



CASE TEACHING NOTES for "Gender: In the Genes or in the Jeans?" A Case Study on Sexual Differentiation"



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OVERVIEW / BACKGROUND

The overall goal of this case is to give students some insight into scientific experimentation as they learn the biology of sexual differentiation. The case as written here would probably take three or four class periods to complete in its entirety. None of us used the entire case. Rather, we each used different parts of it in our courses, which had students with varying backgrounds:

- In a core curriculum science course for non-majors and a course for future elementary school teachers, we had a unit on chromosomes and karyotyping. For these courses, we used Parts [I](#), [II](#), and [III](#) on chromosomal and gonadal differentiation, and Part [VI](#) on the social ramifications. Students completed each section in cooperative learning groups. The topic of genital differentiation was presented in an interactive mini-lecture (see the accompanying [PowerPoint slides](#) and [notes](#) for an outline of the mini-lecture). In these courses, students had previously learned about hormones and receptors in the context of blood glucose regulation.
- For a genetics course, students had at least a basic knowledge of genes, autosomes, sex chromosomes, karyotyping, steroid hormones, and human primary and secondary sexual characteristics.
- In a physiology class, where students already had a solid background in genetics and in the mechanisms of hormone action, we quickly reviewed the chromosomal differentiation topics covered in Parts [I](#) and [II](#) in about 10 minutes, and used two 75-minute lecture periods to cover the remaining sections on differentiation of the gonads and genitals. In this class, we also went into more detail on steroid hormone synthesis and Congenital Adrenal Hyperplasia.

Objectives

- To learn about the difference between autosomes and sex chromosomes.
- To learn about human sexual differentiation at the chromosomal, hormonal, phenotypic, brain, behavioral, and legal levels.
- To understand how scientists reached their understanding of these biological matters by considering both laboratory experiments on animals and "experiments of nature," or conditions that occur naturally in humans.
- To consider some ethical issues related to unusual chromosomal, gonadal, and genital conditions, including the individual's right to know, the roles of parents and physicians in deciding what's best for the child, and society's attitude towards these individuals.
- To gain experience in scientific reasoning, including making predictions based on alternative hypotheses, designing experiments, and interpreting results.

BLOCKS OF ANALYSIS

Detailed case analysis is provided in a separate file that is password-protected. To access this information, go to the [detailed case analysis](#). You will be prompted for a username and password. If you have not yet registered with us, you can see whether you are eligible for an account by reviewing our [password policy and then apply online](#) or write to answerkey@sciencecases.org.

FURTHER ASSIGNMENTS

Students can find additional information about AIS and other disorders of sexual differentiation in the references below. If there is time for additional classes or assignments, one could focus on the behavioral and social aspects of gender and gender identity using an excerpt from the "[Birth, Sex and Death](#)" video (see references). This video shows an interview with an XY woman with Androgen Insensitivity Syndrome (AIS) in which she describes how she feels and how she was viewed by her family and ex-husband. As a follow-up, assign small groups of students to investigate different websites and/or read different popular press articles or primary research articles listed in the references. During the subsequent class meeting, have these small groups report to the rest of the class what they have learned from the different sources.

REFERENCES

Websites (Links valid as of 09/2003)

The following sites describe conditions involving sex chromosomes.

1. Klinefelter's Syndrome and Associates:
<http://www.genetic.org/ks/scvs.htm>
2. Turner's Syndrome Society:
<http://www.turner-syndrome-us.org/>
3. Online Mendelian Inheritance in Man (OMIM) website, Androgen Insensitivity Syndrome (AIS):
<http://www.ncbi.nlm.nih.gov/htbin-post/Omim/dispim?300068> (includes extensive references)
4. Androgen insensitivity syndrome (AIS) support group:
<http://www.medhelp.org/www/ais>
5. Ethics of treating intersex conditions:
<http://www.isna.org/articles/dregerart.html>
6. Loyola University Medical Education Network Quicktime movie of genital differentiation:
<http://www.meddean.luc.edu/lumen/MedEd/urology/pnldev.mov>
7. Pamphlet describing Complete Androgen Insensitivity Syndrome:
<http://www.rch.unimelb.edu.au/publications/cais.html> (link to PDF file)
8. "Androgen insensitivity syndrome," Pinsky, L., and M.A. Trifiro, 1999:
<http://www.geneclinics.org/profiles/androgen/details.html>

Popular Press Articles and Media

1. "The science of sex." June 1992. *Discover Magazine* Special Issue 13(6).

2. France, David. May 28, 2000. "An inconvenient woman." *The New York Times Magazine* 24-29.
3. Marion, Robert. December 2000. "The curse of the Garcias." *Discover* 42-44.
4. Nussbaum, Emily. January 2000. "A question of gender." *Discover* 93-99.
5. Radetsky, Peter. November 1997. "Y?" *Discover* 89-93.
6. Video: "Birth, Sex, and Death" (#GR4332) from the 8-part series "The Secret of Life: The Revolution in Molecular Biology." This can be purchased from Films for the Humanities & Sciences, P.O. Box 2053, Princeton, NJ 08543-2053 or possibly rented from a university library rental service.

Primary Research and Review Articles

1. Adachi, M., R. Takayanagi, A. Tomura, K. Imasaki, S. Kato, K. Goto, T. Yanase, S. Ikuyama, and H. Nawata. 2000. "Androgen-insensitivity syndrome as a possible coactivator disease." *New England Journal of Medicine* 343(12):856-862.
2. Blackless, M., A. Charuvastra, A. Derryck, A. Fausto-Sterling, K. Lauzanne, and E. Lee. 2000. "How sexually dimorphic are we? Review and synthesis." *American Journal of Human Biology* 12:151-166.
3. Migeon, C.J., and A.B. Wisniewski. 1998. "Sexual differentiation: From genes to gender." *Hormone Research* 50(5):245-251.
4. Migeon, C.J., and A.B. Wisniewski. 2000. "Human sex differentiation: From transcription factors to gender." *Hormone Research* 53(3):111-119.
5. Sinclair, A. H., P. Berta, M.S. Palmer, J.R. Hawkins, B.L. Griffiths, J. Smith, J.W. Foster, A. Frischauf, R. Lovell-Badge, and P.N. Goodfellow. 1990. "A gene from the human sex-determining region encodes a protein with homology to a conserved DNA-binding motif." *Nature* 346:240.
6. Small, Chanley M. 1998. "Reinventing sex: The construction of realistic definitions of sex and gender." *American Biology Teacher* 60(8):590-593.
7. Wisniewski, A.B., C.J. Migeon, H.F.L. Meyer-Bahlburg, J.P. Gearhart, G.D. Berkovitz, T.R. Brown, and J. Money. 2000. "Complete androgen insensitivity syndrome: Long-term medical, surgical, and psychosexual outcome." *Journal of Clinical Endocrinology and Metabolism* 85 (8):2664-2669.

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