EDUCATOR'S GUIDE

Human Characteristics and Adaptations:

Is Race Cultural or Biological?

Disney Presents

the Eyes of Nye

For six seasons, millions of students came to understand, appreciate and enjoy the exploration of science through the series, *Bill Nye the Science Guy*. Bill returns with *The Eyes of Nye*, a more in-depth look at science subjects making news, changing lives, and impacting policy. From the future of alternate fuel sources and genetic engineering to population growth trends and issues of race, Bill and his expert cohorts bring science to life right in your classroom, helping you **Motivate** investigation; **Assess** available information; and **Propose** lines of argumentation.

This Educator's Guide includes:

- An **Introduction** that clearly defines the subject and offers an overview of the issue objectives of the guide; how it relates to science from both a social and personal perspective; as well as pertinent questions and insights regarding the topic.
- A listing of all **National Science Education Standards Addressed**.
- Detailed procedures highlighted in the MAP Framework (**Motivate, Assess, Propose**).
- Illustrative **Video Clips** from *The Eyes Of Nye* DVDs with pinpoint chapter cues.
- **Web Site Resources** to help students further investigate and locate research, charts, data as well as experts featured in the program material.
- Easily downloadable **Support Materials** that include articles, transparencies, charts, and much more.

Introduction:

"Race" refers to distinctions that are made between humans based on one or more characteristics. *The Eyes of Nye – Human Characteristics and Adaptations: Is Race Cultural or Biological?* points out discrepancies between attempts to define race and differences in how experts would group races. Among scientists and sociologists, opinions vary on the number of races, ranging from dozens to three—Caucasian, African, and Asian—to none. The differences exist largely due to varied interpretations of data and, significantly, the purpose for analyzing the data.

*Check the **MAP Teaching and Learning Framework** to explore the phases (motivate, assess, and propose) used in this guide.*

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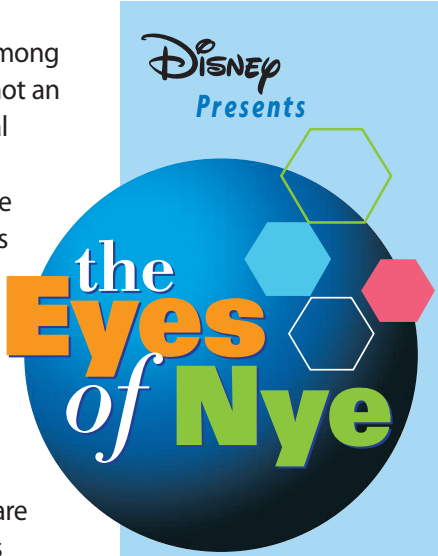
The question of whether to collect statistics that allow the comparison of differences among racial and ethnic groups in the census, public surveys, and administrative databases is not an abstract one…ASA takes the position that calls to end the collection of data using racial categories, although racial categories do not necessarily reflect biological or genetic categories. The failure to gather data on this socially significant category would preserve the status quo and hamper progress toward understanding and addressing inequalities in primary social institutions. The ASA statement highlights significant research findings on the role and consequences of race relations in social institutions such as schools, labor markets, neighborhoods, and health care scholarship that would not have been possible without data on racial categories.



American College of Physicians - 2003

Research is a vital part of identifying, monitoring, and addressing disparities in health care among racial and ethnic minorities. Research to identify sources of disparities, as well as effectiveness of initiatives targeted to eliminate disparities, will necessitate the collection of better data on race, ethnicity, and primary language, using reliable and standardized measurement tools.

Statements as presented, respectively:

The American Anthropological Association response to federal Office of Management ant and Budget (OMB) Directive 15 (1977; to standardize the collection of racial and ethnic information among federal agencies) entitled *Race and Ethnic Standards for Federal Statistics and Administrative Reporting*. Sept 1997.

American Sociological Association. 2003. *The Importance of Collecting Data and Doing Social Scientific Research on Race*. Washington, DC: American Sociological Association.

Position statement published by the American College of Physicians in Annals of Internal Medicine, *Racial and Ethnic Disparities in Health Care: A Position Paper of the American College of Physicians*, 3 August 2004, Volume 141, Issue 3, Pages 226-232.

Understanding differences in interpretation requires students explore biological race data and the extent it can or cannot be *classified*—a resoundingly scientific endeavor, yet one that can lead to dispute as well. Classification (like race) is a human construct, and scientists classify data in a manner that provides the information they consider most beneficial for their *purpose*, whether prescribing medical treatment or charting early tribal migration. Socially and historically, explorations of race—scientific or otherwise—have been even more purposeful, and eventful. Social purposes of those who believe any collection of scientific data poses the risk of a potential dehumanizing effect clash with those who believe the lack of continued scientific study of race will lead to a lack of ability to improve social conditions. Both have merit. Therefore, the question of significance, "Is there race?" is one that places solid science squarely in the social context of society—as compelling an example of a socio-scientific issue as exists today. It is, however, burdened with baggage, and must be taught with care and consideration. The purpose of this guide is to provide a rational, deliberate approach for addressing the issue strongly but at an appropriate level and depth. The objective is to forthrightly deal with the role of science as it applies to a very real and personal issue of social concern.

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National Science Education Standards Addressed

Science As Inquiry

- Abilities necessary to do scientific inquiry
  - Identify questions and concepts that guide scientific investigations.
  - Recognize and analyze alternative explanations and models.
  - Communicate and defend a scientific argument.
- Understanding about scientific inquiry

Life Science

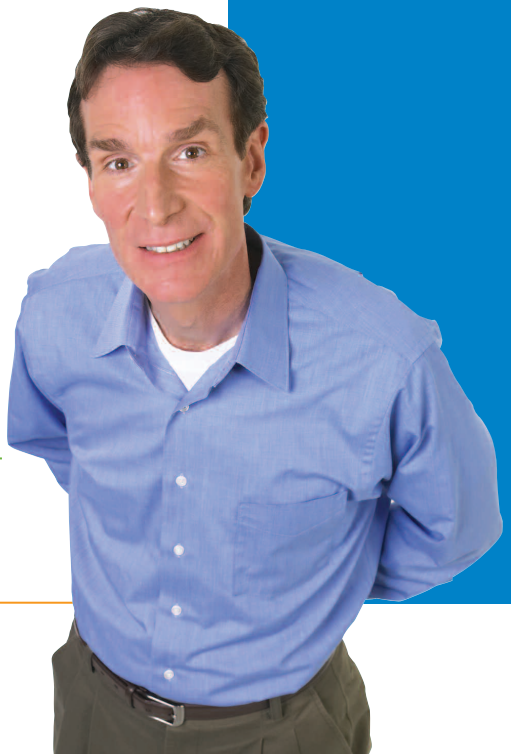
- The cell
- The molecular basis of heredity
- Biological evolution

Science in Personal and Social Perspectives

- Population growth
- Science and technology in local, national, and global challenges

History and Nature of Science

- Science as a human endeavor
- Nature of scientific knowledge
- Historical perspectives



On the DVD:

Human Characteristics and Adaptations – Chapters

Chapter 1: *Preview*
Beginning through 1:42
Ends with title screen.

Chapter 2: In Search of Genetic Data
2:06—4:39
Ends with Bill's saying, "It's just nothing but fun."

Chapter 3: *Origins and Genetic Variation*
4:40—7:49
Starts with Bill in Jeep in Africa and ends with saying "…why do we look so different?"

Chapter 4: *Past Clues and Consistency*
7:49—14:02
Starts with Bill talking with Dr. Jablonski and ends at close of founder effect with Bill saying "…quite yet."

Chapter 5: *Interpreting Genetic Data*
14:03—21:58
Starts with Bill saying, "In almost every one of your cells…" and ends with Dr. King saying "…there are no archetypes that separate people from one continent of origin from another."

Chapter 6: *Is there Race?*
21:59—end of program.
Starts with racist commercial and goes to end of program.

Human Characteristics and Adaptations – Activity Clips

Science and Social Justice
2:06—2:50
(referenced in Educator's Guide step 3)
Ends with Bill saying. "I'll prove it to you."

What is DNA?
14:05—15:03
(referenced in sidebar of Educator's Guide step 5)
Starts with Bill talking about DNA and ends with Bill saying "…and that includes you, pal."

Interpreting Genetic Variability
17:25—21:58
(referenced in Educator's Guide step 5)
Starts with Dr. King saying, "Now what we did…" and ends with her saying "…there are no archetypes that separate people from one continent of origin from another."

Tracking the Migration
6:43—7:49
(referenced in Educator's Guide step 8)
Starts with Bill standing on a map of Africa and ends with him saying "…why do we look so different?"

Melanin, Vitamin D, and Effects of UV Radiation
7:49—9:26
(referenced in Educator's Guide step 9)
Starts where the last clip ends and ends with Dr. Jablonski saying vitamin D helps to enhance the function of the immune system.

Evolution and Skin Color
10:09—11:56
(referenced in Educator's Guide step 9)
Begins with Dr. Jablonski saying, "As we moved out of the tropics…" and ends with her saying they "…had lots of sophisticated ways to buffer themselves against the environment."

Founder Effect
11:58—14:03
(referenced in Educator's Guide step 10)
Starts with Bill asking about founder effect and ends with Bill saying "…quite yet."

No Race!
22:10—22:59
(referenced in Teacher Note following Educator's Guide step 10)
Starts with Bill asking Dr. Jablonski, "So what is what people call race?" and ends with Jablonski saying "…and you realize, this is entirely meaningless."

Procedure: Motivate Phase

1) Open by playing the ***"Chapter 1: Race Preview"*** that tells the story of the social breakthrough of Jackie Robinson's acceptance into Major League Baseball. Discuss the contrast in peoples' views of Robinson then—biologically—and now. Ask what effect scientific advances have had on changes in viewpoints. Expect responses to vary; some students will assert science has had a large effect; others will say *people* caused these changes, or even that there has been no change. Accept responses but ask for a brief

explanation in each instance; record these and ask them to assist in separating them into two categories—scientific and social.

2) Review responses and ask students to describe differences between the two types. They may begin to assume an "unscientific" response is "wrong," so follow closely by noting there are two facets to the race issue. Emphasize this by restating the closing preview question, "Are there biological differences between the races?" while also asking if the Robinson story was scientific or social in nature.

3) Ask students if they can think of any instances in which science has been used to harm or to help relationships between races (if needed, refer to the scientific/social effects list from step 1). If students offer little, ask whether people have generally used "science" for bad or good *racial* purpose to elicit additional responses. They are quite aware of negative instances that range from personal to genocidal situations such as the Holocaust, yet have seldom been asked about the role of science in this situation. Tell them to observe "science" as we have known it at certain times in the past; play ***"Science and Social Injustice."*** Ask students to silently consider if it is important to understand the purpose for which information ("scientific" data) is being collected and used, and if this was a problem with science or with people.

4) Explain the Human Genome Project focused on mapping the genetic make-up of humans and recently concluded there were no significant racial differences. Tell them that due to these and other findings there is growing belief there are no races and numerous efforts are underway to eliminate all race labels and collection of race data, including those used for scientific purposes. Ask if we have any further need to collect scientific data related to race, and query, "Is there race?" Suggest they will likely play a role in helping decide this issue, and they should consider now what they need-to-know.

Potential scientific questions

a) Are there biological differences between the races?

b) Is there scientific value in the collection and analysis of race data?

Potential social question

c) Does collection or use of scientific race information related to race help or hurt our efforts to improve our social condition?

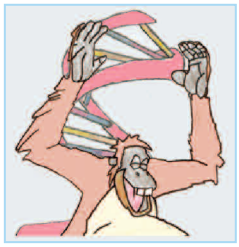
Procedure: Assess Phase

5) Remind students that through genetics we are finding possible answers to questions we have not been able to address. Tell them as we consider the first question—whether or not biological differences exist between the races—to recall that breakthroughs in genetics have prompted many to believe they have *proof* there are no genetic biological differences between races. Play ***"Interpreting Genetic Variability"*** in which Dr. Mary-Claire King presents color-coded data and attempts to make interpretations of ancestral origin. Discuss the difficulties and successes of that undertaking and allow students to

express perceptions of the utility of these data and the processes used. Remind them methods *should* improve over time.

If you wish to incorporate general instruction in DNA and genetics at this time, use ***"What is DNA?"*** *as further assistance.*

6) Ask if genetics have conclusively told us what we need to know about race. Based on Dr. King's display, students will offer differing interpretations. Discuss "The Rosenberg Study" (sidebar). When a computer classification analysis was employed to group genetic sequences, each attempt led to further separation by continent and, seemingly, race. However, note the date of the study, and also suggest for all its acclaim it prompted many negative responses, including supposed use of "junk DNA" that tells us nothing about race. Suggest, whether or not these claims are true, we can assume we have learned since the study. Ask them if they think we have learned *enough* and pause for a moment. Suggest that even with time to learn we may find regular discrepancies, especially with science as new as genetic mapping. Refer to briefings in "Mapping the Chimp: Then and Now" (sidebar) and the yearly swings in what we "knew"—more than once, we went from being *sure* there were *no* significant differences between humans and chimps to being sure there *were*. Ask students to consider again whether we know if there are biological differences, and (second question) if there is scientific value in collection and analysis of race data. The first impacts the second.



7) Discuss what it means to "classify." Explain scientists classify data in almost every investigation. It often has great scientific value but can have unintended consequences. Recall the earlier dilemma—past social impacts of classifications. Tell students there are many debates regarding the scientific value of collection and analysis of race data. Ask to consider one example—the use of race data for the purposes of providing health care. Tell students the American College of Physicians (ACP) considered it contentious enough to address in 2003:

Research is a vital part of identifying, monitoring, and addressing disparities in health care among racial and ethnic minorities. Research…will necessitate the collection of better data on race...

Explain physicians often refer to race data as "poor man's clues." Though "poor" and only a "clue," they often have no choice—sometimes, no matter how small a benefit may be, statistically, they must take advantage of what they can get. Ask students if this may ever have negative repercussions. Distribute or read "A Case for Caution," which describes dangers that can accompany use of such data. Remain neutral, and stress we have much to consider regarding the scientific value of race data, *and* whether this data can help or hurt efforts to improve our social condition, which we will soon address further.

8) Explain for our scientific assessment to be complete we must explore whether new

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See **The Eyes of Nye** Issue Support
The Rosenberg Study
Mapping the Chimp: Then and Now

claims are consistent with past theory and that a key ingredient in most theories related to race is one of "origins"—where do we come from? Explain past data (fossils) as well as new data (genetics) seem to point to Africa; *if* we assume genetic diversity increases the longer a species exists, then the highest levels of diversity we find (in Africa) are significant. Note we find similar *correlational* evidence at other locations—the less time humans have been there the less diversity. Play ***"Tracking the Migration."*** Repeat the question posed, "…since we all have the same ancestors, and we're all the same species, why do we look so different?" and stress correlation is not enough—we need *causal* evidence. Ask students to consider how what we have believed about past migrations can help explain differences between races.

It is difficult to quickly relate with long time spans. Next, however, students must understand the concept of skin color adaptation over many years. Ask them to record estimated years between migrations and color-code a map to time spans elapsed.
Have students get a view from one who has to make that call. Dr. Sally Satel says that in medicine, she is not colorblind….

9) Tell students that to "match" migrations with causes for skin color, we must explore what causes skin coloration. Play "Melanin, Vitamin D, and Effects of UV Radiation." Prepare for the next section by explaining that:

- Our bodies must have Vitamin D to remain healthy.
- We produce vitamin D by absorbing ultraviolet (UV) radiation through our skin.
- There is more UV radiation near equatorial regions and less farther away.

Play ***"Evolution and Skin Color;"*** reinforce the concept that over many years, we adapted to obtain the right balance of UV, developing more melanin (and darker skin) in regions near the equator and less (lighter skins) farther away.

10) Discuss *founder* effect and how it may explain certain other characteristics that distinguish "races." The effect arises due to the separation of a small group of individuals from the larger population; it may be due to many factors, such as migration, selection due to climactic or other change affecting the carrying capacity of the environment, or another factor that causes a population bottleneck. From this reduced gene pool eventually emerges an entire population. Play ***"Founder Effect"*** to reinforce the concept, and tell students, while it does not prove new theories regarding race, it also does not refute those theories.

Teacher Note: *Before proceeding to the propose phase, encourage students to consider reasons for perspectives offered by various experts; along those lines, set a tone for the "propose" phase by playing "No Race!" in which Dr. Jablonski emphatically states there is no such thing as race; it is something people have fabricated for social gain.*

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For more on Dr. Jablonski, evolution of skin color, founder effect & genetic drift, go to eyesofnye.org

Procedure: Propose Phase

11) Recall the social question, "Does using race data help or hurt efforts to improve our social condition?" Recall the early discussion about Mr. Robinson, and why we decided we needed to learn the science to begin with—because the issue of race is about us, our relationships, our well-being as a society. Tell them the remaining "claims" are position statements of organizations they will use as they form and propose their own viewpoints, and these varying views relate to both scientific questions we have investigated and to social aspects—they are inseparable, and because of this, some of the views are surprising. The American Anthropological Association (AAA), for instance, has come out against collection or use of race data, while the American Sociological Association (ASA) has come out in support (see sidebar). A key is the *purpose* of the organization, the former seeing the science and latter seeing mostly the social impact of policies related to the science. Likewise, medical professionals (e.g., doctors, the ACP mentioned earlier) are likely to stand on either side, as would many others. Some groups we may expect to align with the ASA do not, instead striving to eliminate social controversy through elimination of the term. Tell students when real science and social considerations merge, there are rarely single answers, but there ***are*** stances we can take to influence our society to be the best it can be. Tell them they will have that opportunity as they "testify" before a Senate Subcommittee.

Use position statements as a precursor to students' preparation, or provide in the next step along with their planning guide.

12) Divide students into groups of four and ask them to assume a role similar to groups we have discussed. Tell them to plan their testimony carefully (right) in order to express their general purpose as well as their position on use of race-based data. They must address the science in their testimony but should feel free to relate it to social aspects as well. At least three points must be developed; they may use questions we have investigated or extend to other questions if prepared to do so. A representative from their group will provide their "testimony" to the Senate Subcommittee. Allow multiple "components" in arguments. For instance, students may assert there is no biological difference yet still support collection of race data, as long as they clearly state their reasons. Emphasize the reason for their "testimony" is to influence policy for public gain through our legislators. As they develop their testimony, instruct each group to review the other testimony options, and create questions—you may have them create one for each group, two to three total, or the combination you feel will be most appropriate for your students and the time span allotted. Arrange for students seated in the "Senate" to have a participatory role (question asking and note taking), and instruct those providing testimony they may field their fair share of questions.

Encourage students to:

- *Take development of their organization's general purpose seriously; it is useful for those seeking to understand their viewpoint.*
- *Consider new questions; it is a primary goal of investigating questions to begin*

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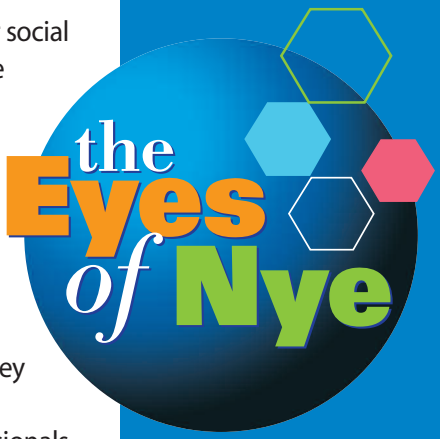

*See **The Eyes of Nye** Issue Support **Organizational Position Statements***

with.

- *Seek additional information on positions of organizations (there is no scarcity online), case information (e.g., Proposition 54 in California 2004), and additional raw data.*
- *Inform other groups of their role, their general purpose, and a brief (few sentences) outline of their position prior to the hearing; the realism will aid the preparation and the questions.*
- *Not view the joint testimonies as a "win-lose" but rather an attempt to influence measures and rules adopted at state or federal levels.*

13) Conduct the hearing and discuss briefly what was learned as a result of their investigations and resulting hearing. Encourage students to extend their questions individually or in groups, noting that with any issue, and especially this issue, we have barely touched on the range of considerations germane to the science of race and its implications in our society.

Final Teacher Note: *The questions, debates, viewpoints, and claims related to the issue of "race" are as complex, varied, and difficult to address as any issue that exists. It is highly worthy for that reason alone. It is even more worthy because of the dire need for reason, for solutions, and understanding science is not without compassion, nor without cause. The amount of information, new policy considerations, and potential new legislation available online, and what will come soon for your students as they assume their citizenship and responsibilities, is sweeping.*

For more, go to eyesofnye.org

ISSUES SUPPORT MATERIAL

Human Characteristics and Adaptations:
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The Rosenberg Study

Noah Rosenberg and colleagues conducted a study published in December 2002 that suggested it is possible to classify humans into groups that correlate closely with race, even if differences between races account for only four percent of human variation.

In the study, Rosenberg fed sequences from 1056 individuals and 52 populations into a computer program called *structure*. *Structure* is designed to find a way of dividing—or classifying—data into as many groups as it is asked to, and the number of groups is denoted by the letter K. Upon being requested to divide the populations of the world as represented by the 52 DNA samples into two, three, four, or five groups according to how similar or dissimilar the sequences were, the program provided the following results:

Number of groups	*Continents*
K = 2	**Group 1** - Africa, Europe and western Asia **Group 2** - Eastern Asia, Australia and the Americas
K = 3	**Group 1** - Sub-Saharan Africa **Group 2** - Europe and Western Asia **Group 3** - Eastern Asia, Australia and the Americas
K = 4	**Group 1** - Sub-Saharan Africa **Group 2** - Europe and Western Asia **Group 3** - Eastern Asia and Australia **Group 4** - Americas
K = 5	**Group 1** - Sub-Saharan Africa **Group 2** - Europe and Western Asia **Group 3** - Eastern Asia **Group 4** - Australia **Group 5** – Americas

The continent boundaries become more distinct as the number of groups *structure* was requested to divide increased. At the highest number, even more

uniquely, the populations separated into groups that correlated very closely to what we have always, classically, considered to be races: Africans, Caucasians, Orientals, and Native Americans. The study, taken at face value, seems to suggest that even if only four percent of the variation in human DNA sequences is separated out among races, they are still significant enough to suggest distinct differences among races.

Is it that distinct, or that simple?

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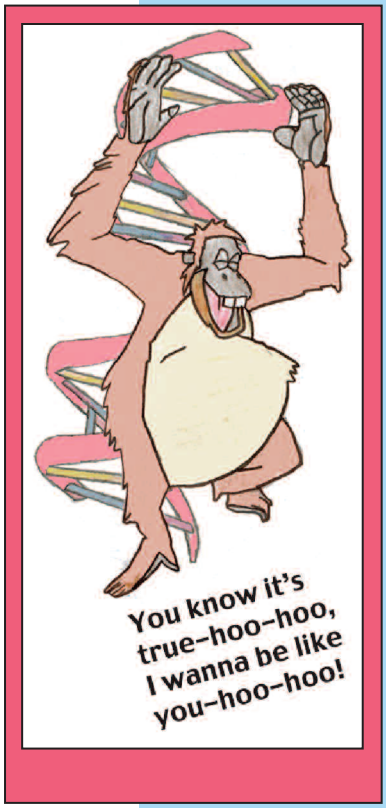
Mapping the Chimp: Then and Now

August 2000 Calls to crack chimp genome

Claim is made chimps are 99 percent genetically identical to humans and decoding the genome of the chimpanzee could explain why humans, and not chimps, succumb to diseases like AIDS and malaria.



May 2001 Gene data underline primate link

After studying 53 similar stretches of DNA in the human and chimp genome, scientists conclude we are even more closely related than previously thought, differing by less than 1.24%, and the human and chimp evolutionary line diverged between 4.6 and 6.2 million years ago.

Sept 2002 Humans and chimps 'not so close'

Studies show humans and chimps do not share as much DNA as we had thought. Past estimates of 98.5% similarity are down to 95%.

May 2003 Chimps genetically close to humans

New genetic research indicates chimps and humans are so closely related that we should all be considered members of the same family—genus Homo, the taxonomic group used to classify humans. Scientists find a 99.4% similarity in key genes of chimps and humans and claim we shared a common ancestor millions of years ago.

April 2004 New light shed on chimp genome

Despite having very similar genetic code (differing by about 1.2%), the difference between chimps and humans is where our codes have gone their separate ways during development. Scientists also claim in any part of the brain about 10% of our gene activity differs from chimps, and there are other small but important differences between genes such as those responsible for language.

Full text of all articles available at the BBC News.

A Case for Caution

In the 1990s some states began publishing "report cards" describing data on risks associated with the use of coronary artery bypass grafts (CABG) for heart attack patients. These were state-level initiatives administered by a state's Department of Health, and included information intended to help patients and providers make the best decisions possible regarding surgery options. The information had an unforeseen and unfortunate effect.

After reviewing hospital discharge data from New York and comparing these data with a number of other states, researchers found that after the report card was released, the gap in CABG surgery in New York between whites versus blacks and Hispanics widened significantly; blacks and Hispanics were less likely to receive CABG than white patients. Furthermore, despite lower use of CABG, there was no increase in common alternative procedures in these groups.

These results suggest that some surgeons responded to the risk information by excluding patients from CABG surgery on the basis of race and ethnicity, according to Rachel M. Werner, M.D., the study's first author and an assistant professor of medicine at the University of Pennsylvania School of Medicine in Philadelphia. "One implication of our study is that report cards work in ways that are more complicated than we assumed, and some physicians may respond to them inappropriately. Although this increase in disparities appears to be transient, it took nine years after report cards were established for the differences in CABG use in blacks, Hispanics, and whites to return to where they were before the first report card's release," Dr. Weiner explains.

However, it is noteworthy that Werner also states, "The finding that report cards increased racial and ethnic disparities in CABG should not be taken as a reason to abandon quality improvement. Instead, it suggests that report cards may need to be improved to increase their impact on patients' physician selection, and reduce physicians' incentive to select patients on the basis of their perceived risk.

The above case information was obtained and adapted from a news release presented at the State of Disparities news conference, and was originally co-authored by David A. Asch, M.D., and Daniel Polsky, Ph.D. The original research articles were solicited by the editors of *Circulation: Journal of the American Heart Association* and conference proceedings from the association's "Discovering the Full Spectrum of Cardiovascular Disease: The Minority Health Summit 2003."

NR05 – 1036 (Werner/CircDisparities)

Organizational Position Statements

American Anthropological Association - 1997

Because so much harm has been based on "racial" distinctions over the years, correctives for such harm must also acknowledge the impact of "racial" consciousness among the U.S. populace, regardless of the fact that "race" has no scientific justification in human biology. Eventually, however, these classifications must be transcended and replaced by more non-racist and accurate ways of representing the diversity of the U.S. population.

American Sociological Association - 2002