

# **Applied Marketing Science: Forensic Science of Nuclear and Mitochondrial DNA to Determine Consumer Buying Behavior**

**Professor Jonathan U. Elimimian**

Albany State University,  
Albany, Georgia, U.S.A

**Dr. Augustine Iluore, MD**

Adjunct Professor, USC Medical School,  
Los Angeles, California, U.S.A

**Dr. Melissa A. Jordan**

College of Business,  
Health Care Administration  
Albany State University,  
Albany, Georgia, U.S.A

## **Abstract**

*Human DNA, which serves to characterize us and regulate our development, is not influenced by marketing stimuli such as lifestyle, values, norms, attitudes, promotions and advertising. The advantage gained with this knowledge is that these human character traits can be deduced from our genetic makeup (genome) and used to formulate marketing strategies. Such strategies would be based on consumer segmentation and targeting for a specific product or service.*

*This concept of applying DNA profiles to marketing plans is a creative and more directed method of capturing the interest of consumers and targeting those most likely to purchase a product or utilize a service. The use of genetic profiles also unveils major opportunities to conduct market segmentation by targeting consumer ancestry through the use of forensic, nuclear and mitochondrial DNA results. The true value comes from the marriage of the information gained from the genetic makeup of consumers in addition to the traditional factors and methodologies used in market segmentation and targeting. To fully benefit and be more capable of understanding consumer-behavior, marketers and researchers are encouraged to perform more in depth research on this topic.*

## Background of the Study:

Despite varying marketing factors and strategies, consumers often respond to stimuli, such as low-price offerings, coupons, give-away as well as quality products and services presented by marketers. Recently, it has been demonstrated that most consumers simultaneously respond to a mixture of stimuli collectively known as their “ancestral influences”. The contributing elements of this ancestral influence include culture, ethnicity, and country origin of the consumer. More specifically, consumers often respond and behave positively or negatively towards a product depending on the product country of origin (Mothers Baugh, Hawkins, 2010).

Therefore, a new gateway of marketing information has been opened, allowing marketers the unique chance to appeal to consumers and further conduct market segmentation by targeting a consumer’s respective ancestry and projected buying-behavior through the use of forensic nuclear and mitochondrial DNA results. We are suggesting that in order to understand a consumer’s behavior, we must know about the consumer’s DNA identification in addition to the existing traditional factors and methodologies of market segmentation and targeting. In this proposal, the use of genomic information is to be considered the primary tool for assessing consumer stimulus.

## Related Theories of DNA Background Information

### Science of DNA Identification:

DNA is a polymer consisting of several units known as nucleotides. Each nucleotide contains a deoxyribose (sugar), a phosphate, and one organic base, either an adenine (A), cytosine (C), thymine (T), or guanine (G). The DNA structure can be described as a ladder that has been twisted along its axis. Another example would be a spiral staircase with the steps of the ladder representing the complementary pairing between the organic bases (Figure 1). In normal situations, “A” pairs with “T” and “G” pairs with “C” in a conserved fashion. Our unique genetic code is determined by the ordered pairing of the base pairs.

Simply, this code (genotype) is best thought of as a blueprint that determines our characteristics (phenotype). Specific sequences of the bases that encode a single characteristic or set of characteristics are called genes. All of our genes are located on our chromosomes at specific locations called loci, or locus if used in its singular form. For a given trait or set of traits, all of the possible variations of a gene are called alleles. Varying alleles of the genes that differ from one person to another provide the basis for DNA identification and profiling. Thus, locations that are polymorphic are deliberately chosen for DNA analysis. (See figure 1 below)

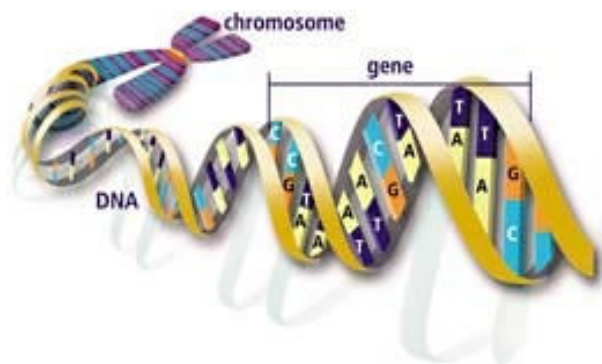


Figure 1: DNA model

(Courtesy U.S Department of Energy Human Genome Program)

**Chromosomes:**

Chromosomes are paired, long threadlike segments of DNA contained within the nucleus of each cell (Figure 1). All human beings, regardless of race or ethnicity have 23 pairs of chromosomes, 46 in total. One chromosome from each pair is inherited from the mother and the other one is inherited from the father. The 23<sup>rd</sup> pair of chromosomes is the “sex” or gender-determining chromosomes (XX or XY), with females being XX and males XY.

**Y- Chromosomes:**

The Y- chromosome, in males, contains important information about the subject’s genealogy. The Y- chromosome is inherited directly from the father to all male offspring and remains highly conserved, i.e. unchanged throughout the generations. Thus, all males connected to the same forefathers will have the same Y-chromosome. This provides the beginnings of establishing an extraordinary link between familial purchasing-behavior and with the genetics.

**Y- Chromosome testing:**

The DNA testing process involves the identification of DNA segments within the chromosome. These DNA segments, short tandem repeat (STR), are used as genetic markers and are designated by a **DYS numeric number** (DNA Y-chromosome Segment number). The number and randomness of STRs varies from person to person, with characteristics like ethnicity and race being inconsequential. Overall, the characteristic alleles possessed by an individual and the order in which they occur indicate the genetic record inherited from the person’s paternal lineage.

Further, the genetic signature of an individual is called their haplotype. Identification of the haplotype and its differences is significant for understanding consumer segmentation and corresponding patterns of consumption. Interpreting the results of haplotype identification between two individuals is used to determine ancestry. The more matching that occurs between two individuals, the more likely that they share a common ancestor. DNA sameness can positively confirm genealogical sameness and assist marketers and researchers by pointing to a relationship between two or more persons with or without the same surname and subsequently explain similarities in their purchasing-behavior.

**Science of Consumer DNA and Genealogy Implications:**

The basic science component of this article is the use of genealogical DNA testing to determine the level of genetic relationships between selected students and their consumer behavior. Test results were used to either confirm a suspected such relationship between two families shows no relationship worldwide. For the purposes of consumer identification by race and consumption patterns, a Native population match, a Global population match, and a regional match were evaluated based on their DNA profile results.

The genealogy test is an emerging tool that combines DNA and physical evidence to reveal the history of ancient human migration. It seeks to answer such questions as, “Where did we come from?” and “Who am I?” DNA studies indicate that all modern humans share a common male ancestor who lived in Africa about 140,000 years ago and all men share a common male ancestor who lived in Africa about 60,000 years ago (Jobling & Smith, 1995).

Generally, a genealogical (DNA marker) test examines the DNA segment at specific locations (Gris Mapping) on a person’s DNA for genetic genealogy purposes. There are two common types of tests; Y-chromosome (Y-DNA) testing for paternal ancestry and mitochondrial DNA (medina) testing for maternal ancestry (Neil Bradman& Thomas 1998).

Specifically, the Y-Chromosome DNA test involves the collection of human cells (example buccal cells from the mouth) from male individuals and analyzing it for Y-Chromosome markers. A consumer's ancestry can be traced using the DNA on his Y-chromosome through Y-STR testing. The laboratory data is then converted into the ancestral data, which is used to generate a report showing the ancestral marker type.

### The Following is an example of the data analysis and result of Paternal Lineage (Y-STR) Testing.

As of now, we know that the paternal lineage test is based on the fact that the Y chromosome is passed down from father to child relatively unchanged through several generations. Special sections on the Y chromosome, called short tandem repeats (STRs), are examined to determine a person's Y-haplogroup — revealing the geographic origins of his ancestors as evidenced by common DNA markers.

### What do you get when you do a Paternal Lineage Test?

- Your haplogroup designation and a haplogroup description page result.
- A personalized map depicting your ancestors' journey and where they initially settled in the ancient world; their clothing and eating habits (consumer behavior)
- Your Y-STR profile (raw data)
- Facts about your haplogroup, including which parts of the world you can find your "genetic cousins" and famous people who share the same haplogroup as you do. Also knowledge of your living conditions (consumer behavior). See **Figure 2 below**.

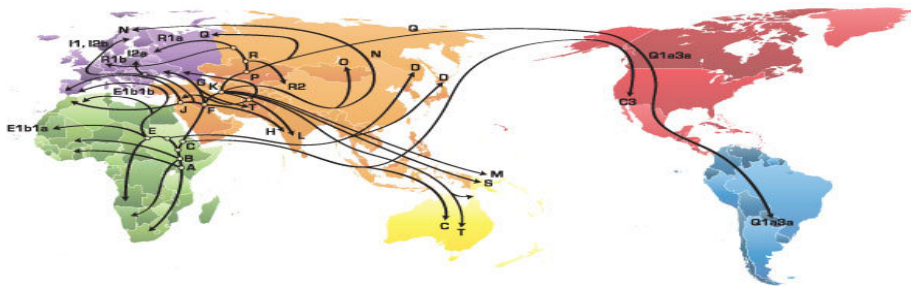


Figure 2. Map of Paternal Lineage Test results.

(Courtesy to Ancestry DNA <http://www.ancestrybydna.com/abd-report.php>)

Since only males have the Y-chromosome, a female wishing to find out about her paternal ancestry can ask a male relative along the same paternal bloodline to take the test.



Figure 3: Certificate of DNA result.

(Courtesy to Ancestry DNA <http://www.ancestrybydna.com/abd-report.php>)

Given the above general background, the study provided discussion and examined the following issues:

- Methodology of the study relating to marketing (consumer behavior)
- Consumer decision process based on DNA data and results
- The Conceptual Model (Marketing Framework)
- DNA variation among individuals and differences in their consumer behavior
- Implication to science and marketing

**Research methodology of the study (Forensic Science Component) And Methods of DNA testing:**

1. DNA sample collection from target group of people  
By rubbing the swab gently inside the mouth against the cheek, loose cells called buccal cells will adhere to the swab. This swab contains a sufficient amount of DNA for testing self-identification and consumer profiling based on ethnic group.
2. Isolate the cells from the swab and centrifuge
3. Extract DNA from the cells using a process called cell lysis
4. Perform polymerase chain reaction (PCR)
5. Sequencing the genome
6. Analysis of data and results.

The students (as consumer sample) are responsible for step #1 with the assistance of the lab. Technician, as well as sending their cheek samples to a professional laboratory to perform steps 2 to 6. The DNA marker data received from the laboratory is then compared with those having the same surnames or places of ancestry origin. After laboratory testing, the researcher then obtains a bigger picture of the subject’s Y-Chromosome profile. This is called a “haplotype” discussed above. The haplotype is the overall profile for one’s DNA markers and is unique to different family groups and for marketing segmentation and targeting.

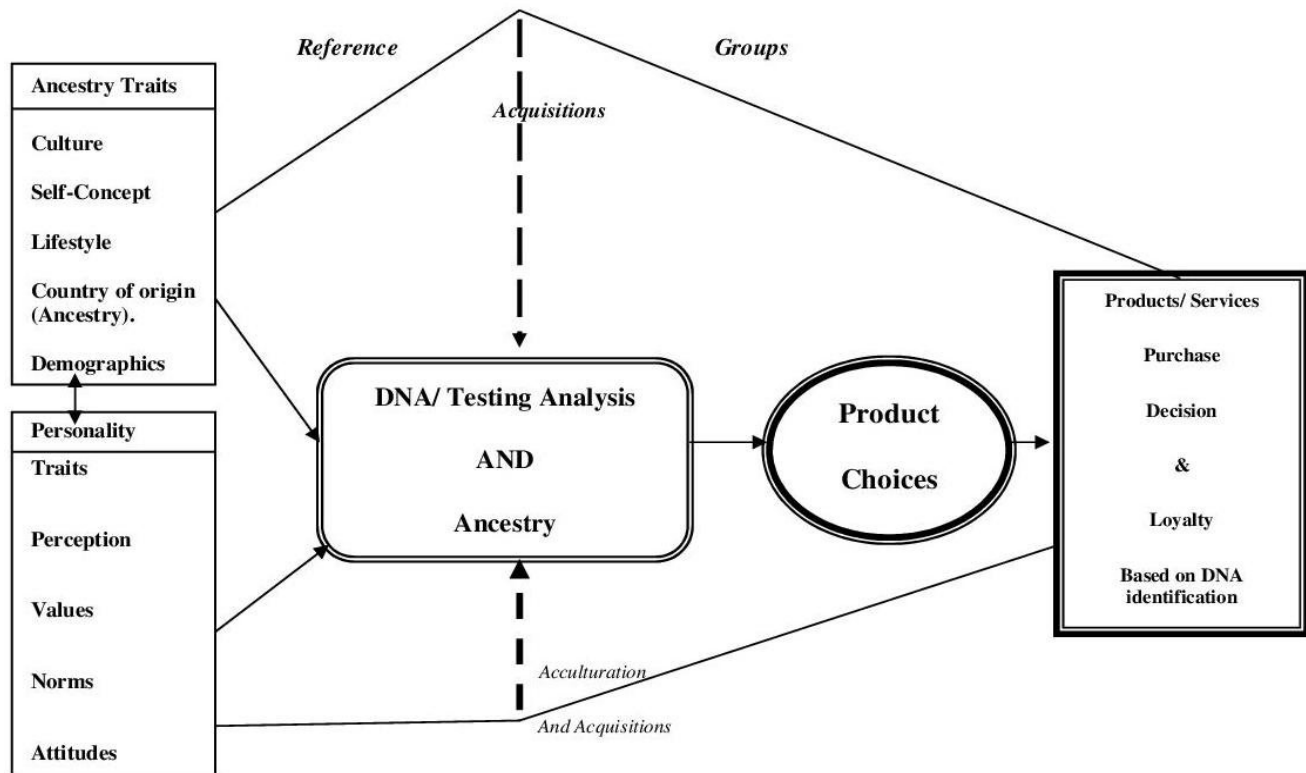
**Table 1: The Research Structure.**

Methods for DNA Profile	Research Subjects of the Consumers DNA profiles.	Outcomes of the analysis.
Selection of 25 Consumers (students). Collection of DNA sample Send sample to professional laboratory for analysis Result Analysis and interpretation	We identified the populations and the regions where a student’s genetic profile is most likely belong.  We identify the ethnic affiliations from the analysis.  We compared the genetic profile to the regions of Asia, Europe, China, African populations	True identification of family origin and other profiling data  Ethnic group segmentation/targeting done.  Consumer segmentation based on geographical origin/location.  Consumer behavior profile (based on a-c) completed.

**Research Question:** What is the individual student’s ancestral origin within the Region of any Continent?

**Instrumentation:** None, but professional laboratory of DNA Testing provided the data and analysis.

**Figure 4: Conceptual Framework of Consumer Decision Process Based on The Science of DNA Results:**



Design by the Author, 2011.

The above figure 4 shows the conceptual framework of the study. The Independent variables are listed from the beginning right side of the model with “Product Choices” to the extreme left of the model known as the “Ancestry Traits” or Demographics/Personality traits. While the Dependent variables are Consumer Purchase Decision, Product Loyalty and DNA Profiles.

**Cultural Factors and DNA Variations in Consumer Behavior:**

Currently, the three largest global retailers are Wal-Mart (United States of America), Carrefour (France), and Tesco (United Kingdom). Each of these giant retailers is engaged in global retail expansion with a focus on Asia and Latin America (Hawkins, 2010). The continent of Africa, Middle Eastern countries, and Russia are often not considered as part of the global partners. Combining all of the world’s continents makes market analysis extremely large and complex regarding the cultural identification of consumers.

For example, superstores and hypermarkets, with their large sizes, one-stop shopping, and enormous variety of products have worked well in Western markets. But in Middle Eastern countries, Asia, Latin America, Africa, and Russia, these formats are complemented with their traditional retail systems such as door-to-door and street marketing. These traditional formats of retailing can clearly be traced to DNA

market behavior of producers, marketers and consumers. There are still a 400:1 ratio between small, independent stores (retailers) and supermarkets in Nigeria, Kenya, and urban Mexico to mention a few of the developing countries. Consequentially, the world's giant retailers are adjusting to these traditional formats around the globe. For example, Wal-Mart has implemented "To-do Die", a discount supermarket in low-income areas in Mexico. Meanwhile, Tesco has responded similarly to the cultural market system in China with the appropriately branded "Tesco Express".

Clearly, having a larger number of smaller stores in these countries is not enough as marketing penetration strategy. Market segmentations and store adaptations based on DNA profiles of consumers across cultural regions are a marketing critical success factors in a global retail environment. Marketing or specific product retailing on cultural variations in income, value, and other demographic variables have been extensively researched in marketing Psychology and Sociology literature (Spiro et.al,1994). But, little work has been done on consumers' DNA profiles and consumer ancestral origins as it relates to consumer buying behavior. These are challenging tasks because of the variations in Genealogy, Physical Sciences in Canonizing Ancestry Origin (Using DNA Testing Results) consumer GIS mapping data and marketing factors (Neil B. and Thomas M., 1998).

### **Implications for Marketing Theory and Practices:**

Marketing educators and practitioners at all levels of the business organizational structure are likely to benefit from the science of DNA beyond this conceptual approach. Marketers can also learn the procedure of developing strategic product production and marketing program by adopting the science of DNA, especially for marketing products/services, such as product branding and consumer identification, segmentation and targeting of consumers.

The state of consumers' education and knowledge of the science of DNA in marketing applications has provided answers to the identification of consumers profiling based on the results attained from the DNA science data. The information and data from the respondents used for this study can be used to formulate consumer marketing operational strategies and for marketing management decisions.

The DNA science data, information and knowledge also provided an opportunity for us to identify consumer buying behavior factors, marketing threats, and opportunities (Igor Ansoff et. al, 1990) based on cultural and ethnic demographics trends. In terms of marketing and sales employment, marketers can adopt the knowledge of DNA for their marketing practices and success. For prospective sales career people, it will provide additional knowledge and skills in marketing and in their career advancement without further high educational training.

Marketing managers and entrepreneurs can improve their sales managers' strategic commitments and improve sales productivity by providing employees with the knowledge of DNA science used to identify consumers for the purposes of products and services marketing segmentation and customer targeting. In the U.S, there is substantial knowledge to gain through the use of DNA science in marketing. It is critical to the success of the new generation of marketers, students, and academicians beyond the knowledge of the traditional 4ps in marketing strategies and practices. It is even more critical because of the cultural variations in the global marketing environment. Therefore, from the experience gained by conducting this study and writing this article, every country needs to adopt the practice of developing and advancing human capital in the practices of marketing by adopting the Science of DNA in marketing practices as discussed in this article.

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**This study was funded by Albany State University, Federal Title III Office.**

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