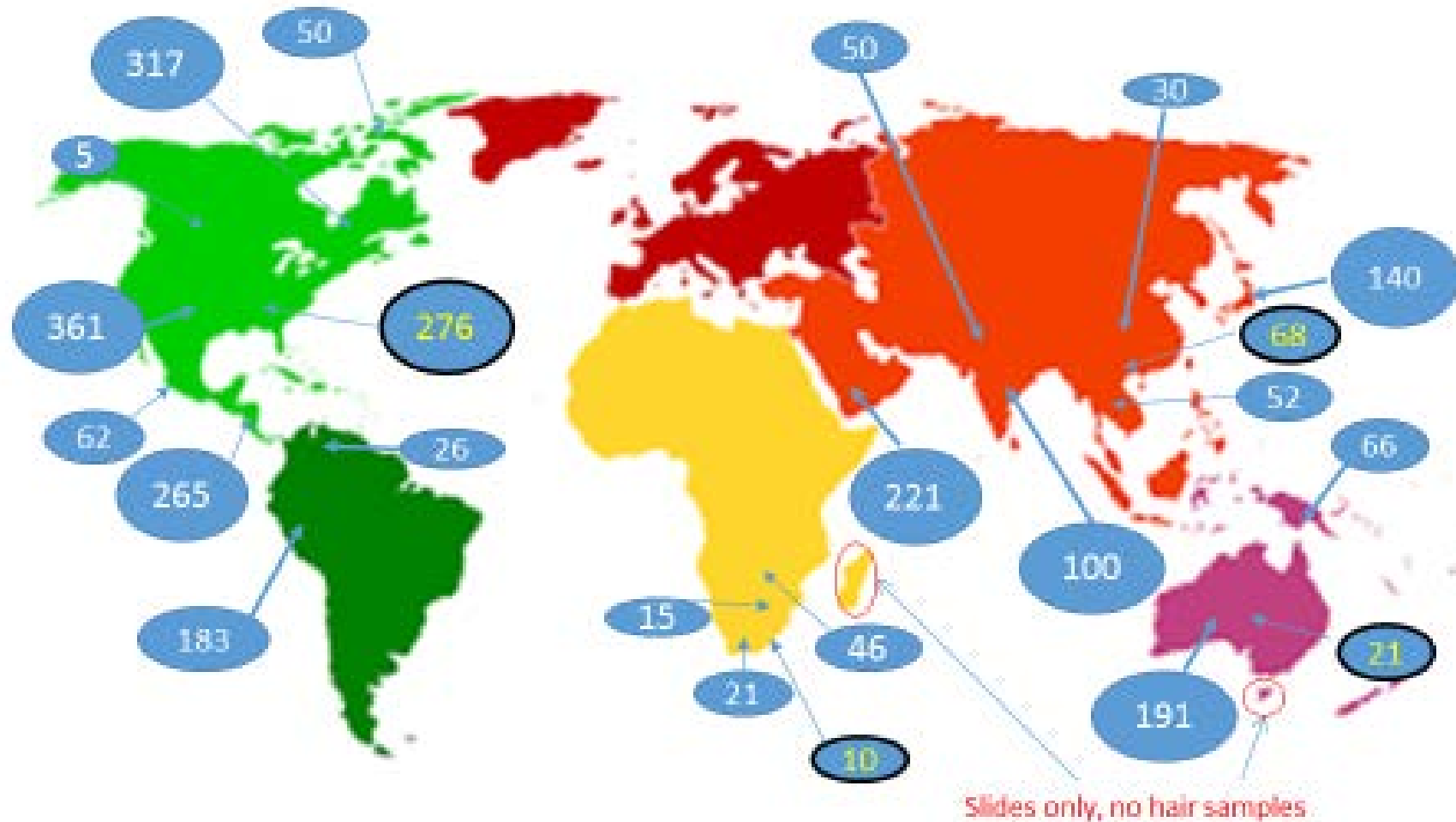
- ◆ Carnegie Institution

- ◆ Aleš Hrdlička

- ◆ Smithsonian NMNH



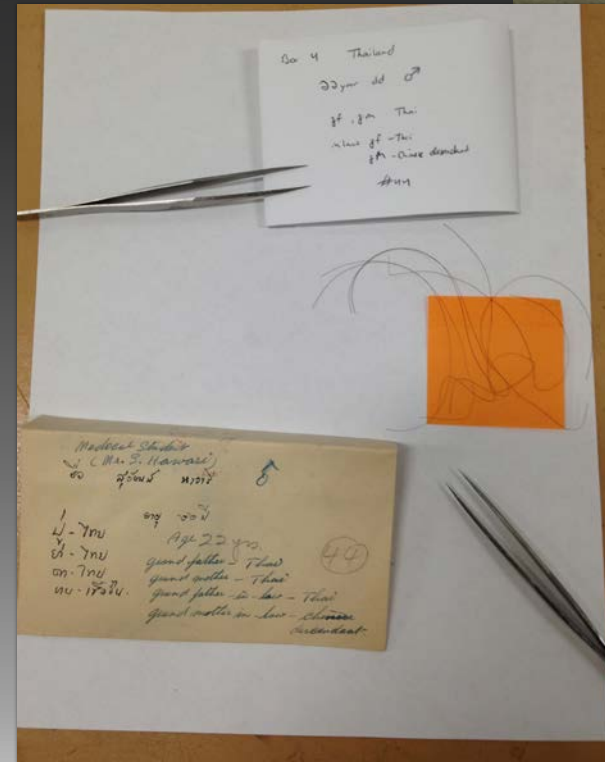
Anthropology: Trotter Hair Collection



Some demographic information is available: family relationships, age, sex, etc.

Museum Collections

- ◆ Smithsonian National Museum of Natural History (NMNH)
 - ◆ Trotter
 - ◆ Hrdlička
- ◆ National Museum of Health and Medicine
 - ◆ Steggerda Collection
- ◆ Harvard Peabody Museum
 - ◆ Caroline Bond Day Collection
- ◆ Field Museum of Natural History



Museum scalp hair collections

- ◆ Smithsonian NMNH
- ◆ National Museum of the American Indian
- ◆ American Museum of Natural History
- ◆ Musée du quai Branly - Paris
- ◆ Field Museum of Natural History



University Collections

◆ Penn State University

- ◆ Cut hair samples from living subjects
- ◆ Associated data (age, sex, genetic ancestry, family relationships, etc.)
- ◆ Genotypes based on 500,000 SNP's
- ◆ **Human Hair Research Repository**
 - ◆ 200+ and still collecting

Ancestry*	ADAPT/ ADAPT2 studies	Double Take study	Common Traits study	UIUC study	Total per ancestry
Black, African, or African-American	215	16	24	10	265
East Asian	128	3	13	20	164
Hispanic or Latino	169	10	54	5	238
Middle Eastern	29	3	0	3	35
Native American	9	6	4	0	16
Pacific Islander	6	1	1	0	8
South Asian	75	0	6	3	84
Southeast Asian	50	1	0	0	51
White, European, or European- American	1,802	167	239	78	2,286
# of hair samples per study:	2,483	207	341	119	3,150

University Collections

- ◆ University of Tennessee Forensic Anthropology Center
 - ◆ Bass collection
 - ◆ 300+ pulled hair samples from donated bodies (~25 hairs)
- ◆ Texas State Forensic Anthropology Center
 - ◆ 150 donor individuals to date

“Destructive analysis is defined as the permanent loss of any biological tissues from the body, including hair, skin, organs, blood and other bodily fluids, bone, cartilage, finger- or toenails, and muscle.”



TEXAS  STATE

Department of Anthropology

Forensic Anthropology Center

Research Techniques

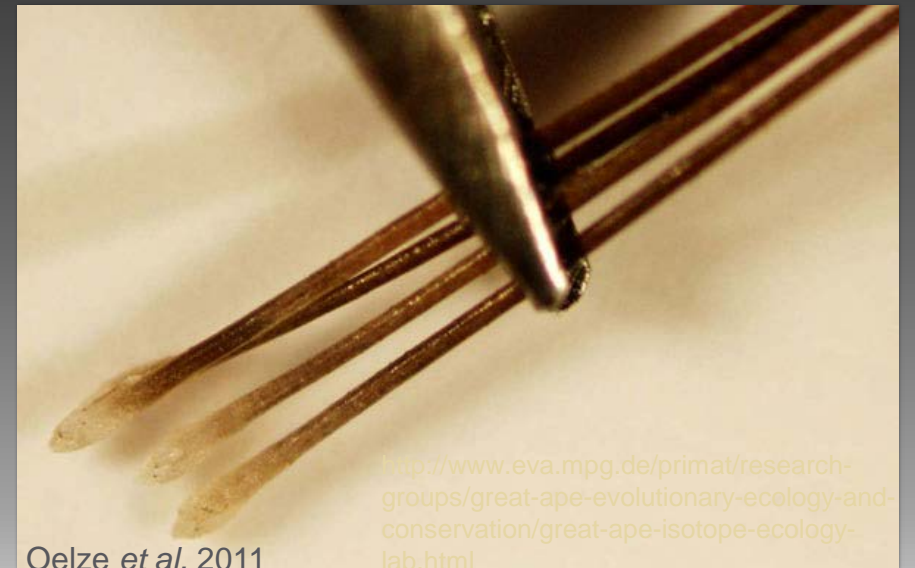
Private/Commercial research interests

- ◆ Cosmetic Industry

- ◆ Raman
- ◆ Electron Microscopy
- ◆ HPLC - melanin

- ◆ Researchers

- ◆ Drug analysis
- ◆ Elemental analysis
- ◆ Isotopic analysis

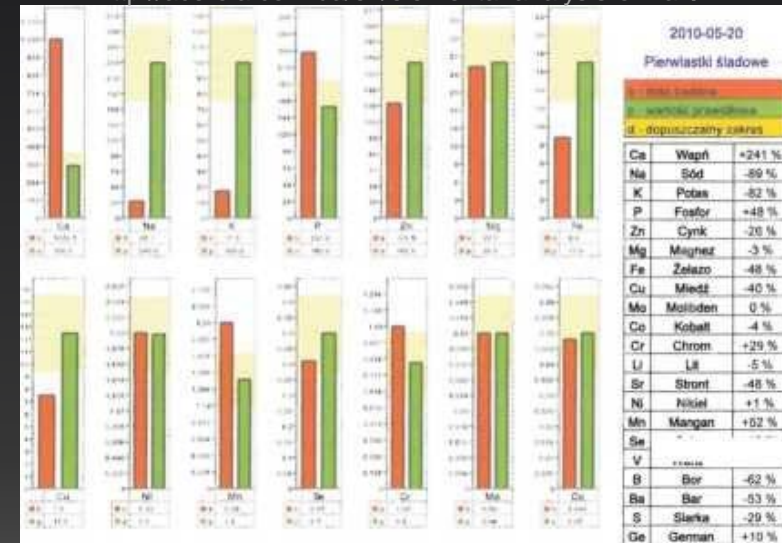


Research Collections

Elemental Analysis

- ◆ The elemental composition of human hair obtained from different studies at Surrey University over a period of 25 years has been recorded and forms part of a database, for biological and environmental samples

<http://acerola.com.ua/en/elemental-analysis-of-hair/>



Journal of Radioanalytical and Nuclear Chemistry, Vol. 259, No. 3 (2004) 493–498

The University of Surrey database of elemental composition of human hair

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¹ Physics Department, University of Surrey, Guildford, Surrey, GU2 7XH, UK

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(Received July 21, 2003)

The elemental composition of human hair obtained from different studies at Surrey University over a period of 25 years has been recorded and forms part of a database, for biological and environmental samples, which is being developed. Instrumental neutron activation analysis (INAA), using reactor neutrons, was the principal method employed and from which reported data are presented. Elemental concentrations of Br, Ca, Ce, Cl, Co, Cr, Cs, F, Fe, Hf, K, Mg, Mn, Na, Rb, Sb, Se, Sr, V and Zn were obtained and recorded in the database. Chronological variations in two sets of subjects separated by a period of time of 16 years are also given. Variations in the concentration values of some elements related to the state of health and disease were reported for hair samples collected from subjects suffering from manic depression, senile dementia and breast cancer. Concentration values of some elements with relation to the nationality of subjects from Bulgaria, England, Kenya, Nigeria and Wales are presented and compared. This study is part of on-going research in the analysis of biomedical and bioenvironmental materials. The database is still in its infancy.

Research Collections

- ◇ Stable Isotopes
 - ◇ Private labs
 - ◇ Universities

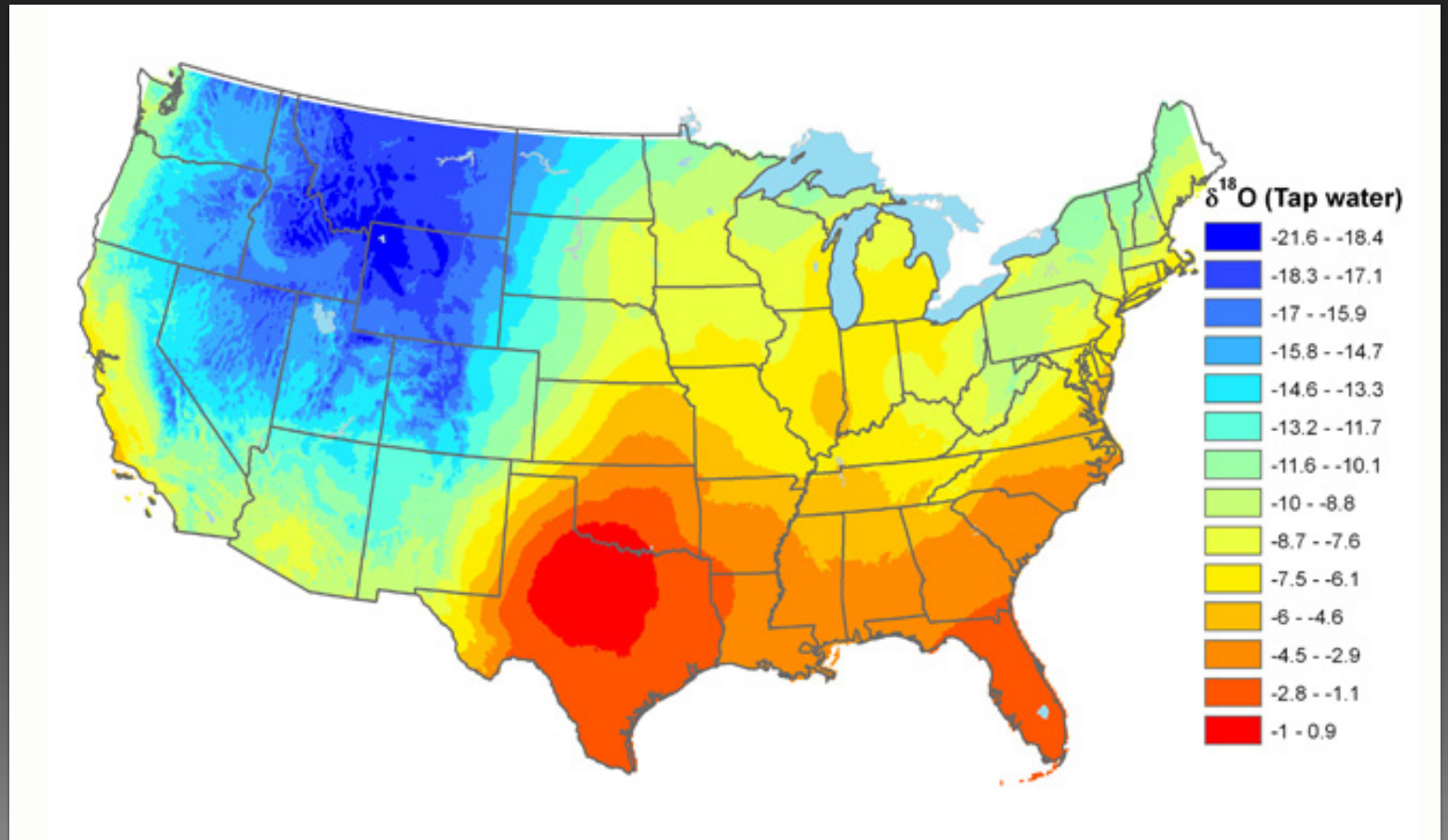


Photo credit: IsoForensics, Inc. 2012

Animal Hair Databases and Collections

- ◆ **Forensic animal hair atlas : a searchable database**
 - ◆ Contains high-resolution SEM and optical images of 35 different species of the most common animal hairs encountered in forensic casework. Includes an examination guidebook, overview of preparation techniques, glossary, bibliography, microscopic characterization, and many topics in animal hair characterization.

RJ LeeGroup, ©1999.



The screenshot shows the Microtrace LLC website. The header is blue with the Microtrace LLC logo on the left and navigation links for 'Contact Us', 'Forensic Services', 'Industries Served', and 'Material Analysis' on the right. The main content area is white and features the title 'Arbidar Fiber and Hair Collections' in blue. Below the title is a black and white illustration of a deer with large antlers. Underneath the illustration is a paragraph of text: 'Microtrace has acquired all rights to the products sold under the Arbidar name. In the ensuing time, Microtrace has worked to refine the collection and improve the quality and authenticity of each specimen.' Below this is another blue heading: 'The Arbidar Animal Hair and Fur Collection'. At the bottom, another paragraph of text reads: 'This diverse set is composed of eighty animal hair samples from around the world representing 49 genera. Each sample is individually packaged and labeled. The collection is organized in clear binder pages for ease of reference and accessibility.'

Sampling requests

- ◆ Destructive sampling
 - ◆ Smithsonian National Museum of Natural History
 - ◆ <http://anthropology.si.edu/cm/sampling.htm>
 - ◆ University of Tennessee Forensic Anthropology Center
 - ◆ <http://fac.utk.edu/research-requests-and-application-forms/>
 - ◆ Texas State Forensic Anthropology Center
 - ◆ <http://www.txstate.edu/anthropology/facts/Forms/FARF.html>
 - ◆ Human Hair Research Repository
 - ◆ Contact Sandra Koch at slk336@psu.edu

References

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Baker, J. D., and D. L. Exline. "Forensic animal hair atlas: a searchable database on CD-Rom. Monroeville, PA: RJ Lee Group." (1999).

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Thank you and acknowledgements

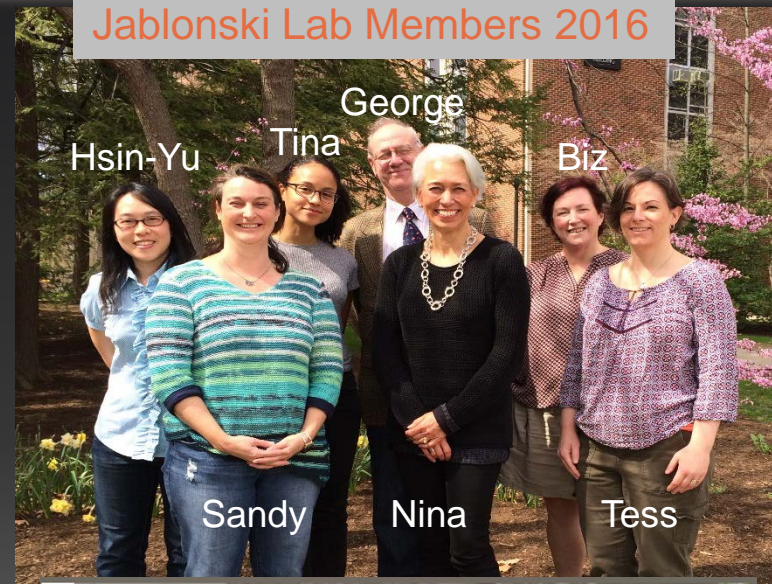


PennState

- ◆ Jablonski Lab
- ◆ Shriver Lab

Contact: slk336@psu.edu

Jablonski Lab Members 2016



Shriver Lab Members May 2016

