NATIONAL CENTER FOR CASE STUDY TEACHING IN SCIENCE

Niños Desaparecidos:
A Case Study about Genetics and Human Rights

by
Katayoun Chamany
Science, Technology and Society Program
Eugene Lang College of the New School University

Part I – News from Argentina

Isabel sat nervously in the waiting room with her mother—at least the woman she had known as her mother ever since she could recall. She had been aware for several years now that she was adopted and that her adoptive parents knew little of her family in Argentina. As she grew up, they had told her what they did know. She had been orphaned during Argentina's "dirty war" and was living in an orphanage in Cordova when they arranged, through a relief agency in the United States, to legally adopt her and bring her home with them to New York. That was 22 years ago.

Isabel remembered really very little of her life in Argentina, although her parents told her that when she was young she often awoke crying in the night, and she had always been afraid of loud noises. Even now she was unable to view fireworks on the Fourth of July without experiencing a sort of quiet terror with each small explosion.

Sitting here waiting, she was glad to have her mom with her. Although she was 22 and beginning to establish her independence, it was nice to have someone for emotional support now that her whole life was about to change. She'd been alternately scared and excited since her mom had called her at school to tell her the news. A lawyer representing the group called Abuelas de Plaza de Mayo—the Grandmothers of the Plaza of May—had called Isabel's American family on behalf of a woman named Claudia Tucuman. Claudia had come to the Grandmothers of the Plaza of May looking for help in her search for her granddaughter who had disappeared during the war.

Claudia began her search after hearing a story from a soldier who had been there the day the village in which her daughter and her family lived had been destroyed. The soldier reported that while everyone old enough to report the atrocity had been killed, the children had been taken to Cordova and put up for adoption. Many of the children had gone to families overseas who could afford to pay off the local authorities and obtain adoption papers. With the hope that her granddaughter might still be alive, and with the help of the Abuelas organization, Claudia had searched through the adoption records and had come to believe that Isabel was her missing granddaughter.

Isabel remembered hearing about the civil war in her Latin American studies class. With the help of her professor, she had located the Boston-based organization Physicians for Human Rights, who had put Isabel's adoptive family in touch with Dr. Paula Figueres. Dr. Figueres, a genetics counselor, had closely followed the work of Dr. Mary-Claire King, a geneticist who had been working since 1984 to help reunite families separated by war, using molecular testing to establish family ties. Now Isabel and her mom were waiting to see Dr. Figueres to hear what she had to say and to get answers to their many questions. What would the testing involve? How conclusive would the answers be? What if the tests showed that Claudia Tucuman was not her grandmother?

Dr. Figueres emerged from her office and asked them to come in. She was an engaging and energetic woman in her fifties who spoke with assurance as she explained her work to them. "In the last two decades, we have found many

molecular markers that possess enough variation in world populations that they can be used for the purpose of identification. Studying molecular variation within the population may also allow us to understand how people and cultures migrated over time and why some populations are either more resistant or susceptible to diseases."

Dr. Figueres smiled reassuringly as she continued. "In an effort to address these questions, an international drive to map the human mitochondrial DNA sequences of diverse populations around the world has been established. This effort is called the Human Genome Diversity Project. Perhaps you have read in the newspapers about the Human Genome Project, which seeks to sequence and map the human nuclear genome?"

She paused briefly. As Isabel and her mom nodded, Dr. Figueres continued. "Sequence data for both nuclear and mitochondrial DNA is now available in databases which can be searched for specific sequences that may only be identical among individuals who are genetically related. Using the tools of genetic analysis and the available data and information, we have been able to reunite about 50 children who were orphaned during the Argentine civil war with their grandmothers who are still alive and searching for them. This is what we hope to do for you as well."

As Isabel's heart began to beat faster, Dr. Figueres again smiled and said, "I am sure you have many questions that we should answer first. Let's begin."

Assignment: Assume the role of Isabel. What questions would you ask?

Part II – Genetic Match?

The fictional scenario in Part I is based on stories of children orphaned by numerous wars over the past 25 years. These include, but are not limited to, the civil war in Argentina that began in 1976 and lasted seven years; the Kurdish struggle for autonomy in Iraq in the late 1980s and early 1990s; the revolutionary war in El Salvador of 1979 to 1991; and the guerilla warfare in Guatemala in the 1970s and early 1980s (1,2). Isabel is a fictional example representing the 540 registered cases of children who went missing during El Salvador's war. The Association for the Search of Disappeared Children in San Salvador has found more than 100 living with adoptive families in countries such as Britain, and it believes there are many more (3).

In the case of Argentina, a commission appointed by the president after the civilian government was restored completed a report on 8,960 disappeared persons, although many human rights groups report numbers as high as 15,000 (4). At the time, the Abuelas de Plaza de Mayo began a campaign to locate at least 217 children ("niños desaparecidos") who had disappeared during the seven-year rule of the military junta and to recover them from their adoptive parents through court action (4,5,6). With the assistance of geneticist Dr. Mary-Claire King, the Abuelas de Plaza de Mayo have won over 50 court cases, reuniting missing children with their living relatives. To this end, 44 of 50 cases revealed that the children had been handed over to military leaders, while six out of 50 were the result of naïve adoptions (5).

To win these cases, the grandmothers needed evidence to prove that they were related to these children. The first such case was that of Paula Eva Logares, who was being raised as the biological daughter of a former police chief and his girlfriend (5,7). Analyzing specific proteins in the blood and making a match between living grandparents and the child solved this case. In this case, the match had a high degree of certainty because four blood samples could be compared—the three living grandparents and the child (5,7).

The choice of proteins used in these tests is the HLA (Human Leucocyte Antigens). These proteins are variable in populations and allow the human body to recognize self from non-self (sometimes they are called the MHC, the Major Histocompatibility Complex). A large cluster of genes located on chromosome 6 codes for the subunits of the HLA proteins (8,9). Each person receives genetic information for each protein from each of his or her parents. Within a population, however, there are multiple versions (alleles) for each gene. Therefore, this locus is considered highly polymorphic.

Typically, polymorphic genes encoding proteins are represented by two to six alleles. One subunit of one of the HLA proteins (DQa) involves the detection of six alleles that define 21 genotypes (8). The HLA proteins and the genes that code for them help researchers identify people based on the detection of specific variants. In the case of the missing children, researchers based their studies on the simple fact that related individuals should share more alleles than non-related individuals.

However, as investigations proceeded over the years it became clear that there was still an unacceptable probability of finding a match between two unrelated individuals by chance. In Caucasian populations, the chance that any two individuals would share the same DQa genotype is about seven percent (8). The degree of variability at these loci was not high enough. In other words, the chance that two individuals chosen at random would share the same profile for these loci was too high.

Analyzing genetic sequences that are highly variable in the population solved this problem. These sequences are scattered in the human genome and if compared among individuals would reveal differences in length due to a variable number of *tandem repeats* (VNTR) (10,11,12,13,14,15). A tandem repeat is a short sequence of DNA that is repeated in a head-to-tail fashion at a specific chromosomal locus. One example of a VNTR in humans is a 17 bp sequence of DNA that may be repeated between 70 and 450 times in any one person's genome. When considering the whole population then, the total number of base pairs at this locus could vary from 1190 to 7650 base pairs. There are many of these VNTR loci in the genome, each in a distinct location. Remember that for each VNTR locus, people receive one copy of this VNTR locus from their fathers and one from their mothers, and these can be different in length.

Each VNTR sequence is located in a specific region of the genome and this location is maintained from individual to individual. Only the length of each VNTR will vary among individuals, not the location. Therefore, you can compare the length of the VNTR sequences among individuals and establish whether individuals are related.

VNTR analysis of the disappeared children would address the accuracy issue but it would not address the problem of few living relatives. Given that the grandmothers were advocating for identification of these children, a maternal living relative was available as a point of reference for VNTR matching. Another fact proved to be valuable in this situation: mitochondrial DNA is only passed on through the maternal germ line. Therefore all subsequent matches were conducted by using highly variable mitochondrial genetic sequences for comparison (4,5,7). Eventually, Argentina established a voluntary national genetic databank for resolving the remaining cases in the future (5).

Assignment: Assume the role of Isabel's adoptive mother. What points would you like clarified?

References

1. Rosenberg, T. February 7, 1992. What did you do in the war, mama? The New York Times Magazine 52.
2. McHale, Laurie. Putting the puzzle together: in the jigsaw world of human genetics, UW professor Mary-Claire King found a crucial piece that helps solve the mystery of breast cancer. University of Washington Alumni Association web site: September 1996 columns. <http://www.washington.edu/alumni/columns/sept96/king2.html> (Site available as of 01/04/01)
3. Gibb, T. Missing children haunt Salvador: campaigners are pressing for army units to be brought to justice for their civil war atrocities against the very young. *The Guardian,* Manchester (UK). Oct. 13, 2000:19.
4. Argentina's National Commission on Disappeared People. Nunca Mas (Never Again). English Edition. London, Boston: Faber and Faber in association with Index on Censorship: 1986. Also available at <http://www.nuncamas.org>*** (Site under construction as of 03/01/01)
5. Mary-Claire King (Interview). July 1993. *Omni* 15(9):68.
6. Slawner, K. Interpreting victim testimony: survivor discourse and the narration of history. The Vanished Gallery (web site). < http://www.yendor.com/vanished/karenhead.html> (Site available as of 01/04/01)
7. King, M. Genetics and human rights: identifying the children of the disappeared. Part of the series The human genome project [videorecording] : biological nature and social opportunities. Executive producer John O. Green. Stanford Alumni Association. Stanford University, Palo Alto, California.
8. Hui, K.M., and J.L. Bidwell, eds. 1993. *The handbook of HLA typing technique.* Boca Raton, Florida: CRC Press.
9. Hurley, C. Jan 3, 2005. Cord Blood: Establishing a National Hematopoietic Stem Cell Bank Program. Appendix F: HLA Overview. <http://www.nap.edu/read/11269/chapter/15> (Site available as of 12/10/15)
10. Jeffreys, A.J. et al. Hypervariable "minisatellite" regions in human DNA. March 7, 1985. *Nature* 314(6006):67.
11. Lander, E. DNA fingerpinting: science, law and the ultimate identifier. In *The Code of Codes: Scientific and Social Issues in the Human Genome Project*. Kelves and Hood, ed. 1992. Cambridge, MA: Harvard University Press, p. 19.
12. Riley, D.E. DNA testing: an introduction for non-scientists—an illustrated explanation.1998. *Scientific Testimony: An Online Journal*. <http://www.scientific.org/tutorials/articles/riley/riley.html> (Site available as of 01/04/01)
13. Scheck, B. Privacy: The impact of DNA databanks. Seminar given at the Jacob Burns Ethics Center, Cardozo Law School, March 2, 1999.

14. Blackett family DNA activity. University of Arizona: The Biology Project (web site). <http://www.biology.arizona.edu/human_bio/activities/blackett/introduction.html> (Site available as of 01/04/01).

15. Alberts, B. et al. 1998. *Essential Cell Biology*. New York: Garland Publishing.

16. The dirty war. Segment of *60 Minutes*, originally aired April 23, 2000. Videorecording. New York: CBS Worldwide Inc.

17. Blood types tutorial. University of Arizona: The Biology Project (web site). <http://www.biology.arizona.edu/human_bio/problem_sets/blood_types/markers.html> (Site available 01/04/01). ***

18. DNA forensics problem set 1. University of Arizona: The Biology Project (web site). September 2000. <http://www.biology.arizona.edu/human_bio/problem_sets/DNA_forensics_1/DNA_forensics.html> (Site available as of 01/04/01).

19. The DNA files: is our fate in our genes? 1998. Soundvision Productions. <http://www.dnafiles.org/about/index.html> (Site available as of 01/04/01).

20. University of Arizona. Biology Project. Human Biology. DNA Forensics Problem Set 1 <http://www.biology.arizona.edu/human_bio/problem_sets/dna_forensics_1/05t.html> (Site available as of 12/10/15).

21. Perelli, C. From counterrevolutionary warfare to political awakening: the Uruguayan and Argentine armed forces in the 1970s. Fall 1993. *Armed Forces & Society* 20(1):25.

22. Yendor of Yonder. The Vanished Gallery (web site). <http://www.yendor.com/vanished/index.html> (Site available as of 01/04/01).***

23. Yendor of Yonder. Military uprisings. The Vanished Gallery (web site). <http://www.yendor.com/vanished/uprisings.html> (Site available as of 01/04/01).***

24. Lewis, R. Mitochondria-eclectic organelles. October 1989. *Biology Digest* 16:202.

25. Witkin, G. Science takes a stand. July 11, 1994. *U.S. News & World Report* 117(2):29.

26. Gosselin, P. Human genome project objects to rival's Science journal deal. *The Los Angeles Times* [Home Edition]. December 13, 2000:C.1.

27. Marshall, E. Human genome: storm erupts over terms for publishing Celera's sequence. December 15, 2000. *Science* 290(5499):2042.

28. Lone, F. Storm brews over gene bank of Estonian population. November 12, 1999. *Science* 286(5443):1262.

***These sites have articles and translations in Spanish.