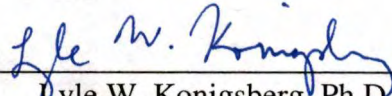


To the Graduate Council:

I am submitting herewith a dissertation written by Nikki L. Rogers entitled "The Affinity of South Carolina's 'Gullah' African Americans: Biological Tests of Cultural and Historical Hypotheses." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Anthropology.

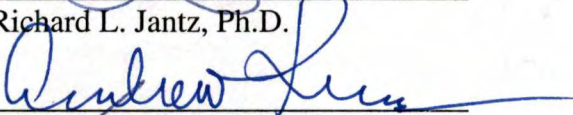


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**THE AFFINITY OF SOUTH CAROLINA'S
"GULLAH" AFRICAN AMERICANS
BIOLOGICAL TESTS OF CULTURAL AND HISTORICAL
HYPOTHESES**

A Dissertatation
presented for the
Doctor of Philosophy Degree
The University of Tennessee, Knoxville

Nikki L. Rogers

May 2000

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For John

*Cast in steel,
Carved in stone ...*

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Abstract

This study examines the specific African ancestry of the "Gullah" African Americans of Lowcountry South Carolina. The proximate goal was to use biological data from Lowcountry populations to test the conclusions of previous cultural, historical, and linguistic research. The ultimate goal was to further knowledge of complex diseases prevalent in African American populations. When ancestral populations are correctly identified, medical researchers can target the most informative comparative populations for studies of genetic and environmental causes of disease.

The proposed Lowcountry/Sierra Leone relationship promoted by Opala (1987) generated new interest and pride in Gullah/Geechee heritage. However, other African connections to the Lowcountry have been somewhat neglected. This study investigates other likely associations between West Africa and the Lowcountry using biological evidence. Chapters 1-3 summarize the history, cultural traditions, and previous studies of the African Americans of the South Carolina Lowcountry. Based upon this information, the biological analysis in Part II tests the proposed affinity of Lowcountry African Americans with peoples of West Africa. Chapter 4 describes the utility of accurate biological description of African Americans and the population dynamics that have affected their genome(s). Chapter 5 presents a brief introduction to abnormal β -globin haplotypes and their application to the question of specific African American ancestry. The regional homogeneity of these markers in Africa presents the unique opportunity to identify the origins of two ancestors of individuals with sickle cell anemia (Hb SS). Chapter 6 examines the anthropometric affinity and population structure of Lowcountry

African Americans (*Fst*, coefficients of kinship, generalized distances) using comparative metric data from available African populations. The genetic results indicate the expected relationships to Upper Guinea and equatorial Africa, but a stronger affiliation with peoples of the Gold and Slave Coasts than expected from cultural and historical evidence. The metric data indicates that the Gullah population exhibits a morphology that closely resembles those of West African populations and suggests relationships with populations that are overlooked in the cultural and historical hypotheses. All results indicate that Lowcountry African Americans represent a biological amalgam with identifiable affinities with all major regions of West Africa.

Table of Contents

Introduction	1
Exposition of This Work	6
PART I: POPULATION ORIGINS AND HISTORY	9
Chapter 1: Lowcountry Agricultural and Economic History	10
Charles Town, South Carolina	11
The Barbadian Influence	11
The Charles Town Economy	16
Georgia	22
Chapter 2: Lowcountry Slavery	26
The African Slave Trade	27
Planter Preferences for African Laborers	30
Who Were the Lowcountry Africans?	36
The Reliability of Historic Records	38
The Domestic Slave Trade	42
Chapter 3: Lowcountry Language and Culture	48
The Significance of African Influences	49
Factors Encouraging Lowcountry Creolization	54
Selected studies of Lowcountry Culture and Language	61
Language	61
Religion	69

Music	71
Contemporary Study of Lowcountry Life	74
Preface to Part II: A Hypothesis of Lowcountry Affinity	82
PART II: THE ORIGINAL INVESTIGATION	84
Chapter 4: The Biology of Lowcountry African Americans	85
Historical Genetics and African American History	87
Admixture Studies	90
Project SuGAR and Diabetes in the Lowcountry	93
Chapter 5: Sickle Cell Haplotypes and African Ancestry	94
The Sickle Cell Allele	96
Natural History of the Sickle Cell Allele	98
Haplotype Studies	103
Recombination Can Produce "Atypical" Haplotypes	104
Haplotyping of Lowcountry African Americans	107
Rationale and Considerations	107
Materials and Methods	108
Attempted Haplotyping of a Sierra Leone Sample	111
Results	111
Haplotype Distribution in the Lowcountry Sample	111
Recombinant Haplotypes	114
Discussion	115
Chapter 6: Metric Analysis of Population Affinity	121

Materials	122
Methods	123
Preliminary Procedure: Missing Data	123
Preliminary Procedure: Sexual Dimorphism	128
Preliminary Procedure: Variables Used in Population Comparisons	130
Multiple Analysis of Variance (MANOVA)	131
Analysis of Population Structure	131
Coefficients of Kinship (R matrices)	133
Generalized Distances and Principal Coordinates	134
Wright's <i>Fst</i>	135
Results	137
Multiple Analysis of Variance (MANOVA)	137
Coefficients of Kinship (R Matrices)	139
Generalized Distances and Principal Coordinates	143
Wright's <i>Fst</i>	148
Discussion	150
Chapter 7: Conclusions	153
Bibliography	160
Appendices	182
Appendix 1: Definitions for Genetic Terms from Chapter 5	183
Appendix 2: Human Subjects Compliance Information	185
Appendix 3: Haplotype Data for Lowcountry Sample	186
Appendix 4: Variance/Covariance Matrices for Lowcountry Blacks	189

Appendix 5: Summary of Missing Data for Lowcountry Metric Samples	191
Appendix 6: Resources for the Study of Lowcountry African and African American Heritage and History	192
Vita	194

FIGURES

Figure 1: The Lowcountry and Sea Islands of Coastal South Carolina and Georgia	2
Figure 2: Countries of the West African Coast	4
Figure 3: The 1665 King's Grant "Carolina"	12
Figure 4: Proximity of South Carolina and the West Indies	15
Figure 5: South Carolina Topographic Regions	17
Figure 6: Rice-growing Regions of West Africa	31
Figure 7: Slaving Regions of West Africa	32
Figure 8: "The Street" at McLeod Plantation, James Island, SC	60
Figure 9: St. Helena Island Praise House	72
Figure 10: Pollitzer's (1958) Population Distances	91
Figure 11: The Hemoglobin Molecule	95
Figure 12: African Hb S Haplotype Distribution	101
Figure 13: β -globin Like Gene Cluster Restriction Sites Selected for Haplotyping	109
Figure 14: Plot of First and Second Eigenvectors for Lowcountry and African Males	145
Figure 15: Plot of First and Second Eigenvectors for Lowcountry and African Females	147
Figure A-3-1: Example of Gel Used for Genetic Analysis	186

TABLES

Table 1: Georgia Demography, 1790	25
Table 2: Origin of Enslaved Africans Sold at Savannah, 1766–1771	36
Table 3: Gullah Translation of Luke 20	62
Table 4: African Contributions of "Conversation Words"	
Documented by Turner (1949)	65
Table 5: Amelia Dawley's Funeral Song	73
Table 6: Haplotype Restriction Patterns	110
Table 7: Allele Distribution in the Lowcountry Sample	112
Table 8: Genotype Distribution the Lowcountry Sample	112
Table 9: Comparison of Allele Frequencies in Lowcountry Natives versus	
Migrants and Individuals of Unknown Birthplace	113
Table 10: Comparison of World Hb S Haplotype Distributions	116
Table 11: Lowcountry African American Sample Demographics	124
Table 12: Pollitzer's Measurements for Lowcountry African Americans	125
Table 13: Sources, Descriptions, and Sample Sizes for African Metric Data	126
Table 14: Missing Data Percentages for Lowcountry African American Samples	127
Table 15: Observed Versus Imputed Summary Data: Lowcountry Males	129
Table 16: MANOVA Results for Sexual Dimorphism in	
Lowcountry Males and Females	129
Table 17: Wright's (1978) Guidelines for Interpreting <i>F_{st}</i> Values	136
Table 18: Two-Level MANOVA Results: Class Variables "Sex," "Region"	138

Table 19: MANOVA Results for Four- and Three-Variable Models: Class	
Variable "Region"	138
Table 20: Ryan-Einot-Gabriel-Welsch (REGWQ) Multiple-Range Test Results	140
Table 21: Unbiased R Matrix for Lowcountry and African Males (NW, FW, StH)	141
Table 22: Unbiased R Matrix for Lowcountry and African Females	
(NW, FW, StH)	142
Table 23: Pairwise d^2 Values Between Lowcountry and African Males	
(NW, FW, StH)	144
Table 24: Pairwise d^2 Values Between Lowcountry and African Females	
(NW, FW, StH)	146
Table 25: Fst Values Across Lowcountry and African Samples	149

Appended Tables

Table A-3-1: Haplotype Data, Atypical Genotypes, and Birthplace Classifications	187
Table A-4-1: Variance/Covariance Matrix for Lowcountry African American Males	
(with missing data)	189
Table A-4-2: Variance/Covariance Matrix for Lowcountry African American Females	
(with missing data)	190
Table A-4-3: Mean Measurements for Lowcountry African Americans	190
Table A-5-1: Missing Data Summary for Lowcountry African American Males	191
Table A-5-2: Missing Data Summary for Lowcountry African American Females	191

Introduction

A strand of barrier islands spans the coast of the southeast United States from approximately Charleston, South Carolina, to the northern border of Florida (Figure 1). Known collectively as the Sea Islands, they have been called the "African American Ellis Island[s]" because they were the disembarking point for a large number of enslaved Africans (MP Johnson, 1988). The Sea Islands and coastal regions of South Carolina and Georgia make up the "Lowcountry," named for its flat terrain and extensive fresh- and saltwater marshes and swamps. The rice, indigo, and cotton plantations of the Lowcountry were among the richest in the antebellum South and constituted the largest North American market for the African slave trade. Many Lowcountry residents are descended from enslaved Africans whose families remained in the area following emancipation. They have retained much of the creolized culture created by their ancestors and illustrate the utility of the term "African American."

The Lowcountry is a living archive that can provide valuable clues to the identities of America's African ancestors. This study reviews how these resources have been used to address this question and examines physical and genetic indicators of African ancestry in the black population of Lowcountry South Carolina. The proximate goal was to use biological data from Lowcountry populations to test the conclusions of previous cultural, historical, and linguistic research. The ultimate goal was to further knowledge of complex diseases prevalent in African Americans. Correctly identifying the ancestral contributors to hybrid populations allows medical researchers to target the most informative comparative populations for studies of genetic and environmental causes of

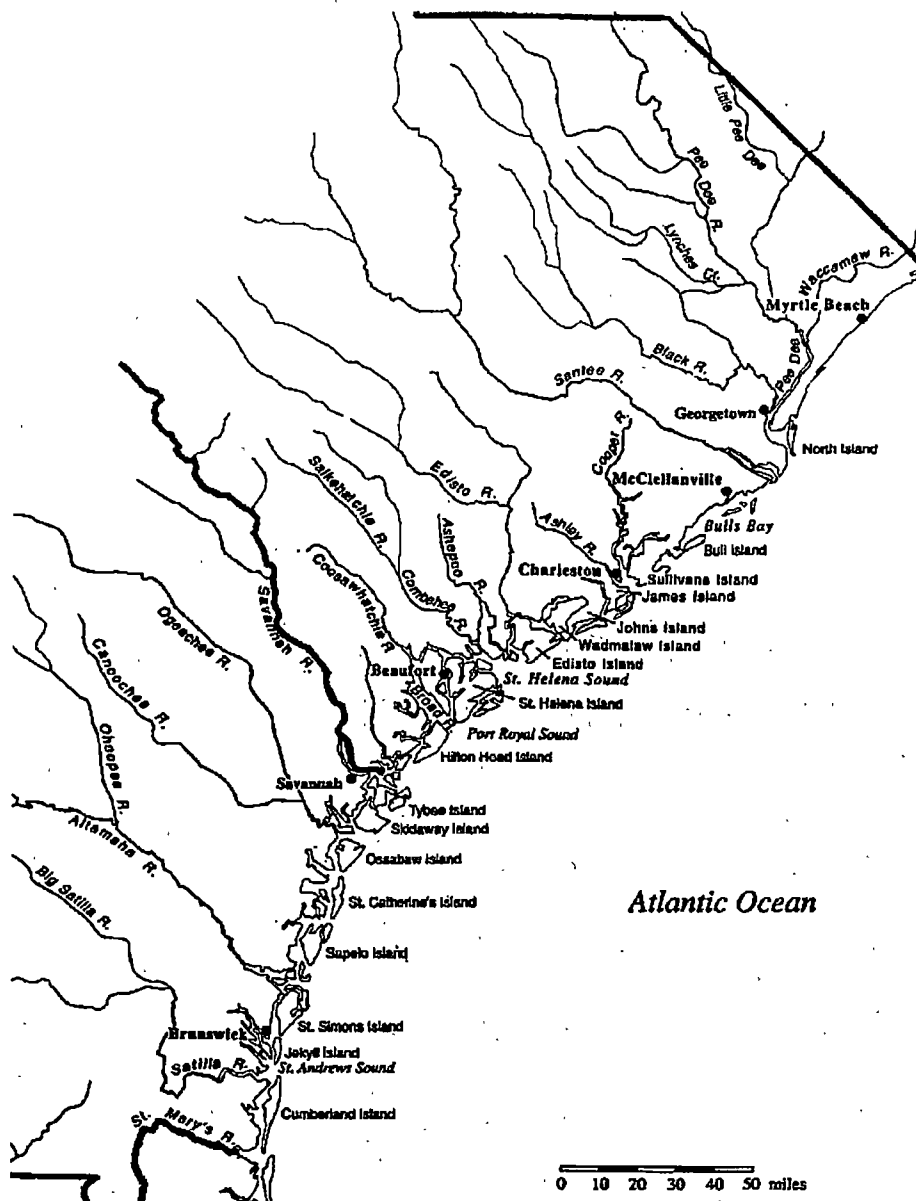


Figure 1: The Lowcountry and Sea Islands of Coastal South Carolina and Georgia
 © William S. Pollitzer. From Pollitzer (1993).

disease. The anthropological perspective has much to contribute to the study of disease through its holistic approach and attention to the interaction of biology and culture.

Most historical and anthropological studies of Lowcountry African origins identify numerous retained and creolized "Africanisms" that can be traced to various West African countries and cultures, reflecting the Lowcountry's complex biological and cultural heritage. For example, Turner (1949) classified nearly four thousand African words in his study of Gullah, the African creole spoken in the Lowcountry, into no less than 32 West African languages. While Hair (1965) and Hancock (1980) stress the parallels between Gullah and the Krio of Sierra Leone, Holloway and Vass (1993) propose a strong linguistic influence of Bantu languages. Studies using historical records of the importation of enslaved Africans to the area reflect an early importance of peoples from Central West Africa (Angola, Congo) that gave way to a predominance of peoples of Upper Guinea (Senegal, Gambia, Sierra Leone) (Donnan, 1928, 1935; Curtin, 1969; Littlefield, 1981, etc.). It is clear that study of Lowcountry African heritage is complicated by its multifaceted history and numerous ancestral groups. Each hypothesis of particular influence can be debated by a separate line of cultural or historical evidence.

Perhaps the most publicized study is Opala's (1987) report of a significant cultural and linguistic link between the small country of Sierra Leone and Lowcountry "Gullah" and "Geechee" communities.¹ This work received extensive media coverage that popularized Opala's theories in the Lowcountry and Sierra Leone. Although slaves were brought from many regions of West Africa, Lowcountry planters preferred laborers from

¹ "Gullah" is often used for South Carolina's African American people, language and culture, "Geechee" for those of Georgia. However, Pyatt (1999) suggests "Geechee" is the proper term for *all* people (regardless of region) who speak a language and participate in the *culture* properly called "Gullah."

regions along Atlantic West Africa, specifically present-day Senegal, Gambia, Guinea-Bissau, Guinea, and Sierra Leone. Opala proposes that a very large number of Lowcountry slaves came from the relatively small area of Sierra Leone (Figure 2) and that the two regions therefore have a special historical and cultural relationship.

The Lowcountry/Sierra Leone relationship generated great interest and pride in Gullah/Geechee heritage and a feeling of kinship between Lowcountry African Americans and the people of Sierra Leone. However, with such extensive publicity comes the danger that the public may perceive the link with Sierra Leone as an *exclusive* bond to West Africa. Because other African connections to the Lowcountry have been somewhat neglected, this study tests other proposed associations between West Africa and the Lowcountry using biological evidence. Although cultural traits can be transmitted both between and *within* generations and can change over one's lifetime, genetic traits are

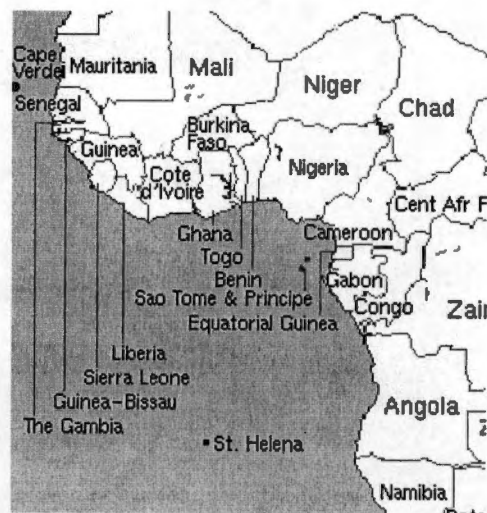


Figure 2: Countries of the West African Coast

received *only* from a previous generation and are much less susceptible to alteration.²

Therefore, biological investigations provide evidence of a more linear inheritance between ancestral and contemporary populations than cultural or linguistic studies. This more direct evidence may shed new light on the question of Lowcountry African origins and generate interest in West African contributors to Lowcountry biological and cultural heritage that received less attention from the popular conception of history.

While cultural and linguistic studies dominate the Lowcountry literature, some studies of the physical heritage have been conducted. The most prolific investigator is William S. Pollitzer, whose personal and collaborative research utilizes anthropometric and genetic data such as ABO blood groups, red cell antigens, prognathism, skin pigmentation, body dimensions and other physical traits (1957, 1958, 1972, 1988, 1991, 1993, 1999; Pollitzer et al., 1964, 1966, 1970; Pollitzer and Anderson, 1989; Anderson and Pollitzer, 1989; Keil et al., 1992, 1993). These analyses document a greater retention of African phenotypes among Lowcountry blacks compared with other African Americans. This is attributed to a lesser degree of European admixture. Among African Americans, Lowcountry blacks are the most morphologically and genetically similar to West Africans (Pollitzer, 1957, 1958).

This study builds upon Pollitzer's work, testing hypotheses of Lowcountry biological affinity suggested by historical, cultural, and linguistic data. The genetic component of this study is based upon a contemporary sample gathered through the Medical University

² Genes that code for predispositions or potentials are affected by the environment to various degrees through phenotypic selection. However, these phenotypes are not nearly as labile as culturally inherited thoughts, ideas, and behaviors.

of South Carolina, while the anthropometric investigation uses data gathered by Pollitzer in the 1950's.

EXPOSITION OF THIS WORK

Part I of this work is comprised of three chapters that summarize the history, cultural traditions, and previous studies of the African American communities of the South Carolina Lowcountry. Chapter 1 outlines the economic development of the Lowcountry, which directly influenced the pace and pattern of slave trade to the region. Import and export records, plantation inventories, and business correspondence between slave traders commonly list slaves with descriptions of their language or nationality or mention preferences for laborers. It is naive to assume that participants in the slave trade were unaware of or uninterested in differences between African peoples. Chapter 2 describes regional planter preferences for African laborers and examines the contributions of individual West African regions to the Lowcountry gene pool. Cultural elements and traditions may also be used to gain insight into the identity of the enslaved Africans brought to the United States. The abstract nature of culture makes this a difficult endeavor. Nevertheless, several studies report intact cultural elements (music, arts, language) that have survived cultural evolution and creolization in the American South and areas of West Africa. Chapter 3 describes these studies and addresses the issues of creolization and African "survivals" in Lowcountry culture.

Part II of this work is prefaced by a hypothesis of Lowcountry African American affinity based upon the information in Part I. It explores physical indicators of ancestry and the health-related consequences of the pan-African/European hybridization that gave

rise to African American populations. In the early part of this century, medical discoveries such as polymorphic red blood cell antigens and abnormal hemoglobins became valuable tools for describing populations and documenting past human migrations. Since the introduction and development of technology for molecular genetics, differences in the genetic structures between human groups (and among individuals) have been employed for the same reasons. As explained in Chapter 4, the goals of anthropology and medicine coincide when they consider the causation and distribution of disease. Deciphering a population's genetic history and relationship to other groups is essential to understanding how an individual's genome and environment interact to prevent or allow the onset of diseases such as diabetes, heart disease, and cancer.

Chapter 5 presents a brief introduction to abnormal β -globin haplotypes and their utility in studies of African American ancestry. If an individual has sickle cell anemia (Hb SS), the homogeneity of these markers within major regions of Africa provides a unique opportunity to trace at least two of that individual's ancestors to their origin. The chapter describes the materials, methods, and results of the genetic investigation. Chapter 6 examines the anthropometric affinity of Lowcountry African Americans using comparative metric data from available African populations. Calculated generalized distances between populations provide measures of population affinity that are illustrated by plotting the principal coordinates for each sample. Multivariate analysis of variance (MANOVA) is used to determine statistical differences and similarities between the African and Gullah populations for metric measurements and assess the degree of West African morphology present in the mean Gullah African American phenotype. The final

chapter presents conclusions concerning Lowcountry ancestry based upon the results of Chapters 5 and 6 and offers considerations for future research.

PART I
Population Origins and History

Chapter 1

Lowcountry Agricultural and Economic History

Charles Town,¹ the main center of the (South) Carolina colony, was established in 1670 as an extension of the successful plantation system of the British West Indies. The colonial settlers brought not only their British agricultural methods, but also enslaved African laborers to build their settlements. A well-developed plantation culture was transplanted in Charles Town and subsequently adapted to the characteristics of its new environment. The Afro-Caribbean flavor of Lowcountry life and culture is the result of this Caribbean settlement and its dynamic interaction with other European and American influences. The development of the unique Lowcountry character is best explained by an examination of the region's social and economic history from colonization up to the Civil War.

When describing the history of South Carolina, it is difficult to avoid a bias toward Charles Town. The city served as the colony's base of operations and overshadowed other Lowcountry agricultural centers such as Beaufort and Georgetown:

... Charles Town practically embodied all of Carolina... Thus, until the immigration of the Scotch-Irish and Virginians into the upper country by the way of the mountains... the development of the colony was... from one point, —the town—, Charles Town. —McCrary, 1897:7

However, it is important to note that the Charles Town colony included all settlement in the Lowcountry prior to the American Revolution.

¹ The British colony was established under the name "Charles Town," but became "Charlestown" when the Royal government was instituted in 1719. After 1783 the city is referred to by its contemporary moniker, "Charleston." For convenience "Charles Town" is used throughout the chapter.

CHARLES TOWN, SOUTH CAROLINA

In 1629 King Charles I of England granted Sir Robert Heath the right to colonize all lands between the 31st and 36th parallels of North America. Despite his few half-hearted attempts, Heath failed to establish a successful colony as required by his charter and it was nullified thirty years later. In 1663, the rights to "Carolina" were jointly awarded to eight prominent aristocrats in recognition of their "pious zeal for the propagation of the Christian Faith and the Enlargement of our [British] Empire and Dominions" (McCrady, 1897:50). In 1665 the grant was extended to include lands from the 29th to just past the 36th parallel (Figure 3). The charter established a proprietary government modeled after the British system, allowing the proprietors liberal viceregal powers, providing their laws did not contradict those of Britain.

Following an unsuccessful attempt at colonizing Cape Fear in 1665, the proprietors established their first permanent settlement in South Carolina in the spring of 1670. Three shiploads of British settlers (less than 200 individuals) chose to build their community (often referred to as "Old Town") on the west bank of the Ashley River because it seemed well suited for farming (Smith, 1903). In 1689 the growing population prompted the colonists to move to Oyster Point at the intersection of the Ashley and Cooper Rivers, the site of present-day Charleston (McCrady, 1897).

The Barbadian Influence

The character of colonial Charles Town was greatly influenced by migrants from the plantations of the British West Indies, most particularly those from Barbados. Although

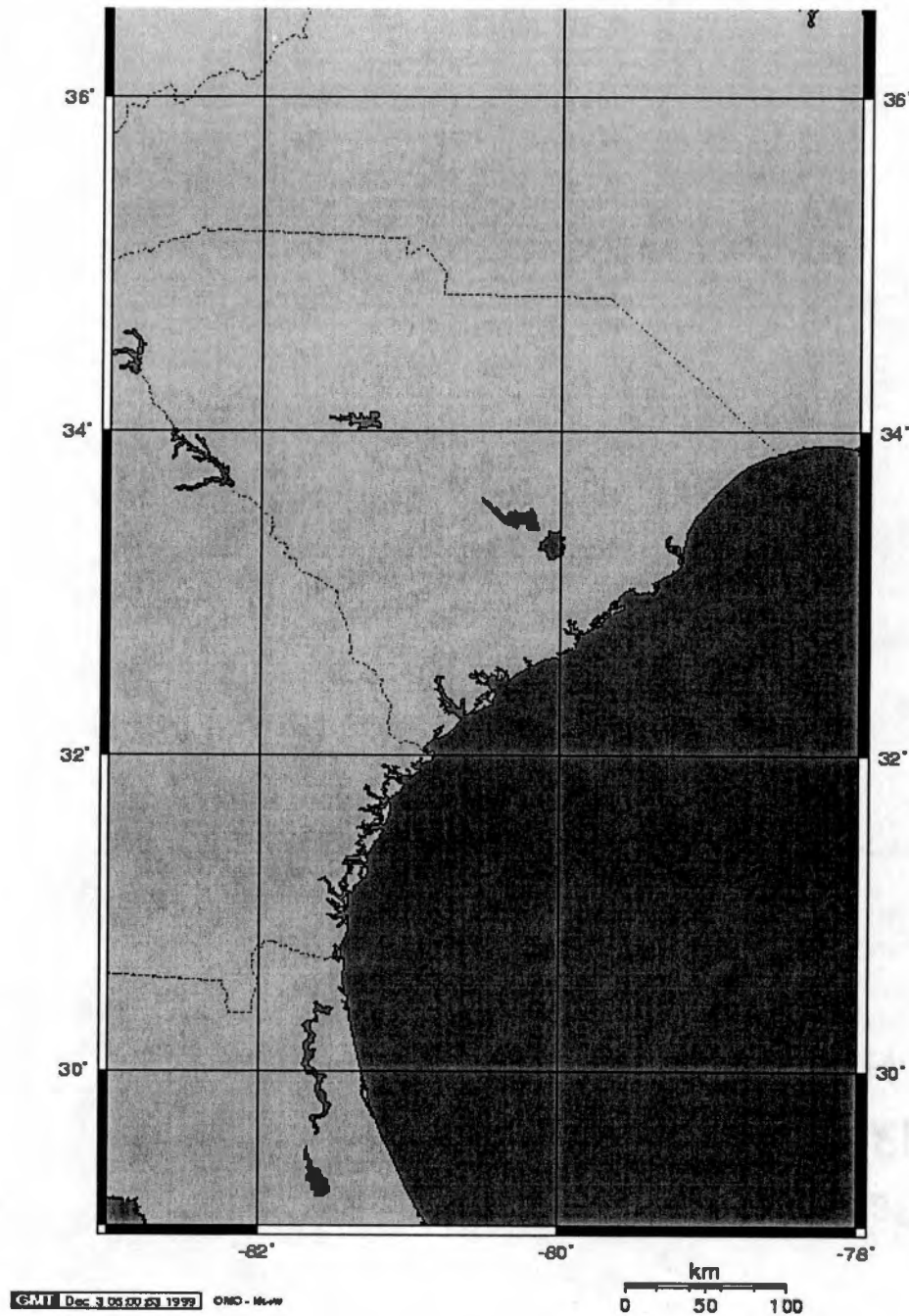


Figure 3: The 1665 King's Grant "Carolina"

The 1629 grant included lands between the 31st and 36th parallels.
 The 1665 grant extended from the 29th to just past the 36th parallel.

Image created using GMT by Wessel and Smith (no date)

the British colony in Barbados was a financial success, its colonists endured the hardships of hurricanes, continual political scuffles and intrigue, and the constant threat of slave insurrection. As a result, Barbadian planters often chose to be absentee owners, entrusting their Caribbean business interests to overseers while enjoying the stability of their native Britain. However, during the British Civil War many fled from Britain to their plantations to avoid persecution for their loyalty to Charles (McCrary, 1897).

The Caribbean planters became frustrated by the lack of opportunities to expand on the islands, and many loyalists petitioned the crown to relocate. In 1663 King Charles issued a charter for a New World colony of (South) Carolina. As an incentive to attract colonists, the charter established a proprietary government with resident statesman empowered to oversee local matters in the best interest of the King. Prospective colonists were tempted by the promise of *laissez faire* economic policies and almost unlimited virgin land for development and expansion (McCrary, 1897). Carolina's economic attraction drew many experienced planters to the venture. In many cases successful fathers financed estates for one or more of their younger male children. Following British custom the eldest son inherited all property, leaving younger male siblings to fend for themselves. This patriarchal assistance created influential dynasties of planters. Not surprisingly, many historically important and recognizable family names were among the first Barbadian settlers, including at least two "Middletons" and one "Drayton" (McCrary, 1897).

As a North American colony, Charles Town was quite different from its counterparts. Contact with the northern Jamestown and Plymouth colonies was hampered

by the geographic barrier of Cape Hatteras, which made even maritime access to the northern Atlantic coast problematic. It was actually less hazardous to reach England and the West Indies, which therefore became the main economic and cultural centers for Charles Town residents (McCrady, 1897). The proximity of the Caribbean colonies contributed a continuing influence on Charles Town and strengthened ties between the two regions (Figure 4).

This relative geographic isolation forced the Charles Town colonists to be self-reliant from the beginning. No British colonies could reach them in case of attack by hostile European or indigenous forces. The French were secured to the west along the Mississippi and the Spanish maintained a stronghold in St. Augustine to the south. While Spain acknowledged British rights to North American lands, they had not conceded land for colonization. Charles Town was therefore considered a trespass on Spanish territory. The ever-present danger of attack kept the Charles Town population centralized near the fortifications, creating a distinctly urban center. Rural development did not begin until the European population experienced a boom in the 1750s and 60s, encouraging settlement in the more inland regions of South Carolina (McCrady, 1897).

A grassroots movement overthrew the proprietary administration and pledged the colony to a royal government in 1719 (Smith, 1903; McCrady, 1897). Coupled with the prosperity of Charles Town, the greater involvement of the Crown encouraged further British settlement along the southeastern coast. The royal government planned to simultaneously expand their original agricultural empire and protect Charles Town by placing a military buffer between Carolina and Spanish St. Augustine. The Georgia

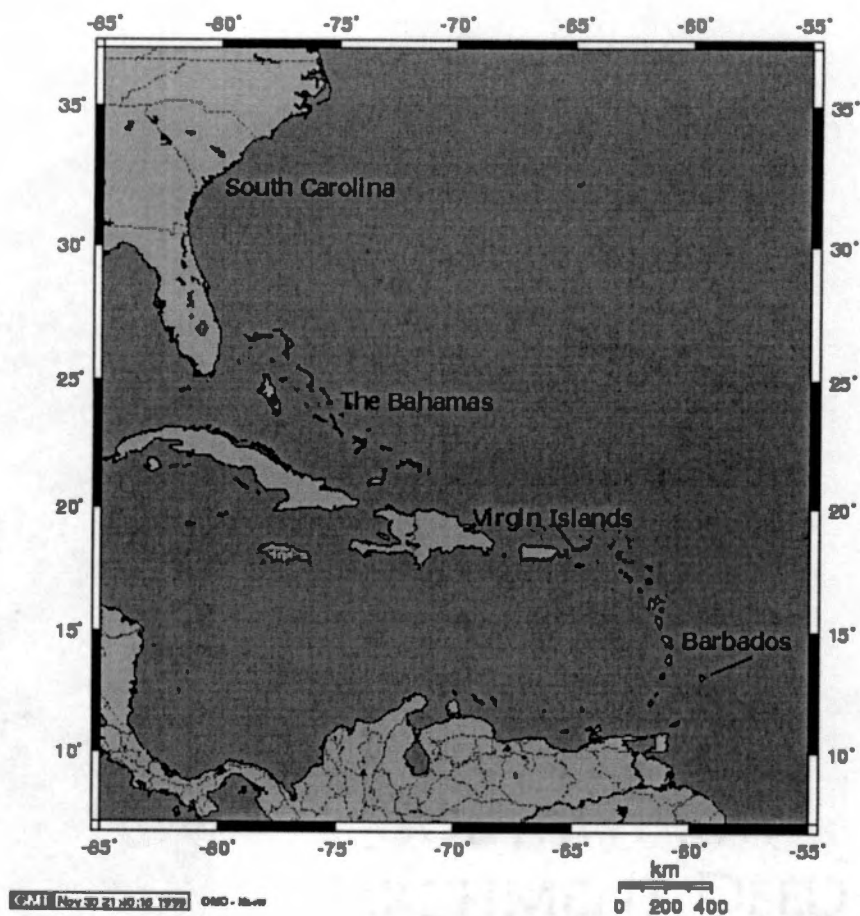


Figure 4: Proximity of South Carolina and the West Indies

Image created using GMT by Wessel and Smith (no date)

colony was established in 1733 to serve this dual purpose. However, Charles Town's business interests intricately linked the fortunes of the two colonies. This association between Georgia and the South Carolina economy was a catalyst for many important events in the Lowcountry's colonial history.

The Charles Town Economy

South Carolina is geographically divided into two distinct regions: the Upcountry, the northwestern region characterized by hills and rocky soil, and a Lowcountry consisting of lush semi-tropical swamps and flat terrain (Figure 5). Although the area in between is sometimes called the Midlands, it is vaguely defined geographically. As one would expect, differences in topography led to infrastructural differences that greatly impacted the culture and history of the Lowcountry and Upcountry regions.

The more difficult agricultural demands of the Upcountry meant that most families subsisted and generated only small excesses for sale. This situation favored small family-run farms with low operating costs. Most Upcountry farmers were unable to afford slave labor. Those that were able to purchase slaves could seldom afford to purchase, house and feed more than a few slaves. As a result the Upcountry had roughly equal numbers of Africans and Europeans participating in its economy, although in many regions the African and Creole² populations were much smaller than the European populations.

² While the term "Creole" is often used in reference to individuals of French and/or Spanish descent, scholars of African American history and culture often use it to distinguish the cultural affiliation of peoples of African ancestry. *Africans* are individuals whose worldview was formed by traditional African influences in their homeland. By comparison, *Creoles* are individuals of African ancestry whose worldview was shaped by various African, Native American, and European influences under the social and cultural pressures of enslavement. These terms are used in this manner throughout the manuscript.

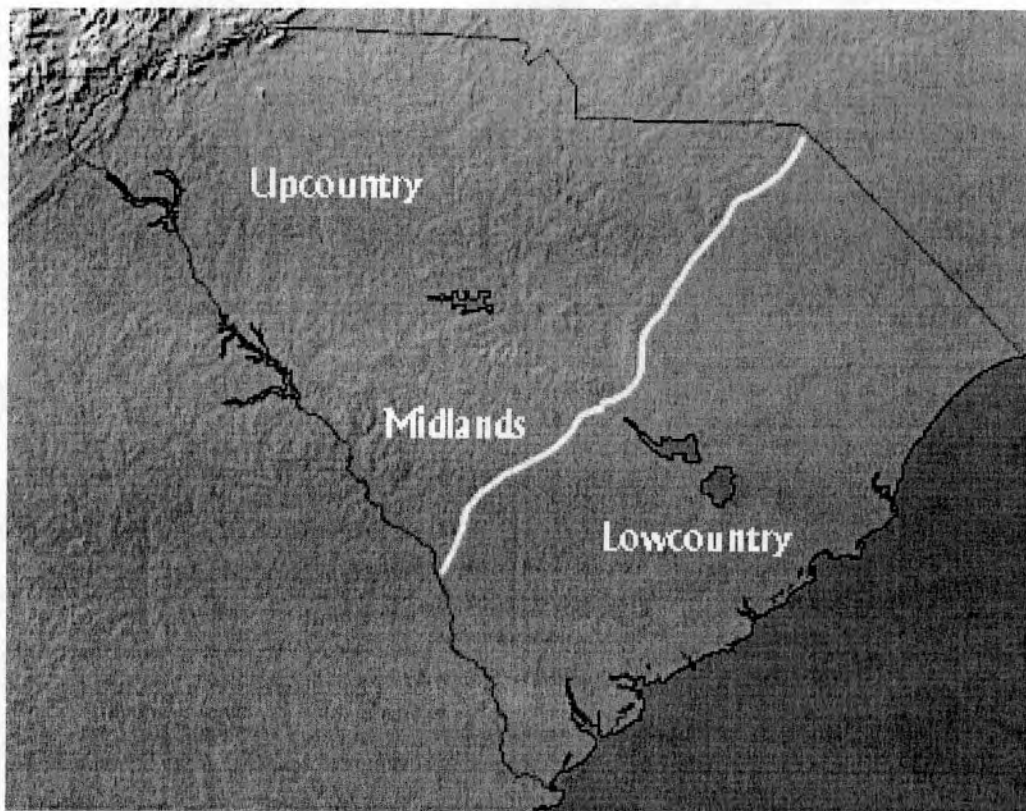


Figure 5: South Carolina Topographic Regions
Map altered from Sterner (1999)
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Johns Hopkins University Applied Physics Laboratory.
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In the fertile Lowcountry, especially the Sea Islands and coastal regions, production of wealth-generating crops was limited only by the amount of land in active cultivation, which was in turn limited by the number of available laborers. Planters with large estates earned large profits from their crops and were then able to afford more slaves. This generated a cycle of increasing capital that led to the concentration of money, power, and land in the hands of a small number of planters. The Lowcountry was home to some small plantations, but they were the minority. The large plantations boasted hundreds of laborers, so Africans and Creoles greatly outnumbered the Europeans who supervised their labors.

The introduction of intensive rice cultivation spurred manual expansion of natural swamplands, creating an environment that favored the *Anopheles* mosquito, a vector of malaria. The migration of African laborers from Barbados also introduced yellow fever, a disease previously unknown in North America (Cook, 1998). Europeans had no natural immunity to either of these lethal afflictions. Planters were either unwilling or unable to reside on their estates year-round. Many retreated to the urban centers (especially Charleston) during the wet and hot seasons, which spanned from May through September. This fashioned a tradition of absentee ownership quite different from that in the Caribbean. Planters rarely returned to Europe, remaining within traveling distance from their plantations, returning periodically to review business matters with their overseers and drivers.

Upland and middle country crops did not bring the high market prices of the coastal crops, making it more difficult for planters in those regions to amass large labor forces

like those held by rice coast planters. This was also true for small farmers with dreams of building a lucrative rice plantation. Without a large labor force one could not successfully bring a rice crop to harvest. It follows that one could not generate enough profit to maintain an estate through the following planting and growing seasons. For this reason, large estates eventually absorbed lands held by small planters, and some of the more influential planters acquired a number of large estates (Flanders, 1933:107). More commonly, well-established families boasted plantations belonging to several male members of the family, creating aristocratic dynasties of sorts. Few, if any Lowcountry plantations, were owned by self-made men from humble beginnings.

The first exports from the South Carolina plantations were pine tar and pitch, naval supplies that found a ready market among importers, exporters, and the shipbuilders in the colony and in the West Indies. Following some successful small-scale cultivation of upland dry rice to the north in the Chesapeake area of Virginia and Maryland, rice cultivation was unsuccessfully attempted as a complement to maritime supplies. Tobacco grew well in Carolina, but Virginia had an established stronghold on the market and increased supply would flood the market and decrease profits for all.

Attempts at indigo cultivation in the period before 1682 were largely unsuccessful. However, after much experimentation a successful cultivation method was developed, providing the colony with a crop quite literally worth its weight in gold. In the years prior to the American Revolution, indigo was in feverish demand for Britain's burgeoning textile industry.

The Caribbean colonies provided an excellent market for Carolina's meat, and cattle

and pigs could range free in the woods with only minor supervision and limited investment (McCrary, 1897). As is common in several African tribes, young children were often responsible for these animals. At least one author (Wood 1974a) has suggested the American term "cowboy" may have been coined in reference to these young animal keepers. Most of Carolina's products were marketed in the West Indies rather than England due to the proximity and lucrative market prices.

The ultimate failure of the naval stores market and the introduction of Carolina Gold rice to the colony at the end of the 17th century spelled a turning point in South Carolina's plantation economy, focusing major investors on the rice trade (Hess, 1992).³ Land suitable for growing Sea Island rice and cotton is limited to a narrow band along the Atlantic coast from South Carolina to northern Florida. These tidewater areas are characterized by pine barrens, salt marshes, and swamps criss-crossed by small freshwater streams and creeks. Freshwater tides were used for irrigating the rice paddies, providing riverine plantations conditions most conducive to rice cultivation (Smith, 1985:4,11).

The shift to intensive rice agriculture made a massive labor force necessary to maintain the complex irrigation systems and keep the numerous paddies free of weeds that threatened to choke the rice seedlings. As the colony and agricultural sector matured, the huge profits and improved infrastructure mitigated the cost of the necessary labor force. European powers had been invested in the African slave trade for centuries by this time, providing a ready source of the necessary labor. By 1720 the slave trade had

³ See Tibbetts (1999) for an excellent review of the economic boon rice brought to South Carolina.

provided so many laborers to South Carolina that the number of Africans exceeded that of Europeans by more than three thousand (Anstey, 1975: Wood, 1974a). The introduction of the tidal flow method of irrigation in 1750 revolutionized North American rice agriculture (Smith 1985:21). Attendant changes in legislation opened the European market to South Carolina's rice, presenting unequalled opportunities for profit.

The American Revolution (1776-1783) took a great toll on South Carolina and Georgia, which sustained more infrastructural and property damage than other states (Boles, 1983:59). Satisfied with their economic position, many planters remained loyal to the crown and subsequently lost their lands to the new American government following the British defeat. Those who retained their holdings experienced an economic depression caused by a decline in rice and indigo harvests, two of the most important cash crops. An immediate cause of this depression was the loss of enslaved laborers to the British Army, which promised to liberate all slaves that fought for the British cause. Of more long-term concern, the South lost its largest consumer of North American indigo exports, i.e., the British Crown, as well as European markets under British influence (Flanders, 1933:55).

This recession turned planters' attentions to other crops such as long-staple cotton that would grow only in along the coastal strand, and short-staple cotton, which would grow in all regions of the South. The introduction of Eli Whitney's cotton gin in 1793 greatly reduced the labor needed to remove the seeds and the fiber from the short-staple cotton plants. This invention encouraged cotton cultivation in all areas of the state and revitalized the failing Southern economy (Bancroft 1959:9). However, Sea Island cotton

was a more valuable commodity in the textile market than the short-staple variants. This gave the planter aristocracy a "King" cotton to accompany their "Queen" rice and allowed them to accumulate more capital. These developments had many effects on Southern society and history, including political developments in Georgia.

GEORGIA

When studying the South Carolina rice culture one cannot ignore the role played by coastal Georgia, as the two regions are intricately linked through economics and culture. The coastal strand retains its character across the state border into Georgia. Although the geographic distinction between the states is negligible, the political demarcation restricted the rice aristocracy of South Carolina to the northernmost islands of the strand until Georgia legalized slavery in 1750. From that point onward, the Georgia Lowcountry was, for all practical purposes, an extension of the South Carolina plantation system. Just as the Barbadians transplanted their culture and society in Charles Town, the Carolina planting elite brought the social, ideological, cultural, and economic elements of their world to Georgia, resulting in parallel societies in both regions' European and African/Creole communities.

Georgia was Britain's 13th North American colony and the first to prohibit slavery. The colony's trustees were not abolitionists, and in fact, many were themselves slaveholders. Slavery was not forbidden because of humanitarian issues, but rather for an experiment in social reform. (See Wood, 1984, for an extensive description of the founders' ideology.) By banning slave labor, Georgia's proprietors hoped to avoid the

status distinctions that existed elsewhere (i.e., Charles Town) between aristocratic planters and the lower-class farmers. They also wished to escape the recurrent waves of fear that swept through slave-holding colonies at each rumor of insurrection.

Furthermore, the Spanish openly accepted runaway slaves into their territory and British planters lost all claim to slaves once they left British soil. Since Georgia bordered Spanish Florida, it was believed that planters would be financially ruined by losing large numbers of slaves to freedom in *La Florida* (Flanders, 1933). However, due to their location between British and Spanish colonies, Georgians were expected to protect their northern British neighbors, acting as a standing militia to suppress attacks by Spanish forces.

The utopian plan for the colony necessarily limited the economic opportunities and enterprises open to Georgians. European indentured servants were the basis of all labor, so crops that required large labor forces were impractical. Unlike slaves, indentured servants were contracted to provide labor for specified periods of time. More importantly, if an indentured servant decided to run away from his/her indentured service, the contractor could make no legal claim on their investment. Simply put, indentured servitude resulted in a more expensive and less stable work force. However, even if the system were somehow stabilized, rice cultivation would have quickly decimated the European labor force through malaria and tropical fevers.

To counter these limitations, Georgia's trustees promoted silk and indigo cultivation and the timber trade. Despite these noble intentions, the colony failed to prosper. Georgians grew increasingly resentful of Charles Town's flourishing economy and

argued that slavery must be legalized if Georgia was to compete in the New World financial market. Despite the prohibition of slavery, many Georgia planters risked importing illicit slave labor. Slaves were purchased in neighboring colonies and "passed off" as hired labor (Smith, 1985:18) if authorities questioned their hiring practices.

Prominent businessmen repeatedly petitioned the colonial authorities to repeal the ban on slavery. The third petition request was approved in 1749 and slavery became legal the following year (Flanders, 1933). As expected, slave labor spurred the colony's economy and transformed it into an agricultural power that rivaled Charles Town. However, those profiting from the fertile lands of the Georgian seacoast were not necessarily those who had struggled through the frail economy based upon European labor. The legalization of slavery attracted South Carolina's planter elite. Most Georgians lacked the capital and labor needed to clear the swamps for cultivation, but planters from South Carolina and the West Indies were able to invest profits and slaves from their existing holdings to develop estates in Georgia (Smith, 1985:36; Wood, 1984:108). Liberal land grant laws further encouraged the expansion of the South Carolina rice regency to Georgia. While soil depletion and operational costs were increasing in South Carolina, the Georgia government was allotting land to individuals based upon family size, which by definition included enslaved laborers. Each migrant family could claim a maximum of 1000 acres (Smith 1985:24,34). With their expansion into Georgia, the South Carolina aristocracy tightened its hold on the North American rice market (Flanders, 1933).

The success of Georgia's coastal plantations was basically assured. Most planters were born to the plantation, experienced in management and possessed of the contacts necessary to market their crops with maximum profit and expediency. Whatever the cause, Georgia rice fields out-produced those in South Carolina by an average of five to ten more bushels per year (Smith, 1985:9).

As in South Carolina, Georgia's African and Creole populations were most concentrated along the rice coast, particularly in Chatham, Liberty, and Richmond counties in the northwest region of the state (Flanders, 1933:52). In Georgia, the census records for 1850 show 551 rice plantations worked by 125,000 resident slaves. These figures reflect an average of 226 slaves per plantation (Smith, 1985:9). As shown in Table 1, enslaved laborers were concentrated along the coastal rice-growing regions. In the more uplands, whites outnumbered blacks by almost three to one, while the reverse was true for the Lowcountry. While Georgia's slave population grew quickly in the 18th century, it never rivaled that of South Carolina. By 1773, Georgia's population consisted of roughly 16,000 enslaved Africans, compared with South Carolina's population of 110,000 (Smith 1985:98). The next chapter explores the ancestry of these enslaved laborers through a discussion of the African and domestic slave trades.

Table 1: Georgia Demography, 1790

	Coastal Region	Upland Region	Total
Blacks	13,419	16,127	29,546
Whites	5,857	46,154	52,011
Total	19,276	62,281	81,557

(Flanders, 1933)

Chapter 2

Lowcountry Slavery

Throughout human history, race and slavery became synonymous only in the New World. Although early colonists utilized Native American slave labor, exposure to European diseases quickly decimated their populations. Those that survived were often described as frail laborers, discouraging widespread enslavement of surviving indigenous peoples. Similarly, the use of indentured European servants proved to be a financial gamble since there was no way to enforce the agreement if a servant failed to honor her/his contract once they reached the colony. The Atlantic slave trade was well established by the time South Carolina and Georgia were founded, making the acquisition of labor more a concern of cost than one of ethics. Servitude denied bondsmen and women all human rights and was cancelled only by the direct decree of the owner or the slave's death. Slaves were considered property and all of their children were born into slavery.

The previous chapter outlined the major economic and historical events that influenced the slave trade in South Carolina and Georgia, providing a basic sketch of the dynamics that led to the region's reliance on human commodities. Economic concerns were of paramount importance in all sectors of plantation life, and the choice of labor was no exception. Lowcountry planters preferred *particular* Africans to work their lands based upon perceived regional characteristics of behavior and temperament, personal beliefs, and economic considerations. These preferences often dictated the pattern of the African slave trade and subsequently influenced the composition of the contemporary

African American population. Is it possible to use characteristics of the contemporary population to identify its ancestral populations? This study seeks to answer that question by comparing the characteristics of African Americans from Lowcountry South Carolina with populations known to have contributed to their genome. The history and unique features of the Lowcountry slave trade provide the basis for selecting comparative populations and the generation of hypotheses that can be tested by scientific investigations of physical characters.

THE AFRICAN SLAVE TRADE

As an extension of the West Indian plantation system, the South Carolina economy relied upon slave labor from its inception. True to its heritage, South Carolina slave code was based upon that written by Barbados, and some parts were even copied verbatim (Henry, 1914: 4). The planters brought contingents of their Caribbean slaves to clear the land and build their new agricultural empire. However, most employed small numbers of slaves due to the limited number of Europeans available to supervise and the expense of maintaining a large labor force.

The first record of Charles Town slavery shows that Carolina's first Proprietary Governor listed a number of slaves among his wife's possessions when they settled in Charles Town in 1671 (Higgins, 1971). At its founding, Charles Town was sparsely populated with approximately equal numbers of blacks and whites. The subsequent development of the South Carolina plantation system required more labor, and its staggering success increased the demand for workers. This series of events shaped a colony that was described by a Swiss visitor in 1737 as "more a Negro colony than a

white one” (Wood, 1975). By 1680 the colony was home to nearly 1,200 European settlers, which grew to approximately 5,500 by the turn of the 18th century. The numbers of enslaved Carolinians was not recorded until 1708, but by that time they already outnumbered the European settlers (McCrary, 1897).

In the early period of the colonial slave trade, importation of Africans from the West Indies was a logical development given the relationship between the two colonies. In addition to the relative proximity, many Charles Town planters were former Caribbean planters or were of planting families. British interests established trade routes from Europe and Africa to the Caribbean and the southeast coast of North America. This strengthened ties between all parties and provided regular shipments of enslaved laborers to the colonies.

The local trade with the West Indies provided benefits other than kin-based commerce. The so-called “seasoning” of slaves to the hard labor and practices of the plantation system was thought to insure that bondsmen would be prepared for the grueling conditions of Lowcountry agriculture. Africans were also exposed to the English language during their tenure in the West Indies. Therefore, laborers imported from the Caribbean were preferred over direct imports from Africa. This preference was soon abandoned as the South Carolina planters grew to suspect that slaves sold to them by Barbadian planters were either “lazy” or rebellious individuals who troubled their former owners. These beliefs led to a distinct preference for slaves imported directly from Africa.

Changes in import fees further encouraged the direct African trade at the expense of the Caribbean trade. This was no accident, as the colonial authorities thought the liberties

allowed West Indian slaves encouraged rebellion.¹ Higher taxes were designed to discourage the import of these purportedly dangerous individuals, resulting in fees that were several times higher for Caribbean imports than for Africans. For example, in 1716 the proprietary assembly collected a tax of £3 for each African slave imported to the colony, compared with £30 for those from the West Indies (McCrary, 1897). Because the economic benefit of direct importation outweighed the possible disadvantages of unseasoned laborers, the colonial slave population was predominantly African-born (Higgins, 1971). Importation of enslaved Africans continued throughout the plantation era, but the natural increase of the black population provided an additional source of labor through the domestic slave trade.

Federal laws banning the foreign slave trade took effect in 1803, but South Carolinians ignored the legislation and continued the practice until 1808. In the last four years of the trade, an estimated 39,075 African slaves were sold in Charles Town (Collins, 1904; Bancroft, 1959; Henry 1914).² Although the domestic slave trade was already growing, the illegal slave trade brought an estimated 250,000 individuals to the United States between 1803 and 1862, flooding the Southern market (DuBois in Collins, 1904:14-20). So many illegals were imported that some were taken to the West Indies for sale (Collins, 1904:21).

¹ Following the American Revolution West Indian plantations were faced with a growing social and economic movement by the enslaved who had (of war-time necessity) begun to grow their own crops and establish large open-air markets and a burgeoning trade economy amongst themselves (Harrison, 1999).

² Cited from "Speech of Senator Smith, of South Carolina, in the United States Senate, Dec. 8, 1820. Annals of Congress, 16th Cong., 2nd Sess.," p. 77. See also Collins (1904), pp. 11 and 39.

Planter Preferences for African Laborers

While they understood the economic promise of Carolina rice, European planters were not familiar with the many methods of its cultivation. It has only recently been recognized that the unparalleled success of the South Carolina rice economy was the result of not only African labor, but also a product of African knowledge and intellect (Wood, 1974b). Historic records and personal documents show that many planters held the abilities of their slaves in high esteem (Hudson, 1997). Despite these accounts, intellectual contributions made by slaves were ignored, downplayed, or dismissed in post-emancipation descriptions of the antebellum economy and have only recently been addressed in the mainstream literature. Enslaved Africans possessed advanced skills in wood and metal work, ceramics, and textiles, among others (Joyner, 1979:445). For a planter, having skilled bondsmen in one's labor pool was a sign of prestige as well as a source of profit. Talented craftspeople were often hired out by their master or were allowed to arrange for their own employment. While the money from these arrangements was usually paid directly to the planter, in many cases craftspeople were able to live almost as free persons of color as long as they continued to generate revenue.

Scholars have recently begun to focus on the contribution of African agriculturists, especially those of the Windward and Guinea coasts (Figure 6) who were familiar with both upland dry rice and tidal rice crops:

... various African groups—Malinke, Soninke, Serer, Joola, Balante, Kisi, Papel, Baga, Mende, Temne, and others—were conversant with numerous varieties of rice, both African and Asian, and with various methods of rice cultivation, some of them quite advanced. It is also evident that knowledge of rice production was widespread in West Africa, centering along the Niger in the interior and along the littoral in the tropical rain forest. —Littlefield, 1981:98

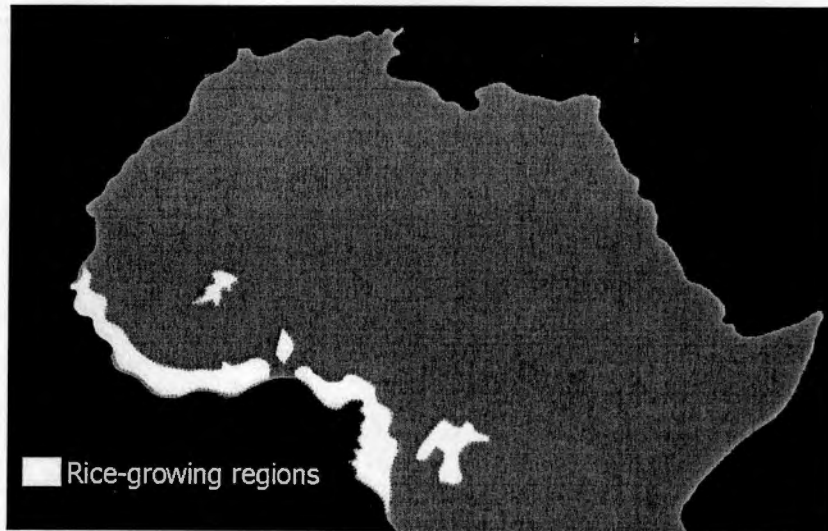


Figure 6: Rice-growing Regions of West Africa

Adapted from Littlefield (1995:20)

The skills and knowledge these peoples possessed made them particularly valuable to the Southern rice plantations. It is no overstatement to suggest that African knowledge, skills, and talents were primarily responsible for the success of the Lowcountry rice plantations.

Slave traders' personal and business correspondence and the emphasis placed on the origin of the slaves in handbills, newspapers, and other advertisements clearly show that Lowcountry planters expressed preferences for laborers from particular regions of West Africa (Figure 7) based upon perceptions of regional or tribal traits. In his letters, Charles Town slave merchant Henry Laurens stated that slaves from the Gold Coast were best, followed by those from Senegambia (Littlefield, 1981). Although available primary sources permute the order of preference, they usually refer to the same regions. Africans from the Bight of Biafra, specifically Calabars or Ibos, were a last resort for the Charles Town slave market. With their more yellow-tinged pigmentation and purported

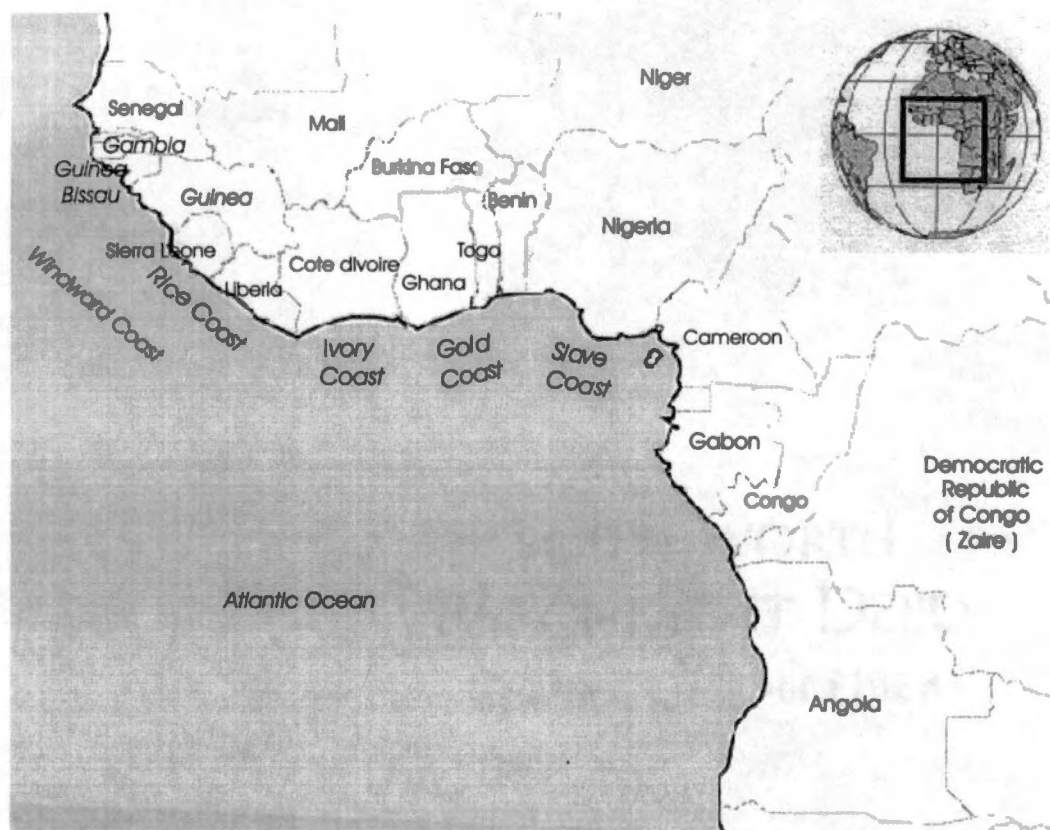


Figure 7: Slaving Regions of West Africa

Altered from Pollitzer (1999:35)
Inset from Foley (1998)

disposition to commit suicide rather than live as slaves;³ they were seen as risky investments (Curtin, 1969).

Several authors document the nearly universal change in South Carolinians' attitude toward Angolan peoples following the Stono Rebellion of 1739. A group of Angolan slaves commandeered firearms from a storehouse and went on a violent rampage through the settlement, burning planters' homes and killing more than forty Europeans along the way. Although they spoke of escaping to St. Augustine, where a significant encampment of runaway Africans was harbored, they were apprehended before they could flee the area (Mullin, 1992:43) The uprising caused all Angolan laborers to be perceived as rebellious. A three-year ban of the foreign slave trade was enacted following the revolt in an attempt to slow the growth of the colony's black majority. However, the demands of the plantation economy and the public's changing priorities led to the re-opening of the Atlantic trade, which continued through the turn of the nineteenth century.

The North American colonies represented only 10% of the British slave market in the New World. The sugar plantations of the Caribbean and Brazil had far greater death rates and far lower birth rates than the North American colonies and constituted a larger market for slave labor (Littlefield, 1981). The preferences of the Caribbean planters were therefore given precedence over those of their North American counterparts. Planters of the British West Indies preferred laborers from the Gold Coast, and almost 80 percent of British expeditions to that region marketed their captives in Jamaica (Littlefield, 1981:20).

³ Many African traditions held that committing suicide would return one's soul to its homeland (Piersen, 1977 citing Hawkins, 1797; Mullin, 1992:69.

As the largest North American market for slave labor, the needs of the Lowcountry plantations were evidently important to Britain. The relative accordance between the laborers preferred by Lowcountry and those imported to the colony attest to the slave traders' attention to profit opportunities and market demand. Noting that South Carolina planters were least desirous of Africans from the Bights of Benin and Biafra, Curtin (1969) presents evidence that shows that slave importation from these areas was among the smallest contributions to the Charles Town market.

Wood (1984:103) finds that documents from the (illicit) Georgia slave trade of the 1720s and 1730s used general terms to describe Africans, but following the legalization of slavery (1750) these accounts attributed particular behaviors and traits to national and ethnic groups. This is not surprising since most Georgian planters either relocated from South Carolina or purchased estates in Georgia as extensions of their Carolina operations. In the first years of Georgia's slave trade, laborers were often brought from the planters' existing plantations or purchased in Charles Town. Although slaves were sometimes available in Georgian ports, many planters preferred to fill their labor needs in Charles Town because the market was more established and was thought to have a better selection (Smith, 1985:24).

As slavery and the rice plantations of coastal Georgia grew, Africans from Gambia, Senegal, Sierra Leone and the Slave Coast were brought to Savannah for sale (Flanders, 1933:37; Smith, 1985:93-95). Using data reported by Donnan (1935) and Littlefield (1981), Wood (1984) presents evidence that Savannah traders supplied the same demand for rice agriculturists as Charles Town traders. Between 1766 and 1771, at least 76 percent of the 2,500 individuals offered for sale in Savannah were from rice-growing

regions, while only 10 percent were from Angola (Table 2). The smaller percentage of Angolan slaves reflects Georgia's later entry into the Atlantic slave trade relative to Charles Town, which imported a large number of Angolans in the years prior to the Stono Rebellion (1739).

Although the slave trade was primarily driven by market preferences, political and practical concerns (at home and abroad) ultimately controlled the availability of slaves in Africa and in turn, the pattern of importation throughout the Atlantic slave trade. Wood (1975) suggests that the large number of Angolans imported early in South Carolina's history reflect the market demands of the period. Unfortunately there is little chance to corroborate this possibility because records from this period are poor. It is equally plausible that this pattern reflects the relative stability of the political systems in Angola and Congo, which allowed easier and more reliable access to African slave markets (Anstey, 1975).

Markets along the Windward and Gold coasts were subject to more political upheaval and ethnic disputes than other slaving areas. At times, such instability increased trading opportunities. For example, the *jihad* waged by tribes of Sierra Leone against their neighbors between 1720 and 1740 provided a large number of war prisoners for sale into slavery (Curtin, 1969). Likewise, political unrest could also cause declines in slave availability because each political event could change the area's affiliation with European slave traders. For example, the destruction of British slaving forts along the West African coast by American forces during the American Revolution focused the post-war British trade on Bance Island off the coast of Sierra Leone, the only fort to be

Table 2: Origin of Enslaved Africans Sold at Savannah, 1766–1771

Origin	Percentage
Rice cultures	
Gambia	40
Sierra Leone	16
Gambia & Sierra Leone	6
Senegal	3
"Rice Coast"	14
"Grain Coast"	5
Other cultures/ Unknown	
"Africa"	6
Angola	10
	N = 2500

Data from Donnan (1935) and Littlefield (1981),
compiled by Wood (1984:103)

rebuilt following the war (Toepke and Serrano, 1998). Geographic factors were also important, as more easily navigable ports decreased the risks to which ships were exposed. The numerous clusters of barrier islands along the Upper Guinea Coast provided easy access to a greater number of regions than the coastal ports situated along Central West Africa or the Angola/Congo coast.

Who Were the Lowcountry Africans?

Many scholars state that the magnitude of the trade from Angola and Congo during the early colonial period was large enough to make these areas the largest contributor of slaves to South Carolina during the Atlantic Slave trade as a whole (Donnan, 1928; Curtin, 1969). However, these classic studies have recently been challenged. It is interesting to note that scholarly interpretations of importation patterns have changed

through this century due to the focus upon important African contributions to the Lowcountry economy and more representative source documents. Early analyses emphasize the large number of captives from west central Africa (Congo and Angola), while more recent analyses highlight the importance of the large number of bondsmen from the northwestern coast (Senegal, Gambia, and Sierra Leone). When one considers the tribal and national origins this is a logical methodology. However, when one surveys West African cultural affiliations, the use of political boundaries may hamper meaningful analysis by arbitrarily separating populations that are (culturally) quite similar.

Littlefield (1981) uses historical documents to outline a logical comparison of slave importation into South Carolina versus other British Colonies. He then tests the historical claim that planters demanded slaves from the rice-growing regions of Africa. The results show that 40% of the imported slaves originated in Angola, while 43% were from the rice growing nations of Senegal, Gambia, and Sierra Leone *combined*. (Earlier studies considered these regions independently, rather than as an agricultural region.) Based upon the evidence, Littlefield concludes that the steady increase in the African slave trade from rice-growing areas are due to a specific demand for laborers familiar with rice cultivation. Richardson (1991) supports this result, finding that Gambians were imported in the greatest number, followed by Angolans. Curtin's (1969) data also supports this conclusion when interpreted using a culture area approach.

Littlefield's conclusion is intuitively appealing in light of the Georgia and South Carolina's cultural legacies. However, the timing of the northwestern slave trade intensification may have also been important. The first shipment to Charles Town from Gambia was in 1731 (Wax, 1973), sixty years after the first slaves were brought to South

Carolina and four decades after the introduction of Carolina gold rice cultivation. It is clear that the demand for peoples of this region was not an immediate circumstance, but rather a gradual trend that accompanied the growth of the rice plantations. Smith (1985:21) notes that the increasing importation of rice agriculturalists *predates* the region's adoption of the tidal flow method of cultivation, introduced in 1750. Therefore, the change in importation should also be viewed in the context of other market trends. The number of Angolans imported to Charles Town peaked in the early period of the colony and then plummeted, while importation from the rice-growing regions increased steadily throughout. Changing attitudes caused by the Stono Rebellion would have encouraged trading expeditions to other regions in any event, to compensate for the loss of Angola as a ready source of labor. The greater market value of rice agriculturists could have focused this expansion along the Guinea coasts. A broad view of slave trade dynamics shows that the choice of laborers was not only a matter of preference, but as everything else in the Lowcountry plantation system, a matter of supply and demand.

The Reliability of Historical Sources

A cautionary note about the reliability of historical sources must accompany any description of the Atlantic slave trade. The numbers used for these censuses are taken from shipping and import records, tax books from port cities, plantation records, records of sale, and historic newspaper advertisements. The nature of these sources insures we will never have complete confidence in historical estimates due to spotty record keeping, non-specific entries, and (especially in the case of tax records and the illegal slave trade) the inherent human desire to avoid paying tariffs. In addition, African export records may

not reflect the destination of the ships. Such documents lose much of their utility if they cannot be linked to reliable records at the port of destination. Export records from Africa often record the number of slaves taken aboard, but the hardships of the Middle Passage usually reduced the number of slaves actually landed. While Anstey (1975:25) estimates mortality rates of up to 10 percent for the period between 1761 and 1807, trends in the treatment of slaves cannot be accurately determined from the data he presents. One data set illustrates a significant trend of decrease in mortality rates through the period from more than 9 percent to less than 4 percent, while the another reflects rates over 8 percent throughout and a slight increase in the latter period. Little can be done about these problems, so historians must work with or around them.

Even when appropriate records are available, sampling and methodological assumptions may bias estimates of the slave trade. For example, Curtin's (1969) census of the Atlantic slave trade is based upon data compiled from published summaries rather than primary documents. This subjects his analysis and conclusions to the various sampling choices of previous authors. As mentioned previously, analyzing importation documents by point of origin yields one conclusion, while grouping the origins into cultural regions produces another.

Some authors substitute estimates or averages for missing slave importation data. Although these statistics are often based upon sensible assumptions, they may be incorrect. For example, Curtin's (1969) estimates for Dutch imports assumed that the country's involvement in the slave trade remained constant throughout the period. These estimates were later revised using newly discovered documents. The corrected analysis confirms that Curtin's estimates were quite accurate (Curtin, 1975). However, the records

also revealed that domestic political unrest interrupted Dutch trading for a time. Curtin's overall estimate for Dutch slave importation did not account for this trade hiatus and therefore overestimated the volume of the Dutch slave trade.

Continuing research of the Atlantic slave trade has steadily improved our picture of this period in history. As the previous paragraph illustrates, the discovery of additional documents has provided many missing pieces of information. Mistaken assumptions and incorrect conclusions are quickly addressed thanks to increased interest in the field and improvements in communication. For example, authors contributing to Engerman and Genovese's (1975) symposium on quantitative study of the slave trade provide information on the Dutch slave trade and other aspects of the Atlantic trade that were not available to Curtin. The greater access to records and collections via electronic media have opened the field to a larger number of researchers and facilitated efficient communication within the field.

The full details of the African slave trade may never be known. Pollitzer's (1993) summary of Curtin's data for the importation of Africans into South Carolina reflects more than 20,000 individuals for whom ports of origin are unknown. Allocation of these people into any of the known areas of origin would significantly affect our view of the cultural influences on Lowcountry biology, traditions and history. The magnitude and ports of origin of the illegal slave trade are also unknown. Internal migration due to the domestic slave trade, migration between plantations owned by planters with numerous estates, runaway slaves, and post-war migration of Freedmen and their families further complicate any study of the distribution of Africans in the southeast.

However, it is likely that using only data from historical records could hamper studies of the slave trade. In light of the large profits to be made, it is likely that the national or tribal origins listed in advertisements and in correspondence between slave merchants were incorrect or misrepresented. Littlefield (1981:30) cites a case in which Captain Henry Moore was ordered to represent his shipment of slaves as coming from Whydah along the Slave Coast no matter their true origin, as Whydah slaves commanded higher prices than others. He also cites complaints of fraud to the House of Commons (1696-1786), in which novice traders fell prey to "ship captains who passed off one type of slave as another" (p. 31).

While Littlefield (1981) asserts that planters prided themselves on their knowledge of African peoples, he does acknowledge that one cannot be sure that they used accurate criteria, especially if these were supplied by slave traders. In fact, he cites a case in which Henry Laurens claimed to be ignorant of the origin of a shipment of slaves that arrived without a detailed list of origins (1981:23). Many terms were used interchangeably although they did not describe the same groups and some were used so widely that they have little meaning. The same names could refer to regions as small as a political domain and as large as an entire coast. However, Littlefield claims that planters were able to discern peoples from central Africa (Congo, Angola) from peoples of Upper Guinea (Sierra Leone, Senegal, Gambia). As the trade developed, familiarity with tribal marks, dental modification, and African languages may have allowed them to more accurately distinguish between peoples. Further, they could have relied on the knowledge and experience of the enslaved Africans and Creoles in their employ or confirmed information with the captives themselves if communication was possible. Opala (in

Toepke and Serrano, 1998) claims that the British traders at Sierra Leone's Bance Island branded the letters "SL" on captives' shoulders to document their port of origin, although this could easily be done to individuals from any region. There is unfortunately no precise way to gauge the prevalence of these situations and therefore test the accuracy of the historical record.

THE DOMESTIC SLAVE TRADE

As older colonies, Virginia and Maryland each boasted successful plantations with a well-established tradition. However, with no efficient system of fertilization the soil became exhausted and caused a slow decline in tobacco production. New states to the south and west like Kentucky, Missouri, Georgia, Tennessee, Alabama, Mississippi, Texas, and Louisiana provided virgin soil and unlimited opportunities for planters to increase the size of their crops when the markets became inundated and tobacco prices decreased. Planters in the established colonies had few opportunities to increase their production through expansion because land was more expensive than in the frontier regions. The movement to the new southern frontiers and the close of the Atlantic Slave trade led to the development of a vigorous internal slave trade and widespread speculation in the slave market.

Motivation for the "selling South" of slaves by planters of the Upper South is a hotly contested issue. Abolitionists accused planters of breeding African and Creole laborers for the internal market, an argument supported by some authors and refuted by others. Boles (1983:68-69) contests the idea that Virginia and Maryland *intentionally bred* slaves for the domestic market. His quantitative analysis of economic and demographic data

fails to support the assertion of breeding slaves for production. Rather, he concludes that the change from tobacco to wheat agriculture due to depleted soil conditions created a large surplus of labor. He concludes that the common practice of over-extending credit lines forced many Virginia and Maryland planters to sell off their most valuable and liquid asset—labor. The feverish demand for slaves in the new southern slave territories provided lucrative returns on individuals that were underemployed on the tobacco plantations eating rations that many planters purchased on credit. Boles suggests this circumstance was an economic solution, not a planned business venture.

Bancroft (1959:69-82) claims that Virginia plantations did indeed *breed* slaves for the southern market. He points out that in addition to providing excess laborers for sale, fertility often determined the market value of female slaves, especially in frontier areas. Childless women and those beyond childbearing age were much less valued than those that could bear children for sale or additional labor (Bancroft 1959:108). Perhaps more convincingly:

...the periods of heaviest sales to the trader were precisely those during which, from crop production alone, the Upper South sellers were already enjoying particular success and prosperity. —Tadman, 1989:115

Planters of the Upper South who sold slaves to the southern territories realized a faster profit than those who used the additional labor created by natural increases to expand crop production. Tadman concludes the Upper South's participation in the domestic slave trade was motivated by economic gain rather than financial necessity.

During the early nineteenth century the so-called "Negro fever" caused slave prices to skyrocket and speculation in slaves became a popular business venture. Many states joined Virginia and Maryland in supplying the domestic market, attracted by the huge

potential for profit. This "fever" was spawned by the expansion of cotton production to the uplands of the South following the introduction of the cotton gin. Eli Whitney's invention efficiently separated the fiber from the seeds, revolutionizing the southern economy and providing the uplands their first major cash crop. After the gin solved the time-consuming problem of seed removal, the only factor limiting cotton production was the number of workers available to harvest it. Additional workers generated additional profit, so demand for laborers grew at a furious pace. Slave prices reached all-time highs in the period leading up to the Civil War despite the competition between the (illicit) foreign and domestic trades.

It is clear that Charleston played a major role in this period of speculation and high prices: Boles (1983:133) describes the influx of Upper South Creoles as "significant" and Bancroft (1959) notes that 2,048 slaves were advertised for sale in Charleston's two papers on January 2, 1860 alone. However, it is unclear if merchants had prospective buyers in the Lowcountry or if the bondsmen were to be "sold South." In his study of the internal slave trade, Tadman (1989:12-14) used U.S. census data to portray the movement of domestic slaves across the South. He found that despite the (ineffective) ban of the importation of domestic slaves from 1790 through "the early 1800s," South Carolina was among the states importing slaves from other states during that period. However, by the end of the 1820s it was a major exporter of slaves to the Southern frontier. In fact, Tadman estimates that the state exported more than 20,000 bondsmen during the 1820s, more than 50,000 in the following decade, and more than 60,000 in the decade before the Civil War. His calculations for Georgia show that at least 10,000 slaves were imported during each decade between 1790 and 1850. In the decade prior to the Civil War, just

over 7,000 slaves were exported. Based upon these figures, during the period between 1850 and 1859 the likelihood of a slave being sold in an exporting state was between 14 and 17 percent. Therefore:

Over a lifetime ... the cumulative chances of being sold would have been high in all regions, and in the exporting states it would have been quite rare to have survived into middle age without being sold locally or interregionally.

—Tadman, 1989:121

While these analyses suggest South Carolina played an active role in the long-distance domestic slave trade, Tadman concludes that a high proportion of bondsmen were transferred within Charleston district, which he then extrapolates to the state as a whole:

...one can conclude, very approximately, that private local residents may have bought some 54,000 slaves at the state's judicial sales; thus in this sample decade [1850–1859] South Carolina's judicial sales to local private individuals were about 30 percent greater than purchases (from all sources) by traders in that state.

—Tadman 1989:120

He further claims that his methodology was more likely to underrepresent sales to local planters who did not participate in the long-distance trade, making this a conservative estimate of the local slave trade. This does not fit with his earlier description of South Carolina as a major exporter based upon significant reductions in its slave population. The differences in the Lowcountry and Upcountry economies may have resulted in a net gain of slaves in the former and a net loss of slaves in the latter. If this is not the case, then it is unclear how his conclusions for both analyses can be supported.

Other sources suggest that while the Lowcountry slave markets were frequented by long-distance slave traders who certainly purchased local slaves for out-of-state clients, the local market was still lucrative. For example, one author cites a Charleston visitor's observation of the domestic trade:

...great numbers are ... absorbed by South Carolina and Georgia, where the cultivation of rice thins the black population so fast, as to render a constant fresh supply of Negroes indispensable in order to meet the increasing demand for that great staple production of the country. —Flanders, 1933:185

The magnitude of forced out-migration of Lowcountry Africans and Creoles remains unknown, so the domestic slave trade's effect on the nature of Gullah culture cannot be adequately addressed until the primary sources are analyzed with this particular question in mind.

A larger and more important migration took place following the emancipation of all slaves in 1865:

Nothing meant freedom more tangibly than having the leisure to move around, to travel about without the mandatory pass and ever-present fear of patrollers. Consequently many freedmen tried out their freedom shoes by rambling, but this migration was less pervasive and more purposeful than most contemporary whites realized... most important, they moved about in search of better employment. The black population of southern towns and cities grew very rapidly, as significant numbers of former slave artisans moved to cities to try to practice their crafts, but the overwhelming majority of freedmen remained in rural areas. —Boles, 1983:199-200

The large population of urban slaves in Charleston may have attracted freedmen and their families from the Upcountry and other surrounding areas. New migrants may also have come to the Lowcountry to be reunited with or search for family members "sold away" before emancipation. Certainly the economic promise of Reconstruction in an established port city such as Charleston attracted some freedmen settlers to the region.

Despite Lowcountry planters' documented preference for laborers from the rice-growing regions of West Africa, it is highly unlikely that the ancestral population was comprised of only these individuals. The out- and in-migrations during the domestic slave trade and Reconstruction would have affected the demography of the Lowcountry, altering the phenotypic composition of the Lowcountry population as native black

Carolinians assimilated freedmen from other regions and states into their population and culture. Throughout the time of slavery, differential fertility and death rates coupled with regional social alliances would have introduced population dynamics that cannot accurately be estimated. However, the possible genetic contribution of all individuals must be considered when determining the proper comparative populations for genetic and phenotypic studies of disease. Therefore comparative populations from all regions of West Africa should be consulted to determine the most likely contributors to the genome of black South Carolinians, although particular attention should be paid to peoples from the rice belt.

It is possible that the true ancestral relationship has been erased by the dynamics mentioned above: Lowcountry African Americans may constitute a physical or genetic type that does not resemble those populations that gave rise to them. However, there is value in identifying physical and genetic similarities between black Americans and African populations. By comparing genetic characteristics and environmental influences, it may be possible to isolate factors contributing to diseases that disproportionately affect African Americans. This conclusion is applied to the question of the Lowcountry's African heritage in the original research presented in Part II.

Chapter 3

Lowcountry Culture and Language

As illustrated in the previous chapter, study of the African diaspora to Lowcountry South Carolina has provided a good deal of information concerning the heritage of Gullah-speaking African Americans.¹ However, clues to the specific origins of Lowcountry African Americans are also found in their contemporary culture. Recognizing the primary role of enslaved Africans and Creoles in the economic, social, and cultural development of the Lowcountry has increased study of culture's adaptational value and the types of dynamic exchange that occur in situations of cultural contact and dominion.

This chapter summarizes the theoretical debate over the interpretations of Lowcountry and Sea Island culture and reviews the research concerning the origins of the Gullah language, religion, and community structure in South Carolina and Georgia. These descriptions are not meant to be exhaustive, but are presented to illustrate how the current cultural evidence has been used to supplement and test historical accounts of the region's connection to West Africa. The final section discusses the status of cultural studies in the contemporary setting, including recent developments in cultural preservation and education.

¹ Following the example of Thompson (1987:1), the term *diaspora* is used in this manuscript "synonymously with dispersion, deriving inspiration from the Jewish concept of diaspora enshrined in the Book of Deuteronomy..." Thompson highlights parallels between the Jewish and African migrations both in magnitude and the forces that drove them (slavery and imperialism).

THE SIGNIFICANCE OF AFRICAN INFLUENCES

Modern contributions to Sea Island literature all begin by describing the infrastructural factors that have shaped Sea Island culture: the West African slave trade, longstanding isolation, dynamic evolution driven by adaptation to the stresses of slavery, and creolization of African and European influences into a unique culture and language. The academic community has reached a *defacto* consensus that the "Gullah" traditions of coastal South Carolina and Georgia represent the most African culture in North America. However, this conclusion was a source of great controversy when it was first suggested in the early 20th Century.

Sociological and anthropological work in the Lowcountry and Sea Islands was considered important during Reconstruction, both to aid Freedmen and their descendents in their adjustment to post-war difficulties and to document the disappearing black culture that had been created by a slave society. Because of prevailing social forces and a lack of black scholars, most of this research was carried out by white researchers.

While most scholars wrote with a sense of affection for both the people and the region, the works produced in this period range from patronizing and stereotypical to denigrating. In an example of the former category of work, Crum (1968:35) suggests the practice of slavery emotionally burdened the planter aristocracy more than their slave because of their complete responsibility for the slaves' well being: "Their suffering was far keener than the suffering of the carefree black people whom they held in bondage." Henry's (1914) published dissertation refers to African and Creole bondsmen as an "irresponsible and often dangerous part of Southern society" (p.28), and describes them as "barbaric" in character (p.5). Henry explains that black South Carolinians were not

allowed to testify in court against white citizens because of their "primitive condition" and "lack of moral responsibility" (p.15).

In perhaps the most extreme example of prejudiced research, Gonzales' presents a popular theory of the Gullah language's development:

Slovenly and careless of speech, these gullah seized upon the peasant English used by some of the early settlers and by the white servants of the wealthier Colonists, wrapped their clumsy tongues about it as well as they could, and, enriched with certain expressive African words, it issued through their flat noses and thick lips as so workable a form of speech that it was gradually adopted by other slaves... With characteristic laziness, these Gullah Negroes took short cuts to the ears of their auditors, using as few words as possible, sometimes making one gender serve for three, one tense for several, and totally disregarding singular and plural numbers...
—Gonzales, 1922:10

Studies by authors without racist agendas still denied significant intellectual contributions from Africans. Researchers like Reed Smith, H.L. Mencken, and Guy Johnson attributed nearly all unique features of the Gullah language to European sources (Jones-Jackson, 1978b:422).² Johnson's (1930) explanation for the development of Gullah suggests slave owners and overseers used a simple version of English to communicate with slaves. The enslaved Africans allegedly adopted this "baby talk" as their language and added a few retained African words, creating an inferior English dialect.

Numerous mainstream scholars espoused Johnson's theory of a *purely* European basis for the Gullah language and discounted intellectual substrates of African languages *a priori*. Joyner (1984:161-162) defends Johnson against accusations of academic racism. He suggests Johnson's interpretation is better viewed as a reflection of the patronizing

² Interestingly, a similar argument for the development of African American Vernacular English (AAVE) from purely English sources has only recently been challenged (see Weldon, 1998).

intellectual climate of the time rather than personal bias, as Johnson was an "active racial egalitarian throughout his adult life" and encouraged young scholars to challenge his theory.

The modern era of Sea Island scholarship began with Lorenzo Dow Turner's (1949) pioneering book *Africanisms in the Gullah Dialect*. It denied *exclusive* European claims to Gullah and identified African contributions using data collected during fieldwork in the Sea Islands, Africa, and Brazil. Turner's African American ancestry allowed him more extensive entrée into Sea Island communities than was afforded previous researchers due to their European ancestry. Informants identified more with Turner than with previous investigators, resulting in a study based on more extensive data and interpreted with a more pro-African perspective.

Turner's research intensified an ongoing debate concerning the development of African American culture that involved two prominent scholars. E. Franklin Frazier of Howard University (1939, 1949) proposed that enslaved Africans lost all traces of their ancestral cultures through complete assimilation into European American society. Therefore, African Americans exhibited a primarily European cultural heritage. Based upon his fieldwork in the United States and Africa, Melville J. Herskovits of Northwestern University asserted that people of African ancestry retained elements of West African culture that could be identified in contemporary culture. He challenged support for interpretations that assumed a complete loss of African cultural elements:

In this discussion the point of view is held that, as in all scientific inquiry, the data must be followed wherever they lead; and that an open mind on all phases of the problem must be retained until all possibilities of analysis have been exhausted. Negroes in the United States are not Africans, but they are the descendants of Africans. There is no more theoretical support for a hypothesis that they have retained nothing of the culture of their African forebears, than for supposing that

they have remained completely African in their behavior. The realistic appraisal of the problem attempted here follows the hypothesis that this group, like all other folk who have maintained a group identity in this country, have retained something of their cultural heritage, while at the same time accommodating themselves... to the customs of the country as a whole. —Herskovits, 1941:145

As the academic community began the transition from hierarchical theories of "superior" and "inferior" cultures toward cultural and biological relativism, the mainstream became more accepting of Herskovits' view. The preponderance of evidence supporting contributions of African ideology made it difficult to retain the earlier theories and their Eurocentric bias.

While Herskovits's work was a major step forward in the study of African American culture, his theory of cultural retention is not the most appropriate theoretical approach to the study of Lowcountry culture and language. Joyner (1979) explains that the idea of cultural retention does not adequately reflect the dynamic nature of the acculturation process. Herskovits attempted to identify intact traditions rather than address cultural innovations shaped by the experience of the Middle Passage and enslavement. Joyner suggests that mental templates for behavior are more likely to be retained because they can be implemented in novel environments. By identifying these mental templates, one can identify possible West African beliefs, traditions, and ideas and examine the adaptation of such mental structures in new environments. Such changes indicate that culture has great flexibility, which translates into evolutionary and psychological benefits for humans in the most challenging situations.

Joyner further charges that by identifying "Africanisms," Herskovits underestimated the variation among African cultures. The African continent is not a homogenous cultural region. African cultures vary greatly due to infrastructural constraints, organizational

practices, and ideological elements developed over time. Societies that coexist within the same culture may exhibit characteristics not shared by their cohorts. Although Herskovits attempted to identify unambiguous ties between West African and African American culture, identification of exact parallels between the two is nearly impossible because cultural elements seldom survive as intact entities in circumstances of significant cultural domination.

The operational paradigm of acculturation or *creolization* has replaced Herskovits's retention model in most studies of African American culture. In linguistics the concept of creolization explains "... the convergence of two or more languages into an essentially new native tongue" (Joyner, 1979:438). Stewart (1967) and Dillard (1975) successfully applied the concept of creolization to the Gullah language and the concept was extended to other cultural components. Applied to the Lowcountry, the creolization concept describes the process by which various African cultural traditions converged and changed to create a new *African* American culture. The evolutionary process of cultural adaptation allows anthropologists to better appreciate the novel ways in which enslaved Africans and Creoles creatively shaped their cultural environment through the outlets available to them.

Despite the focus on dynamic change in situations of cultural contact, research by Opala (1987), Holloway and Vass (1993), Pollitzer (1999), and this work still strive to distinguish identifiable West African characters within Lowcountry traditions and biology. Such studies provide the basis for studies of creolization: if the ancestral traditions or biology cannot be identified how could the changes be adequately documented? The Lowcountry and Sea Islands provide a unique opportunity to connect

the past with the present through a variety of different, yet complementary, anthropological and historical approaches.

FACTORS ENCOURAGING SEA ISLAND CREOLIZATION

The African heritage was not erased by the Middle Passage, nor was it transported to America practically intact. One must simultaneously bear in mind the severity of the wrenching from Africa and the resiliency of the human spirit. The African cultural component varied from place to place, from time to time, from person to person. Transported Africans gradually became something new, Afro-Americans, but that complex and still incompletely understood process is better comprehended in the demographic context of import and survival rates, female fertility, and population density. —Boles, 1983:141

As Boles explains, Africans immersed in European colonial societies lost many of their native customs and ideas due to continual forced interaction with Europeans. However, larger slave densities provided Africans and Creoles increased opportunities for cultural interaction, facilitating development of a common Pan-African culture through creolization. The large rice and cotton plantations of coastal South Carolina and Georgia situated large numbers of Africans and Creoles in the same settlement and often isolated them from significant interaction with Europeans. Planters were often absent from their estates for prolonged periods of time, retiring to urban areas such as Charles Town or Savannah for the social season or vacationing to the North or Europe for months at a time. Inland towns such as Summerton and Summerville (South Carolina) indicate their historical importance during the wet, hot seasons. Although Southern planters visited their estates regularly, this was most common during the cold and dry months (Smith 1985:7). During the planter's absence, white *overseers* were responsible for supervising the plantation's daily operation. On many plantations the overseer was the only European in frequent contact with the African laborers. Furthermore, overseers and

planters often spoke through *drivers*, members of the African or Creole community who negotiated relations between the management and laborers. This common separation between European and African segments of the population provided the unique opportunity for relatively free interaction within the African and Creole communities.

It is even more interesting to consider this separation in light of Wood's (1984:104) claim that Georgia slaveholders did not intentionally separate Africans of the same tribe. She states that encouraging tribal affiliations facilitated efficient communication and created personal attachments to the plantation, which was thought to decrease the likelihood of runaways. In the context of cultural creolization, it also allowed continuation of some familiar traditions and practices by members of the same nation or tribe when they were brought to the same plantation. As illustrated in chapter 2, this situation may have been common in the Lowcountry due to the preference for Africans from the rice-growing regions of northwest Africa.

Boles (1983:37) proposes that the slave traders' preference for young individuals may have contributed to the evolution of new practices and beliefs. This preference meant that few specialists with completed training in spiritual, magical, or ritual duties were brought to the colonies. He further suggests that a community mostly comprised of single young males would not be the most likely to preserve cultural elements. The latter statement should be amended to specify that such a community would be less likely than others to *consciously* preserve their native cultures. Abstract attributes like language, worldview, and recognition of fictive or actual kin are mental templates for behavior learned from birth that comprise one's way of interacting with the world (Joyner, 1979). Therefore, while religious ceremonies and ritual traditions were likely discarded if they

no longer held social meaning, mental elements of culture were likely retained, especially when one was in contact with fellow countrymen and women.

Another important influence on the burgeoning Creole culture was the continual importation of Africans. The period of greatest importation of Africans to the Lowcountry (1720–1780) coincided with the first large natural increase of the Creole population so that:

Into this proto-community with its developing culture came the African migrants with their fresh memories of African beliefs, rituals, customs, and styles of artistic and musical expression... what they carried with them was absorbed by the growing American-born slave population, which, because of its thriving family life, was an excellent receiver, preserver, and transmitter of culture. —Boles, 1983:141-142

While culture is transmitted between successive generations, it is also transmitted *within* generations through peer groups, and can also be learned by elders from younger generations. The continuing African influences reinforced traditional values and practices, especially in populations isolated from continual European contact.

The task system of labor was another unique feature of the Lowcountry economy that encouraged cultural creolization. The most prevalent system of labor organization throughout the agricultural South was the gang system. Large numbers ("gangs") of laborers worked together on a particular project directed by an overseer or driver. Everyone in a gang began their workday at first light and continued to sundown with breaks for specified meal times. This was not true in the Lowcountry. Each slave was assigned a "task," defined as one full day's work for a capable laborer (Smith, 1985). When the assigned task was completed, the laborer was permitted to tend to her/his personal chores. When industrious workers completed two tasks in a single day they would earn a "day off." The very old, the very young, and the infirm were often assigned

partial tasks equivalent to a full day's work for individuals working at a slower pace or with reduced physical ability. Many individuals finished their task by late afternoon, allowing time for other necessary activities and private time.

In contrast to the large open African markets established by the slaves in the British Colonial West Indies (Mullin, 1992:155),³ Henry (1914) documents complaints about blacks congregating in public places in South Carolina. He notes that numerous slave-control laws were passed that sought to control even the "free time" behavior of the enslaved. However, in the Lowcountry the laws usually applied only when bondsmen were away from their home plantations. These control laws were sometimes ignored (especially in the more rural areas) unless local planters wished to exercise their power. Despite these attempts to limit their off-time activities, Lowcountry slaves gained more autonomy than was possible in other areas of the plantation South due to the task system.

Noting that the gang system was present in all other plantation systems, Smith (1985:61) suggests the task system was the result of a negotiation between the planter and laborers in light of the harsh conditions imposed by rice cultivation. Rice fields were tended through the summer and harvested in August or September, involving slaves in the wet cycle of the rice process during the hottest season(s), the prime time for mosquitoes. She claims wet agricultural practices were acknowledged to be harsher than those of inland dry agriculture and this encouraged negotiation between laborers and management. Planters may have allowed some concessions to placate their laborers and allay their own fears of revolt.

³ Mullin quotes Daniel McKinnon (1804): "Negroes are the only market people." From other sources, Mullin states that people traveled miles to attend the large Sunday markets. Markets were held in Jamaica as early as 1724 and were strong institutions on other island colonies.

In an opposing viewpoint, Flanders (1933) states that the type of crops cultivated determined labor practices, not labor negotiation. He claims tobacco, short staple cotton, and sugar were best suited to gang labor, while the cultivation of rice was more efficiently performed using the task system of labor organization. Using the task system for Sea Island cotton cultivation was an anomaly; the task system was an entrenched tradition by the time cotton was introduced, so the existing system was simply extended to the new crop.

Many scholars suggest that the free time afforded by the task system allowed many social and commercial activities that improved the health and psychological well being of the enslaved bondsmen (Smith, 1985; Hudson, 1997). In addition to regular rations distributed from the plantation storehouse, most rice plantations afforded slaves access to lands for personal gardens. During their "off time," slaves could also fish or collect oysters, hunt squirrels, opossums, rabbits, and other small game. Some planters allowed slaves access to firearms for hunting and protection of plantation property, which translated into better provisioning of protein-rich game animals and better health. The tradition of encouraging self-sufficiency made the planter less responsible for the slaves' provisioning and reduced operating costs (Smith, 1985:115). More importantly, it provided slaves on the rice plantations a more adequate, varied diet and allowed them to exert some control over their own lives. In many cases it also presented opportunities to earn small amounts of cash or goods from the sale of their produce and livestock to the planters.

Hudson (1997) explores the consequences of the task system and ways in which the enslaved capitalized on opportunities to improve their social and financial status. He

asserts that by appearing to be efficient and willing to work, slaves "put space" between their personal lives and the control of the Big House. When the planter was satisfied that his laborers were performing to his standards, he was less likely to concern himself with their personal lives, thereby giving the slaves more autonomy and privacy. Hudson provides numerous examples of the property and social status many Africans and African Americans were able to build for themselves by their industriousness and exploitation of available opportunities for financial gain. He states that Lowcountry plantations sometimes offered these opportunities, citing the observations of a Sea Island visitor who commented on the competition between bondsmen for opportunities to earn money from "off time" labor (1997:15).

A final factor in the development of the Gullah culture was the physical isolation of the slave quarters. On small Upcountry farms, bondsmen commonly shared a domestic sphere with their owners. Conversely, on large Lowcountry plantations slaves were quartered in individual dwellings that lined "the street" (Figure 8). This area was often removed from both the planter's "big house" and the overseer's quarters because the slaves' quarters were said to be noisy. This sometimes afforded the slaves on rice plantations more privacy than was possible elsewhere and encouraged the formation of extended support networks within the slave community. The street served as a domestic center as well as a social and cultural center. When tasks were completed, slaves could return to their homes and attend to their domestic duties, socialize with their friends and families, and participate in activities that gave them outlets for personal expression and socialization (Smith, 1985; Mullin, 1992).



Figure 8: "The Street" at McLeod Plantation, James Island, SC

These buildings, located a short distance from the "Big House," were refurbished by the Historic Charleston Foundation following their purchase of the plantation in 1993. (Photo by NLR)

SELECTED STUDIES OF LOWCOUNTRY CULTURE AND LANGUAGE

The studies described below illustrate the variety of African cultural traits that have become a part of Lowcountry tradition. While the specific origins of these traditions are still debated, there is a consensus that Africa does indeed (metaphorically) "lie off the coast of Georgia" and South Carolina (Szwed, 1970). These summaries are provided to further support the hypothesis of the biological investigations described in Part II of this work. Interested readers are referred to Pollitzer (1999) and the original sources for more comprehensive treatments of each topic.

Language

Since the late 1960s, linguists have studied the relationship between Gullah and other African creoles and pidgins. By comparing linguistic structures, they hope to uncover historical influences on the Gullah language, the only English-based creole to survive in North America (Hancock, 1982:17). Gullah shares some characteristics with African American Vernacular English (AAVE) but exhibits a more African substrate. In fact, Weldon (1998) proposes Gullah or a similar African creole formed the basis of AAVE, which developed from a language shift from the ancestral creole. Gullah has not undergone such a significant linguistic shift and is spoken with an accent that resembles that of speakers of Caribbean creole languages. Table 3 lists an excerpt from the Bible in both King James English and Gullah to illustrate some of the two languages' differences in syntax and vocabulary.

Varying degrees of inter-island variation and differential cooperation from the Islanders complicate linguistic studies. Lowcountry African Americans share a long-standing suspicion of outsiders, and as Bennett (1908) first commented, one investigator

Table 3: Gullah Translation of Luke 20

English: King James Version	Gullah: ©The American Bible Society
²⁴ Shew me a penny. Whose image and superscription hath it? They answered and said, Caesar's.	²⁴ E tell um say, "Oona sho me a silba coin." Wen dey sho um dat money, e aks um, "Whodat habe e face an e nyame on dis coin yah?" Dey ansa Jedus say, "Dat de Emperor Caesar face an nyame dey."
²⁵ And he said unto them, Render therefore unto Caesar the things which be Caesar's, and unto God the things which be God's.	²⁵ Jedus say, "Well den, oona mus gibe Caesar dat wa blongst ta Caesar an mus gibe God wa blongst ta God."
²⁶ And they could not take hold of his words before the people: and they marvelled at his answer, and held their peace.	²⁶ So den wid all de people dey, dem man ain't been able fa ketch Jedus een none ob de wod wa e say. Wen Jedus ansa um so, dey been stonish down an dey hush op dey mout.

Excerpted from Garaty (1994)

may be more successful in gaining information than another. Furthermore, since few of the linguistic studies have taken place on the same island, few direct comparisons can be made (Jones-Jackson, 1978b:425).

Although it contains numerous recognizable English elements, Gullah is not a dialect of English because it "lacks the structural intercomprehensibility afforded dialects of American English" (Jones-Jackson, 1978b:424). It is not a pidgin language because such languages are linguistic hybrids that have no native speakers. If (or when) a pidgin gains native speakers and a more structured syntax, it is classified as a creole (Joyner, 1979). Creole languages differ from pidgins by increased vocabulary, increased functional complexity, more explicit grammatical construction, and more fixed pronunciation. That is, a pidgin may not have a syntax or rules for its speakers but a creole does (Hancock, 1969). This definition fits Gullah, which developed as a creole language during the era of slavery. Elements of Gullah have been attributed to languages spoken by the Twi, Efik, Yoruba, Igbo, Mende, and Vai, among others (Jones-Jackson, 1978b:423). However, the degree of influence and the identity of the African substrate languages remain controversial.

Hancock (1969, 1980) states that pidginized languages based upon Portuguese and English developed in the 15th century through the developing trade along the West African coast, and later became the Atlantic pidgins recognized by linguists. Based upon the African names uncovered by Turner (1949), he proposes a historical origin of Gullah along the Windward coast of West Africa in the region of Sierra Leone. This is based upon the preponderance of personal names cited by Turner that can be traced to that region. Cassidy (1980:4,5) challenges this interpretation of Turner's data and suggests the

more appropriate reference for African words used in Gullah is Turner's compilation of "words used in conversation" because they have meaning beyond individual identification. The use of given names may be linked with recent ancestors, as when a child is "named after" her grandmother rather than named for her/his personality or circumstance of birth.

Of the "conversation words" on Turner's list, most are of Angola-Congo origin, followed by languages from Senegal and Gambia, then Sierra Leone and Liberia. The smallest contributions are from Togo-Dahomey and the Gold Coast (Table 4). Cassidy interprets this as evidence that Bantu-speaking peoples from Congo and Angola exerted a significant influence on Gullah. This can be equated with either an earlier entry or a greater number of native speakers from the region of Angola-Congo. However, as with the estimates of slave importation presented in the previous chapter, this result is different if cultural regions are used as the unit of analysis rather than nations. The contribution from regions with high-level skill in rice cultivation (Senegal-Gambia and Sierra Leone-Liberia) should be added together. Then, as with slave importation estimates, the rice-growing Windward Coast is shown to have contributed a greater number of words to conversational Gullah.

Hancock's (1980:20) response to Cassidy's critique highlights Turner's (shortest) list of words taken from Gullah stories, songs, and prayers. Most of the words on this list are attributed to the Vai and Mende languages of Sierra Leone (Hair, 1965:80-82). A clarification of Hancock's work also supports a substrate of creole developed in Sierra Leone, with later influence by the Bantu speakers of Angola and Congo. Based

**Table 4: African Contributions of "Conversation Words"
Documented by Turner (1949)**

Language region	Percentage of Words representing region
Angola-Congo	39
Senegal-Gambia	21
Sierra Leone-Liberian	17
Nigeria	12
Togo-Dahomey	6
Gold Coast	5

Summarized from Cassidy (1980:4,5)

upon the evidence in the previous chapter this seems less plausible. Slave shipments from the Bantu regions of Congo and Angola were unpopular following the Stono Rebellion in 1739, while slaving along the Windward Coast was intensified due to growing planter preferences for these laborers. The chronology of this explanation does not fit the historical record: it is more plausible to suggest a base of Bantu was overwhelmed by languages common to the Windward Coast following the Stono Rebellion. These Mande and Western Bantoid languages may have received additional advantage by selection for cultural and social traditions that were important to rice cultivation. Like material culture that aided in growing successful crops, languages used by tribes in the rice regions may have been "selected" by the environment in which terminology for the rice business was retained and encouraged by the planters.

The importation of slaves from Barbados in the early days of the colony suggests these first arrivals most likely understood some form of English. In fact, second and third

generation Barbadian slaves were noted for their excellent command of English, compared with new arrivals from Africa (Hancock, 1980 citing Wood, 1974:175). Since enslaved Africans worked alongside European indentured servants in the Caribbean, Hancock suggests Barbadian slaves learned a non-creolized version of English. Further, he suggests Gullah developed when Barbadian slave importation was abandoned for direct importation of Africans who spoke European/African creoles that developed through the slave trade. Hancock believes these European/African creoles formed the basis of Gullah. This scenario places the Krio of Sierra on a line with Gullah, implying a remote common linguistic "proto-pidgin" ancestor (1980:27). He discounts a significant contribution of Bantu languages because these tribes were not part of the population that would have used these proto-pidgin languages.

Holloway (1989) and Holloway and Vass (1993) highlight the preponderance of Bantu place names throughout the American Southeast as evidence for a strong influence by Bantu languages of central Africa. They suggest that the Bantu effect was stronger compared to those of other language groups because Bantu languages are all quite similar to one another. Holloway claims that Bantu tribesmen were preferred for fieldwork that minimized contact between Europeans and Africans, encouraging use of African languages among the slaves. Following Curtin (1969), Holloway claims that Mande-speaking tribes (Upper Guinea) were preferred for domestic work in the plantation homes because Europeans considered them more handsome than other peoples. Despite this alleged preference, it is unlikely that a significant number of the captives from this area were employed in domestic service. If for no other reason, domestic servants comprised a small portion of slaves employed while a much larger number of slaves were employed

as field hands. It is also likely that African-born domestics became less common following the natural increase of Creole slaves, who were more familiar with English and European culture.

Many of the more recent studies examine the purported demise of the Gullah language. The linguistic concept of creolization has an antonym known as *decreolization*. Where the creolization process creates a new composite language from several, decreolization is the destruction of a creole language through loss of vocabulary, syntax, and structure. While some linguists claim Gullah was fully decreolized, dead, or both (see DeCamp, 1971), Jones-Jackson (1978a) identified components of intact language in contemporary use. Her extensive access to daily life in a modern Gullah community allowed her to document the continuation of the West African practice of "basket" naming on Wadmalaw Island, first noted by Turner in 1949. At birth a child is given a proper name for public use and a private "basket name" used only by the family or in the presence of other acknowledged members of the community. Jones-Jackson found that children continued to be named for the day on which they were born ("Thursday," for example), for their place in the sibship ("Third"), or for particular characteristics of their personality, all of which are common West African practices.

Jones-Jackson also documented a continuing privatization of the language, which contributes to the supposition that Gullah is spoken less in each subsequent generation. The improved education of the younger generation and increased exposure to outside influences has moved use of the language from the workplace and the public arena to the more private and casual circles of the family and community. For example, on my first visit to Johns Island, I needed help with a purchase at a department store. Two clerks

were conversing as I approached. They interrupted their conversation to assist me, answering my questions in standard English. When I was out of their sight, but still within earshot, they resumed their conversation in what I could then identify as Gullah.

It is possible that privatization makes the language appear to be more decreolized than it actually is. For example, although it is suspected that younger individuals speak Gullah with less expertise than the elderly, each speaker (and each region) has a unique pattern of speaking. This is exhibited by a different level of "code switching" between predominantly American English and Gullah they consider appropriate to a situation and the audience present (Personal communication, Harrison, 1999). This linguistic phenomenon is likely responsible for the variation in results recorded by different observers: a study will be less successful if one does not identify the most experienced speakers of the language or if interviewees are uncomfortable revealing their full range of linguistic knowledge. This may also be attributed to some sectors of the community privatizing the Gullah language.

This increasing privatization may be a reflection of the social and intellectual denigration the Gullah have endured or for other unknown reasons. The most obvious explanation is the negative characterization of their language as "baby talk" or substandard English. For many generations, Gullah speakers have been stereotyped as uneducated or incapable of learning standard English. Emory Campbell, director of Penn Center in Beaufort, acknowledges that many graduates of the Penn School rejected Gullah and Gullah culture to become "polished Americans" and did not discuss their native traditions (Carrier, 1990).

However, instead of protecting themselves from negative public opinion, some Gullah speakers may simply be unwilling to use their language in front of strangers. In the video documentary *Family Across the Sea* (Carrier, 1990), the narrator suggests that people who spoke Gullah may have privatized their language because they treasured their remaining connection to Africa and feared it could be taken from them:

The Gullah went further, keeping this tongue a secret... An act that allowed the Gullah to remain African in their souls. —Carrier, 1990

However, the film also presents a more pragmatic explanation voiced by former Sierra Leonean cabinet minister A.K. Touree, who holds a doctorate in linguistics. Touree states people forced to speak a language imposed by colonial powers are driven into an uncomfortable and necessarily subordinate position. This often causes a loss of proficiency in their native language and sub-standard mastery of the official language. He suggests that dominated people cling to language as a "storehouse" of their native ideology and cultural heritage. Krio, the African/English creole spoken by people native to Sierra Leone, was spoken only in secret during the colonial period. Touree says that maintaining a private language of communication is a common African reaction to cultural marginalization (Carrier, 1990), which suggests that the privatization of Gullah may also reflect the African ideological heritage of its speakers.

Religion

Lowcountry planters viewed the introduction of Christianity to enslaved Africans as either a part of their religious duty, an additional avenue of social control, or both. White and black congregations heard different sermons, each tailored to the audience's position in the plantation power structure. The enslaved heard sermons that justified slavery and

emphasized the importance of loyalty, while the planters, their families, and those of European ancestry heard sermons that justified slavery and highlighted the need to "educate" lesser individuals who were in "need" of their enlightened guidance. However, the importance of this duty to "educate" was not to be taken literally. The New Negro Acts, passed following the Stono Rebellion of 1739, forbade educating slaves because literate slaves were thought to be more likely to encourage insurrection (Guthrie, 1996). Despite these obvious motivations for forced conversion, Christianity became a great comfort to the enslaved. Although it was used to justify their enslavement, it assured them that they would be free in the afterlife. Christianity was therefore important to planters and slaves for very different reasons.

Christian rituals were Africanized through creolization with African rituals common to West African belief systems.⁴ The ring shout that often characterized services in the Lowcountry and Sea Islands is a result of this process, in which the chanting and dancing of African religion was transferred to the worship of a Christian deity. Burial practices that include the symbolic "killing" of ceramics, clocks, and other material objects that are placed on the grave are also due to the creolization of Christianity and African religious symbology. These practices have been documented in numerous African American communities in the Southeast U.S. (See Westmacott, 1992 and Thompson, 1983)

Although not officially deemed as "churches," praise houses are community institutions that serve as places of worship and remain an integral part of Lowcountry society. These small houses were built following local legislation forbidding gatherings of slaves from different plantations as a deterrent to organized revolts following the

⁴ Interested readers are referred to Creel (1988) for a more extensive description of Lowcountry religion.

Stono Rebellion of 1739. Because few churches were located on plantation grounds, praise houses continued slaves' Christian indoctrination without violating slave-control laws. Creel (1988) suggests that these structures allowed the development of a more African practice of Christianity, as services were usually led by black ministers or preachers. These institutions survived slavery and reconstruction, and plantations on St. Helena boasted between one and four praise houses still in use after the Civil War. In her study of emic designations of community membership based upon the former plantation system, Guthrie (1992, 1996) found three functioning houses on the island.

When I first started field research on the Island, I looked for praise houses and never found any until they were pointed out to me by a local resident. Praise houses are furnished very simply with backless wooden benches or straight-back wooden chairs. Each contains a single light bulb hanging from the ceiling, a speaker's podium, and rough wooden plank floors. A cowbell calls the faithful to service. Organs, hymn books, altars, pianos, or other common church accoutrements are never found in praise houses. —Guthrie, 1996:89

Guthrie found that when these institutions survive, they remain an important unit of Sea Island spiritual life and retain the authority to settle grievances between members of the community. It is interesting to note that some congregations have posted signs identifying these structure as praise houses (Figure 9). Since members of the community are familiar with the location of these institutions, this can be interpreted as a public display of pride in Gullah heritage and history.

Music

...more than perhaps any other aspect of African culture, music survived the ordeal of the Middle Passage to play a significant role in the lives of American slaves and contribute greatly to indigenous forms of American music. —Boles, 1983:147

The centrality of music in Gullah culture has provided inspiration to the lives of enslaved Africans and their free descendents and recently led at least one family to their ancestors' homeland.⁵ Mary Moran of Harris Neck, Georgia, is the descendent of former slaves. Her mother taught her a song that was passed down from mother to daughter through several generations. Although they did not understand the words, they believed the song was African, like so many other elements of Gullah heritage. As part of his fieldwork, Lorenzo Dow Turner recorded Moran's mother, Amelia Dawley, singing the song in 1932. He identified the language as Mande and translated the song in his 1949 study of the Gullah language (Table 5). This song remains the longest preserved African text identified in the Gullah language.

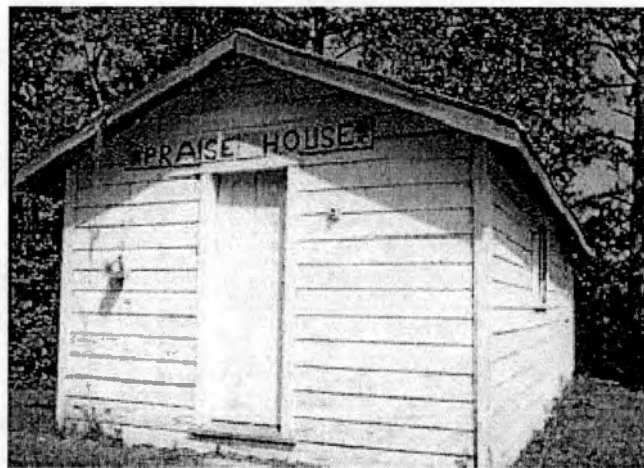


Figure 9: St. Helena Island Praise House

The sign informs the public that the structure is a cultural center.

From CoastalGuide (no date)

⁵ This account is summarized from Frazier (1997a,b) and Toepke and Serrano (1998).

Fifty years later, anthropologist Joe Opala and ethnomusicologist Cynthia Schmidt located Turner's recording of Amelia Dawley's song. They arranged for a choral group in Freetown, Sierra Leone, to perform the song as a greeting for a group of American Sea Islanders visiting the African country as a cultural exchange and "homecoming." The two researchers were amazed to discover that members of the American homecoming group were familiar with Amelia Dawley and how to contact members of her family. When the researchers contacted Dawley's elderly daughter, Mary Moran, she told them her mother had indeed taught her the song Turner recorded in the 1930s.

Table 5: Amelia Dawley's Funeral Song

English Translation	Mende Funeral Song
¹ Everyone come together, let us struggle; The grave is not yet finished; let his heart be perfectly at peace.	¹ Ah wakah muh monuh kambay yah lay kwambay
² Everyone come together, let us struggle; the grave is not yet finished; let his heart be very much at peace.	² Ah wakah muh monuh kambay yah lay kwan.
³ Sudden death commands everyone's attention like a firing gun.	³ Hah suh wiligo seeyah yuh banga lilly.
⁴ Sudden death commands everyone's attention, oh elders, oh heads of the family.	⁴ Hah suh wiligo dwelling duh kwan.
⁵ Sudden death commands everyone's attention like a distant drum beat.	⁵ Hah suh siligo seeyah yuh kwendieyah.

From Frazier (1997b), cited from Turner (1949).

The researchers then began a search for the song in the Mende villages of Sierra Leone, enlisting the help of Tazief Loroma, a linguist and member of the Mende tribe. They played the recording in several villages and eventually found a woman who recognized the words, although the melody differed from her song. Baindu Jabati identified the song as an important part of her tribe's *Tenjami* funeral ceremony. The first two lines of each version of the funeral song have identical words and rhythm that called mourners to the graveside. The final two lines were changed to fit the individual circumstances (Frazier, 1997b). In generations past, Jabati's family was responsible for conducting *Tenjami* ceremony for members of their village. However, she had never performed this service because the mostly Islamic and Christian citizens of her community considered it a pagan ritual. She did not intend to pass the song to her descendents because it had no meaning outside of the ceremony.

While an altered version of the song also exists as a part of Sierra Leone's popular culture, Jabati's knowledge of the song's ritual importance allowed the researchers to identify the song's origin. The responsibility for conducting the *Tenjami* ceremony included the explicit ownership of the songs learned by Moran and Jabati. This meant that Moran and Jabati were very likely descended from the same tribe and family lineage. A recent video documentary (Toepke and Serrano, 1998) follows Moran's visit to Sierra Leone with her family and her meeting with Baindu Jabati.

CONTEMPORARY STUDY OF LOWCOUNTRY LIFE

As the trend for African American cultural consciousness gained strength through the 1960s and 70s, African American researchers became increasingly interested in the

Lowcountry and Sea Islands. This is reflected in the virtual explosion of literature between 1970 and 1980. An excellent collection of articles in the *Journal of Black Studies* (1980) is dedicated to the region's cultural heritage, the controversy over the origins of the Gullah language, religious practices, and Esau Jenkins' grassroots political movement for minority voter registration that swept the region in the 1960s. This collection was later published in book form as Twining and Baird's (1991) *Sea Island Roots*.

In addition to her statements in *Sea Island Roots*, Twining challenged future investigators to use a more holistic approach to the uniqueness of the contemporary population in an earlier work:

Too long have we had articles such as John Szwed's 'Africa Lies Just Off the Coast of Georgia' which depends on out-dated scholarship purporting to represent the culture as it now is. The people of that area are tired of being regarded as interesting relics and want to be seen as whole persons with social needs as well as fascinating old culture traits." —Twining, 1975:143

There is a need to recognize the contemporary Sea Island population and its participation (or lack thereof) in contemporary American and Southern culture. However, some valuable integrated contemporary studies of the region have been conducted with the cooperation of Lowcountry communities.

The excellent works by linguist Patricia Jones-Jackson (1978a, 1978b, 1984, 1987) provide the most comprehensive description of modern life in the Sea Islands. Jones-Jackson was able to live as an accepted member of the community by virtue of her African American ancestry and close relationship with an "othermother," a respected elder woman native to the island. This allowed Jones-Jackson to document the status of

the culture and study the process of decreolization in the face of exposure to outside influences.

Jones-Jackson's untimely death in an automobile accident in the Lowcountry in 1989 left her work unfinished, and no other researcher has been able to document the day-to-day modern life in the islands so completely. Patricia Guthrie conducted ethnographic research on St. Helena and surrounding islands in South Carolina during the 1970s and returned in 1992. Her recent publications (1992, 1996) document social practices, household composition, and ideological concepts such as "catching sense" and community justice. Although her research was conducted prior to that of Jones-Jackson, its recent availability presents a major contribution to Lowcountry studies.

Cultural research continues in the Lowcountry, but gaining access and the cooperation of Gullah communities can be difficult. Through the 1960s, some work by outside researchers was conducted with little regard to the concerns of the community, leading to an increasing reluctance to participate in such investigations (Jackson et al., 1974:33, 39). Some African American researchers and Lowcountry citizens wished to keep white researchers from studying the Sea Island culture altogether, making it clear that

...they did not want white people doing primary research on the island, because they felt that Whites would 'misinterpret black culture.' —Moerman, 1974:vii

Given early examples such as Gonzales (1922) and the controversial photos⁶ included in Carawan and Carawan (1966), this reaction can be understood. However, many

⁶ Although the Carawans clearly exhibit respect and affection for residents of the Lowcountry, the photos included in the first edition of their book (1966) focused on the rural poor, which some found offensive and non-representative. The 1989 edition provides a more representative depiction of Lowcountry life.

citizens and organizations have adopted a more positive, although protective, approach that allows research to continue.

The mistrust of researchers is not limited to scholars of European ancestry, but includes anyone who is considered an "outsider." Beoku-Betts (1994) provides a thoughtful description of her experiences as a participant observer in the Sea Islands. While her status as a black woman initially helped her establish a polite rapport with the people she wished to interview, her social, educational and marital status, as well as her British accent and African citizenship negatively affected her ability to gain entree into the community. By breaking some traditional "rules" of positivist/objectivist participant observation by sharing personal experiences and information, she was able to negotiate a relationship that allowed her to learn about the culinary traditions she was researching (personal communication, Harrison, 1999). Like many Lowcountry researchers, Beoku-Betts reports that once this relationship was established, the study's participants expected continued contact with her after her fieldwork was completed. Further, they clearly expected her to share the results of her study with the community in a timely manner.

Despite this successful negotiation, Beoku-Betts documents the limitations that some individuals placed upon her access to information even when they consented to interviews. Despite their completely voluntary participation, some participants constructed short, concise answers that were not as informative as the answers of other participants. Many did not expand their answers despite requests for clarification or redirected queries. Beoku-Betts interpreted this as an attempt to conceal information for fear of judgment, a sense that their contribution was not worthy of study, or because they did not wish to share the details of their personal experiences with an outsider. As

reflected by the title of her study, "When Black is Not Enough," she finds that Gullah communities (like other disenfranchised peoples) have learned not to participate in studies until the researchers have clearly and explicitly explained and substantiated their intent and proven their credibility. Even then, one may not expect full disclosure from all participants.

These women made me understand that the Gullah are a very proud people who do not like to be perceived as simple and ignorant and not be respected. They felt that this is how they have been portrayed by outsiders. —Beoku-Betts, 1994:425

While this situation provides an excellent example of the consequences of unethical or biased research, it is heartening that Lowcountry African Americans support the study of their culture and history if it is carried out under *their* supervision. This proactive approach allows legitimate research to continue while protecting the community and insuring they have full access to the results of such investigations.

Sharing and discussing the results of scholarly research with the community is a particularly important part of Lowcountry studies that benefits all parties. Beoku-Betts (1994:429) found that discussing her research with members of the community allowed her to better understand their collective and individual interpretations and opinions of events described in newspapers and other published literature. It also allows citizens to appreciate the value their heritage has to the advancement of knowledge and the development of theory that can be applied to interesting and practical endeavors (see Chapter 4 for some examples).

Many Sea Islanders have become quite vocal about the public dissemination of cultural research. During one of my visits to the Lowcountry I took a tour of historic Charleston with a company specializing in African American history. Our tour guide

provided a short explanation of the Gullah language, mentioning that Turner documented its African elements during the first half of this century, adding "But nobody told *us*."

Frazier (1997b) also alludes to this lack of communication between the academic community and the Sea Island participants, noting that although Turner recorded her mother's African song in 1932 and published a translation of it in 1949:

...[Moran] didn't understand the song and she did not know, until 1991, that the song was a Mende funeral song. —Frazier, 1997b

More proactive involvement of community leaders has led to greater cooperation between the academic and native communities. Today, most researchers work through the auspices of respected community centers such as Penn Center in Beaufort or the Avery Research Center in Charleston. Cooperative associations with community leaders are adopted to avoid even unintentional exploitation, understand and address community concerns, and insure that the information is shared with the public in a timely manner (See Project SuGAR, no date). Still, outsiders of all backgrounds may be viewed with suspicion and the results of each participant-based study must be analyzed knowing that informants may not have revealed the full story. However, some recent developments suggest that study of the Sea Islands' African legacy is entering an exciting new era.

The edited volume by historian and Sea Island native Marquetta Goodwine (1998) is the first Sea Island research produced by a member of the native African American community. Goodwine's *Gullah/Geechee Sea Island Coalition* (Afrikan Kultural Arts Network, no date) is sponsoring a petition to add Beaufort, SC, to the National Register of Historic Places. This would protect the region from the commercial development that has destroyed much of the Gullah way of life in other areas of the Lowcountry. Many Gullah families continue to practice a traditional communal style of living in Beaufort,

providing one of the few areas where such traditions remain a part of daily life. The Coalition successfully lobbied to change zoning laws to include an environmental/cultural protection overlay for St. Helena Island. This legislation prohibits the construction of gated communities, golf courses, and tennis courts on the Island (Goodwine, 1999). They have also opened a new cultural center and archive, "Hunnah Home," that is dedicated to the study and preservation of the area's heritage.

Thanks to two Sea Island educators, pre-schoolers and adults alike can learn the importance, value, and uniqueness of Sea Island culture through the educational and entertaining television show *Gullah Gullah Island*. The show features songs and characters inspired by Sea Island folklore and oral traditions, and explores elements of Sea Island culture while it promotes understanding and learning.⁷ Episodes are broadcast nationally by the Nickelodeon Network and are available on videocassette through national outlets. The show's creators and stars, Ron and Natalie Daise, are residents of St. Helena who use their talents to educate the public about Gullah culture through books and traveling performances based upon Ron Daise's Lowcountry upbringing. Although Natalie Daise was born and raised in New York, she has become an advocate for preservation of her adopted Sea Island culture. In 1997 the two received the Folk Heritage Award from the South Carolina state legislature in recognition of their many contributions to Gullah folk culture preservation and education (Daise 1987; Daise and Daise, 1986-96; Daise and Daise, no date).

⁷ A Nickelodeon web site describes *Gullah Gullah Island*:

"Hosts Ron and Natalie Daise, a warm and loving African-American couple who live on a Sea Island off the coast of South Carolina, open their home to pre-schoolers and their care-givers with a rich mix of song, games, stories, dance and humor... Each episode also includes an exploration of the unique culture of the Sea Island region with an up-close look at the community and its people, including artists, fishermen, weavers and farmers." (Nickelodeon Network, no date)

The twentieth century has witnessed the growth of Lowcountry research from studies burdened by Eurocentric agendas to the recognition of cultural adaptation as psychological protection against enslavement. The movement toward community involvement in Lowcountry studies and the sense of personal responsibility required of the academic community has increased support of study and preservation of the unique and valuable Lowcountry heritage. With more cooperation between the native and academic communities, the future of Lowcountry research holds great promise.

Preface to Part II

A Hypothesis of Lowcountry Affinity

The biological analyses that make up Part II of this dissertation are of both anthropological and epidemiological interest. Increased knowledge concerning the Lowcountry's ancestral populations and the effects of regional population migrations and mating patterns will improve our ability to accurately interpret the pheno- and genotypes present in the contemporary population. Many events and factors shaped the African and Creole populations, including the arduous Middle Passage and the hardships of plantation labor. These dynamic trends caused reduction and selection of unknown magnitudes in the baseline population that gave rise to the contemporary genome.

Although out-migration of Lowcountry African Americans likely occurred, especially during the Civil War and following Emancipation, the numbers of migrants and distances traveled are not known. This is also true for in-migration, both through the internal slave trade and personal migration for financial and familial reasons in the time since Emancipation. Because the effects of migration could not be accurately modeled, they were not included in this hypothesis of population affinity. The effects of migration could be quite significant because migration is seldom random, but rather is commonly kin-selected. That is, families usually migrate together and/or facilitate the later migration of relatives (Fix, 1978, 1993, 1994). Such non-random population dynamics have the greatest effects upon population structure.

Because the magnitudes of migration, bottlenecks, and birth and death rates are unknown, a hypothesis of Lowcountry biological and genetic affinity was based upon

available cultural and historical data. Given the information summarized in Part I, Lowcountry African Americans were expected to illustrate greater similarity to populations of Upper Guinea and the Windward Coast (Senegal, Guinea, Guinea-Bissau, and Sierra Leone), followed by populations of equatorial Africa (Congo, Angola). Although Africans from the Ivory, Gold, and Slave Coasts were highly valued laborers, the historical and cultural data suggest the numerical contribution of peoples from Upper Guinea, the Windward coasts, and equatorial Africa were most significant.

The studies in Chapters 5 and 6 provide biological data that are used to evaluate the validity of this hypothesis in the final chapter. The independence of the genetic and anthropometric analyses allows objective testing of the cultural and historical conclusions presented by other authors.

Part II

Original Investigation

Chapter 4

The Biology of Lowcountry African Americans

Melville Herskovits's book *The American Negro: A Study in Racial Crossing* (1928) was the first work to consider the biological consequences of the African diaspora. Herskovits emphasized the importance of recognizing that African Americans constitute a unique admixed biological population rather than displaced Africans. Using the term "Negro" to refer to Africans, he stated:

The American Negro is an amalgam, and the application of the term 'Negro' to him is purely sociological. But the phrase 'American Negro' has real biological significance ... —Herskovits, 1928:17

The diverse biological legacy of African Americans is interesting from an anthropological standpoint because we concern ourselves with the processes of cultural and biological contact. Although the historical record provides a number of accurate accounts of the origin of African American ancestors, they do not provide all of the details and may be plagued by several weaknesses (see Chapter 2). The anthropological approach is, by definition, a holistic view of questions that define the human experience. The physical anthropologist uses data from the cognate fields of cultural anthropology, archeology, and history to supplement and interpret biological information that distinguishes populational events such as migrations, demographic variation, adaptation, and evolution in various contexts and environments.

While some might view these concerns as esoteric, this is not the case. The biological admixture of diverse African genomes with one another and with Europeans, Asians, and indigenous peoples of the Americas is of great import to the incidence and

patterning of disease in the contemporary African American population. Kiple (1987) and Kiple and King (1981) present convincing arguments supporting study of African American biology. They show that the modern Western environment appears to activate disease processes in people whose ancestors were adapted to quite different environmental and dietary conditions. This novel Western environment negatively affects a number of populations including Native Americans, Polynesians, and Asians, although the works discussed here focus on peoples of African ancestry. Understanding the biological repercussions of the African diaspora can suggest new avenues of treatment and prevention, provide clues to African American ancestry, and expose population dynamics of interest to anthropologists, the medical establishment, and students of African American history.

Many debilitating diseases affect African Americans more frequently than their West African or European counterparts, reflected by significantly different rates of mortality and morbidity for black and white Americans:

Cancer, heart disease and stroke, cirrhosis, diabetes, infant mortality, unintentional injuries, and homicide were identified as the largest contributors to an estimated 60,000 excess black deaths in this country by the Secretary's Task Force on Black and Minority Health in 1985. Since then, AIDS has also emerged as a serious health threat to black Americans... Black men are nearly twice as likely to die from cancer as the general population. Blacks are 33 percent more likely to have high blood pressure than whites and are more likely to suffer strokes at an earlier age and with more severe results. Black babies are twice as likely as white babies to die before their first birthday... The rate of AIDS among blacks is more than triple that of whites. —Braithwaite and Taylor, 1992:xiii

Some of these health problems are purely genetic in origin (sickle cell disease), some are known to have both a genetic and environmental component (type II diabetes, hypertension), and others often have social and lifestyle correlates that may confound

efforts at prevention (AIDS, homicide). Factors such as age, socio-economic status, diet, environment, and access to medical care also affect the patterning of disease. In many cultures these are not independent of ancestry or ethnicity. Studies that control for these variables help elucidate the social and lifestyle correlates of disease across populations. Better understanding of these effects provide valuable information that can be used to improve quality of life and increase life expectancies for patients with conditions that disproportionately affect particular populations.

HISTORICAL GENETICS AND AFRICAN AMERICAN HISTORY

Anthropologists have contributed to the phenomenal growth of the field of human genetics because these methods allow direct estimation of biological relationships between individuals and populations, the very relationships that have long been estimated using phenotypic data. Studies of what has been termed *historical genetics* (Morton, 1973; Conceicao et al., 1987; Sans et al., 1997) have been particularly useful to both the anthropologist and medical researchers. However, anthropologists' understanding of long-term evolutionary dynamics and short-term selection can provide more extensive explanations for population-specific risks of disease.

Consider the example of hypertension, commonly known as high blood pressure. Most are familiar with the public service campaign encouraging Americans to be aware of the condition and to "treat it and live." Some elements of this campaign specifically target a black Americans because they suffer greater mortality from cardiovascular disease. Among blacks, most fatal strokes are the result of hypertension. In fact, one agency estimates that blacks experience 66 percent greater mortality than whites due to

stroke (Hildreth and Saunders, 1992). Racial differences in the clinical expression of hypertension have been attributed to factors including physiological differences, differences in evolutionary history between populations, and cultural factors.

Medical research has illustrated physical differences that may contribute to the prevalence of hypertension in populations of African descent. Comparison of black Americans, white Americans, and Nigerian women showed that individuals of African descent exhibited greater fat distributions in their upper body, which is thought to place them at greater risk for hypertension (Adams-Campbell et al., 1990). Other studies have found correlations between hypertension and darkness of skin pigmentation, hormonal levels, sympathetic nervous function, renal function, and cellular transport mechanisms. (See Hildreth and Saunders (1992) for an excellent review of these studies through 1992).

The salt-retention hypothesis (Grim, 1988) uses a more anthropological approach to the question of African American hypertension. This hypothesis suggests that the Middle Passage is partially responsible for this difference between American whites and blacks, as well as those found between Africans and African Americans. Most of the mortality aboard the crowded slave ships was attributed to dysentery, a condition that causes severe diarrhea and subsequent dehydration if untreated. Those individuals who were better able to retain salt would have been more resistant to dehydration and would have therefore survived in greater numbers. This could account for the greater prevalence of hypertension in the contemporary African American population because they would be significantly more efficient at retaining fluid, leading to increased blood volume and higher blood pressure. This would be especially true for individuals diagnosed as being "salt sensitive." The salt retention hypothesis could also explain why many African

peoples do not exhibit hypertension even after their culture has been westernized: the selective force of dysentery and dehydration did not affect populations that did not experience the Middle Passage.

An interesting series of studies of hypertension in Lowcountry Gullah populations examined possible associations between African ancestry and increased risk of mortality due to hypertension and heart disease (Boyle, 1970; Keil, 1981; Keil et al., 1992; Keil et al., 1993). African affinity was estimated by degree of skin pigmentation, determined by reflectometry. Although an association between skin pigmentation and hypertension was found (Boyle, 1970), further analysis showed that much of this effect was patterned by socioeconomic status rather than pigmentation (Keil, 1981). A 30-year longitudinal study by Keil and colleagues (1992) found no significant relationship between pigmentation and increased mortality from hypertension. The major effects were attributed to *sex* rather than *ancestry*. Males experienced greater mortality due to heart disease, regardless of ancestry. On average, African Americans exhibit higher blood pressures, but this did not translate into a greater incidence of cardiac-related mortality. Subsequent examination of the specific risk between males and females of European and African ancestry showed both white and black males to be at higher risk of coronary disease than their female counterparts (Keil and colleagues, 1993). These more recent studies corroborate Tyroler and James's (1978) suggestion that spurious associations between race and hypertension may be caused by (or exacerbated by) social, economic, and cultural factors. In situations where physical and genetic traits predispose certain individuals to increased disease risk, studies focusing on the interaction of culture and biology can aid in the identification of those individuals at highest risk. Anthropologists are uniquely equipped to provide

holistic analysis and insight into human behavior, culture, and biology, making them a useful asset to medical research.

ADMIXTURE STUDIES

With the notable exception of the hypertension studies described above, few studies of African American genetics and biology have been conducted in the Lowcountry. Pollitzer's (1958) study of Lowcountry blacks was the first to confirm the low rate of European admixture suggested by the population's documented cultural and geographic isolation. Genetic data (ABO, Duffy, Kell, and MN systems), anthropometric measures, skin pigmentation data, and prevalence of the sickle cell allele (Hb S) were used to calculate the degree of Caucasian admixture in the Gullah population. While admixture estimates for other groups of African Americans ranged from 20-30%,¹ Pollitzer estimated that only 8% of the genes in the Gullah population were of European origin. Independent analysis of the genetic and morphological data yielded similar results despite the environmental component involved in anthropometric traits.

Pollitzer's study supported Heskovits's (1928) assertion that the African Americans constitute a "new hybrid" of African and European heritage. It also showed that other African American groups exhibited more Caucasian admixture than the Gullah and were more biologically removed from West African populations. As a result, the physical map of the three groups of African ancestry show the Gullah to be more similar to Africans than other African Americans (Figure 10). This retained African biology was also

¹ These estimates are based upon other reports. In some areas it is likely that admixture exceeds 30%, but these groups are often categorized as "tri-racial isolates" rather than African Americans. The level of admixture depends upon numerous cultural and historical factors operating in each region (Personal communication, Harrison, 1999).

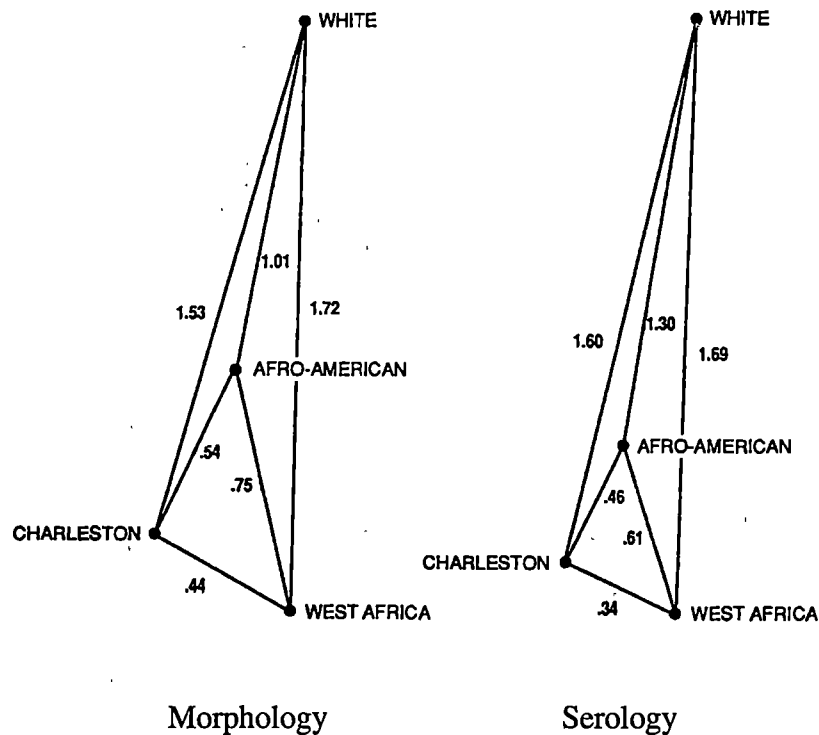


Figure 10: Pollitzer's (1958) Population Distances

reflected by the high frequency of the sickle cell allele. African Americans in and around the city of Charleston exhibit the sickle cell allele more often than most other groups of African Americans. In fact, the frequency of this allele in the Lowcountry (15.1%) was very similar to that found in African regions affected by malaria (see Livingstone, 1973). Recent data shows that 21.7% of African American newborns in South Carolina carry the sickle mutation, compared with an allele frequency of only 0.03% among all other babies born in the state (Ashley-Koch et al., 1998). Before the advent of public insect control programs in the mid-twentieth century, South Carolina's hot, humid environment and extensive natural and man-made floodplains made it an excellent environment for *Anopheles* mosquitoes, the most common vector of malaria.

A later study of the inhabitants of the more rural James Island showed that urban blacks exhibited slightly more Caucasian admixture than their rural counterparts (Pollitzer et. al, 1964). While urban blacks were estimated to have roughly 8% European ancestry (Pollitzer, 1958), those from more rural areas were estimated to have only 5% European ancestry. The lesser admixture found in the rural sample was also supported by Boyle and colleagues' (1968) study of the sickle allele. They found that the frequency of the Hb S allele in the Sea Islands was almost double that of urban areas, interpreted as a more *African* population in the islands than in the urban centers.² (This could also indicate that rural areas were still subject to malaria and its selection for the AS heterozygote, reflecting a more African *environment* rather than a more African *phenotype*.) To date, only one other group of African Americans has exhibited such a low degree of European admixture, explained by cultural and geographic isolation caused by a unique history (Wienker, 1987).

The multivariate study by Menegaz-Bock (1968) compared the Gullah to other anthropologically important groups (Seminole, Pima, Hollister-Haliwa tri-racial isolate) to assess the heritability of tooth size. Despite their documented historical relationship (McRae, no date), Menegaz-Bock's results fail to support a biological relationship between the Gullah and Seminole with regard to tooth size. Pollitzer (1996) compared Gullah dental measurements to those from African peoples to assess specific tribal origins, but the lack of West African dental measurements did not allow direct comparison with the proposed ancestral populations.

² This finding was challenged by Huisman and colleagues (1980) and was defended by Pollitzer (1991). Pollitzer cites several studies that confirm frequencies as high as 15 and 16 percent. He suggests the Huisman and colleagues' sampling strategy may account for the differences.

PROJECT SUGAR AND DIABETES IN THE LOWCOUNTRY

Chakraborty (1986) explains that naturally occurring hybrid populations present unique opportunities to identify candidate genes for complex diseases. This can be accomplished by comparing the rate and expression of disease in the hybrid population to its known ancestral groups. This methodology also provides valuable insight into the genetic and environmental components of disease. Diabetes affects almost 25% of the African American population in the Lowcountry and Sea Islands, more than twice the average American rate of diabetes (Spruill, 1999). Study of Lowcountry blacks can help identify the genetic cause(s) of diabetes and results can be used to benefit the local population. Project SuGAR, the Sea Island Genetic African American Family Register is an ongoing study at the Medical University of South Carolina that seeks to identify the genetic and/or environmental factors that make Gullah families more vulnerable to the disease (Project SuGAR, no date). By comparing the genetic characteristics of these Lowcountry families with African groups that share a genetic heritage, they hope to identify genes that control obesity and insulin metabolism. Pedigree analysis of family data is used to identify candidate genes in both Lowcountry and African DNA. (Candidate genes are coding regions of DNA that show significant correlation with clinical traits of the disease.) The sickle cell haplotype study that comprises Chapter 5 of this dissertation was funded by Project SuGAR as a part of their search for African populations most genetically similar to Lowcountry African Americans. The project has made extensive use of the available anthropological data and promises to uncover more detailed information concerning the African affinity of the Lowcountry Gullah population.

Chapter 5

Sickle Cell Haplotypes and African Ancestry¹

Humans possess two clusters of globin genes located on separate chromosomes. Chromosome 16 includes the " α -like" globin gene cluster that controls the ζ -globin chain proteins in embryos and the α -globin chain proteins in adults. Chromosome 11 includes the " β -like" globin gene cluster, which controls the genes that produce ϵ globin in the embryo, γ -globin in the fetus, and β - and δ - globin in the adult. Each globin gene contains two coding regions interrupted by non-coding introns (Steinberg and Embury, 1994:9).

Each of the globin proteins combines with iron-rich heme groups to produce hemoglobin, a tetramic molecule consisting of two α -chains composed of 141 amino acids and two β -chains composed of 146 amino acids (Figure 11). These hemoglobins bind up to 97% of the oxygen carried by the red blood cells to all body tissues (Audeskirk and Audeskirk, 1993; Molnar, 1992). The combination and type of α and β chain products determine the type of hemoglobin present in an individual's bloodstream. Each stage of human development has a characteristic set of functional hemoglobins controlled by their respective genes: embryonic hemoglobins, fetal hemoglobin (Hb F), and normal adult hemoglobin (Hb A, which can be differentiated into types A₁ and A₂). The physiological systems that regulate the transition between stages are not fully understood, so abnormalities in hemoglobin production during any stage of life cannot be corrected (Steinberg and Embury, 1994:9).

¹ Appendix 1 defines a number of the technical terms used in this chapter.

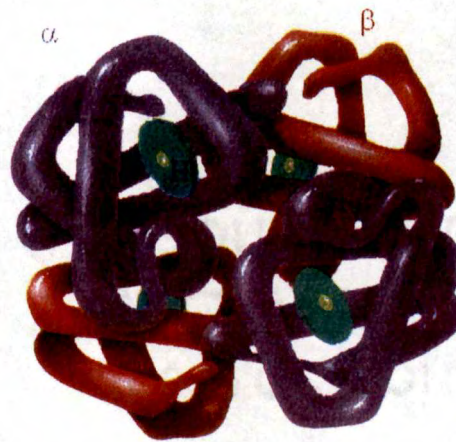


Figure 11: The Hemoglobin Molecule

α = alpha protein chains

β = beta protein chains

H = heme groups

Adapted from Audeskirk and Audeskirk (1993: 656)

Mutations in the globin genes are relatively common in both the α and β chains. Each mutation results in a distinct hemoglobinopathy and has a characteristic effect on oxygen transport. Hemoglobin disorders are inherited traits subject to the forces of natural selection. It is therefore not surprising that some human populations exhibit these conditions more frequently than others due to their particular environment and population history. For example, the mutation that causes β -thalassemia is most prevalent in peoples of the Mediterranean, while the mutation that causes sickle cell anemia is most common in peoples of West Africa. Despite the malevolence of these mutations when present in the heterozygous state, strong heterozygote advantage has produced balanced polymorphisms that keep the deleterious alleles in the gene pool.

THE SICKLE CELL ALLELE

Perhaps the most studied hemoglobinopathic mutation is the one that causes sickle cell anemia. This condition is characterized by the presence of an abnormal adult form of hemoglobin known as hemoglobin S (Hb S or β -S).² This protein results from a single base change in codon 6 of the β -chain, changing the codon from GAG to GTG. This causes the amino acid *valine* to be substituted for *glutamic acid*, which is found in the normal Hb A protein. This abnormal protein polymerizes when it is deoxygenated, resulting in the disease's characteristic sickle-shaped erythrocytes. This physical change decreases the amount of oxygen that each blood cell carries, reducing the oxygen supply to body tissues. Of more consequence, the deformed erythrocytes can become trapped in blood vessels and produce microthrombi, which cause debilitating or lethal stroke. At least 476 β -globin variants have been documented, many of which cause diseases characterized by sickled erythrocytes.³ However, only the Hb S mutation causes the condition known as sickle cell anemia.

When the Hb S allele is present in a homozygous state (SS) the individual is diagnosed with sickle cell *anemia*. A heterozygous individual (AS) is said to be a "carrier" and is diagnosed with sickle cell *trait*. If two carriers produce offspring, they have a 25% chance of producing a child with sickle cell anemia. Individuals with sickle cell anemia suffer significantly more severe health consequences than those with sickle cell trait. Heterozygous "carriers" are usually unaware that they carry the allele unless

² Although it is present in West Africa and affects the same codon, the Hemoglobin C mutation results in a different abnormal protein and has different clinical symptoms.

³ A full description of these variants can be found on the National Institute of Health's web site, Online Mendelian Inheritance of Man (OMIM) (NIH, no date).

they have undergone genetic counseling, have a family history of the condition, or experience hemolytic crises brought on in unusual situations such as oxygen depletion in high-altitude environments (unpressurized air travel, mountain terrain). Homozygous individuals have increased chances of mortality at all ages and often suffer debilitating symptoms such as juvenile or adult stroke, acute infections, tissue infarcts, and hemolytic crises that may result in tissue necrosis (Talacki et al., 1990). Between 1979 and 1995, the mortality rate for South Carolina sickle cell patients was 6.3 per 1,000,000 individuals, the third highest in the nation (Ashley-Koch et al., 1998).⁴

While the clinical manifestation of sickle cell anemia is often severe, there is great variation in the degree to which patients experience symptoms. This variation is often attributed to different combinations of the various hemoglobin products, which can significantly affect polymerization. In heterozygotes, Hb S levels do not often exceed 40%, which, under normal circumstances, is not sufficient to trigger the painful crises and other clinical symptoms expressed by persons with higher levels. This explains why individuals with only one allele coding for Hb S (sickle cell trait) do not suffer the clinical symptoms expressed by those homozygous for the mutation.

The levels of other hemoglobins present in a patient's system affect the degree of clinical severity even in patients with sickle cell anemia (Hb SS). For example, elevated levels of fetal hemoglobin (Hb F) in adults can somewhat counteract the polymerization effect and its related clinical symptoms. Scientists are eager to identify the genes responsible for producing specific hemoglobins and learn to manipulate their function. If

⁴ The District of Columbia has the highest rate (14.6 per 1,000,000), followed by Mississippi (6.6 per 1,000,000) (Ashley-Koch et al., 1998).

production of fetal hemoglobin could be controlled, manipulating the ratios of abnormal and fetal hemoglobins could control symptoms of sickle cell anemia (Steinberg and Embury, 1994:10).

NATURAL HISTORY OF THE SICKLE CELL ALLELE

Herrick's (1910) initial description of sickled red blood cells and their correlation with hemolytic crisis was the first scientific investigation of sickle cell anemia. Scientists learned how to induce sickling in normal erythrocytes and concluded that the shape of blood cells depended upon the systematic oxygen concentration (Emmel, 1917; Hahn and Gillespie, 1927). In 1949 Linus Pauling and co-workers revolutionized sickle cell research by confirming that the sickling phenomenon was caused by abnormal hemoglobin transport of oxygen. Shortly thereafter Neel formally described sickle cell anemia as a homozygous condition caused by pairing of two heterozygous parents affected with sickle cell trait (1951). Perutz and associates (1960) ushered in the "new era" of sickle cell research when they presented the first x-ray crystallography representation of the hemoglobin molecule (Ranney 1994:1). (Interested readers are referred to Ranney's excellent article for more in-depth description of the scientific discoveries of this early period.)

Sickle cell anemia is a lethal condition with clinical manifestations that lower patients' resistance to other dangerous infections. Until recently, it was inevitably a terminal condition and affected individuals usually perished before adulthood. Scientists wondered why the disease was so prevalent if affected individuals seldom survived to reproduce. Study of commonalties in the distribution of sickle cell and environmental factors was undertaken to explain the continuation of this lethal mutation.

Allison (1954a,b) first suggested that the high frequency of the sickle cell allele in African and African-derived populations was the result of natural selection in malarial environments. The high prevalence of the mutation in tropical West Africa led him to suggest that the Hb S allele somehow afforded protection against malaria. Native economies based upon wetland agriculture had transformed the natural lowlands to floodplains, providing conditions excellent for vectors that spread malaria. Allison proposed that individuals with normal hemoglobin suffered decreased fitness due to the effects of malaria, while those with sickle cell anemia suffered decreased fitness due to their disease. Those with sickle cell trait, however, received a degree of protection from malaria due to their single Hb S allele and did not suffer decreased fitness due to complications of sickle cell anemia. This heterozygote advantage produced a balanced polymorphism that maintained the deleterious sickle cell mutation in the population at a much higher rate than would be expected from mutation alone. This conclusion revolutionized anthropological investigation of the disease.⁵

The introduction of molecular techniques provided expanded opportunities to study the natural history of the sickle cell mutation. The Hpa I restriction site 3' to the β -globin locus, discovered by Kan and Dozy (1978), was among the first modern genetic polymorphisms used for medical and anthropological studies of population history. Mutations in the Hpa I recognition site were identified roughly 5000 kb downstream of the Hb S mutation. Absence of the restriction site resulted in a longer fragment (13.0 kb), while presence of the site resulted in two smaller fragments (9.0 and 4.0 kb). The linkage

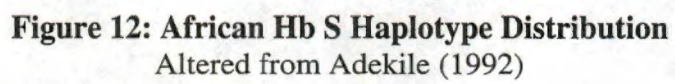
⁵ It is possible that there has been even stronger selection for the sickle cell mutation. Recent investigations suggest the sickle cell allele may offer protection against infections and conditions unrelated to malaria (Nagel and Fleming, 1992).

of the longer fragment with the sickle cell allele was suggested as a tool for prenatal diagnosis of sickle cell anemia and represents a major milestone in early detection of the disease.

Subsequent methods for prenatal testing soon eclipsed the method employing the Hpa I polymorphism. However, discovery of polymorphisms in linkage with the sickle mutation spurred study of the origin and spread of the sickle cell mutation(s). The fact that sickle cell patients exhibited a number of independent polymorphisms in linkage with the sickle cell mutation (Kan and Dozy 1978, 1980; Feldenzer et al, 1979; Anonarakis et al, 1982) suggested that the disease mutation might have occurred several times in Africa (Nagel and Fleming, 1992). The possibility of a multicentric origin for the sickle cell mutation spurred a flurry of restriction mapping studies that have provided a relatively clear picture of the alleles' natural history.

In all, four independent β -chain mutations resulting in sickle cell have been documented in Africa (Oner et. al., 1992; Lapoumeroulie et. al., 1992) and a fifth is found in Saudi Arabia and India.⁶ Each of the four African haplotypes has a discrete geographic distribution along the West African coast (Fig. 12). Each type was originally referred to by a number, but most scientists found it less taxing to call the major haplotypes by their geographic name (Powars and Hiti, 1993). The major African haplotypes are the Bantu type (20), formerly known as Central African Republic type (CAR), the Senegal type (3), Benin type (19) and Cameroon type (17).

⁶ The Indian haplotype is not examined in this study because it is not present in Africa.



The Senegal allele is found in the rice-growing regions of northwest Africa, inhabited by speakers of Fulani and Wolof languages. Mid-Atlantic West Africa is characterized by the Benin allele, which is most often found in peoples belonging to the Kwa language group (Kru, Akan, Yoruba, and Ibo). The expansion of Bantu-speaking peoples into sub-Saharan West Africa introduced the Bantu haplotype to the region, leading to the suggestion that the mutation predated their migration or occurred during or very shortly after it began (Nagel and Fleming, 1992). The Cameroon haplotype is found only in the Eton and Ewondo peoples of Cameroon and its distribution within those populations is limited. In the first description of the Cameroon haplotype, Lapoumeroulie and colleagues (1992) report that only 13 out of 80 alleles (16%) studied exhibited this pattern. All other ethnic groups in Cameroon exhibit the Bantu haplotype. It is therefore thought to be a private mutation or evidence that these societies represent remnants of the original populations that evaded the assimilation into the neighboring Bantu populations. (Summarized from Nagel and Fleming, 1992.)

The possibility of a functional relationship between Hb S haplotypes and the clinical severity of sickle cell anemia provided significant funding for research focused on developing new treatments. Several studies have found that individuals with Senegal haplotype have less severe symptoms due to higher Hb F levels, while patients with the Bantu type exhibit the most severe symptoms. The Benin haplotype appears to cause symptoms intermediate between the Senegal and Bantu types (Green et al., 1993; Nagel et al., 1991; Steinberg et al., 1994). Some researchers report no significant differences in hematological indices between sickle cell patients that can be attributed to different

haplotypes (Rieder et al., 1991; de Montalembert et al., 1993). Others have noted that study of the sickle cell mutation is often complicated by coexistence with other hemoglobinopathies such as α -thalassemia. Konstantopoulos and colleagues (1996) suggest these conditions are linked in some populations and could have played a role in the selection of the sickle cell mutation because some coexisting mutations ameliorate the clinical symptoms of sickle cell anemia. Lu and colleagues (1996) searched the intervening regions of the β -globin like gene cluster for additional polymorphisms linked to the major haplotypes that could affect the expression of Hb F. They concluded that the known haplotype polymorphisms were the only factors correlated with Hb F levels in this region. However, they acknowledge that genes on other chromosomes have been found to affect Hb F levels and state that sex chromosomes and/or hormones may also play a role in regulation of this protein. Despite much study, the question of the functional significance of β -globin haplotypes remains unresolved.

HAPLOTYPE STUDIES

The application of β -globin haplotypes to anthropological questions was suggested in the first report of polymorphisms linked to the sickle mutation (Kan and Dozy, 1978). While most of the funding for sickle cell studies has been provided for medical research, anthropological questions have always been an integral part of these studies. Genetic investigation has been successfully used to test the accuracy of historical data and explore the genetic diversity and dynamics of African and African American populations. By identifying the mutation responsible for a patient's sickle cell anemia, investigators can determine the origin of (at least) two of the individual's ancestors.

Although haplotyping of the β -S allele is usually undertaken in order to identify an individual's ancestry, haplotypes found in a contemporary population may reflect population dynamics. For example, the β -S mutation linked with the informative polymorphisms is usually lethal, so the individuals carrying the most ancestral information (i.e., homozygotes) often do not produce offspring in preindustrial societies or contemporary Third World countries. For example, in a sample of 170 individuals from Sierra Leone collected for Project SuGAR, no individuals homozygous for the sickle cell allele (SS) were present in a random sample of adult individuals although more than a quarter (28 %) were heterozygous for the mutation (AS). In an environment with reduced selection for the sickle mutation, such high levels of early mortality in homozygous individuals would speed the loss of individuals and could decrease the representativeness of the subsequent gene pool.

RECOMBINATION CAN PRODUCE "ATYPICAL" HAPLOTYPES

In preparation for sexual reproduction, specialized human reproductive cells undergo a process called *meiosis*. Meiosis culminates in the production of haploid cells that contain one-half of the genetic information necessary to form a zygote. In sexually reproducing organisms, meiosis creates the *gametes* (sperm and ova). The meiotic event of interest to this research occurs at the earliest stages of meiosis, so only those events pertinent to the current study are discussed.

During *interphase*, the resting phase of cell function, chromosomes are not recognizable as independent entities. Instead, they are unwound and fill the nucleus with their thread-like material called *chromatin*. This allows for normal functioning of the

genes, including protein synthesis and replication, the primary functions that occur during interphase. Toward the end of interphase each of the chromosomal strands replicate, resulting in two homologous chromosomes composed of identical twin chromatids. As interphase ends and meiosis begins, each of the two homologous chromosomes aligns so that all homologous coding regions match up. Homologous chromosomes intertwine at random intervals and form bridge-like structures called *chiasmata*. Genetic material is exchanged between these chiasmata in a process called *crossing over*. This exchange is made between corresponding segments of the two homologues so that the information coded by the crossover section occupies the same location on its new chromosome as on its former chromosome. Therefore information is not lost or gained, but rather exchanged. Following cross over the chromosomes condense into recognizable bodies (visible under magnification) and homologues and chromatids divide, resulting in haploid gametes. (Summarized from Audeskirk and Audeskirk, 1993.)

The exchange of genetic material that occurs during crossing over allows for new combinations of genetic material in offspring. Crossing over allows an individual to pass on a chromosome with hybrids of their own paternally and maternally inherited genes, introducing new variation into each generation. (This variation *is in addition* to the independent assortment of maternal and paternal chromosomes that occurs during meiosis.)

The Hb S haplotypes used in this study are patterns of polymorphic restriction sites that are most likely the product of recombination among the (5) independent Hb S alleles and variants of the Hb A allele. Both the normal Hb A and abnormal Hb S allele reside in the same location on chromosome 11 and can therefore exchange sequences through

crossover. The distance between regions of crossing over is relatively large, so genes that reside in close proximity to one another are usually inherited together (i.e., are linked). However, the genes of the β -globin like gene cluster span more than 73 kilobases (kb). The restriction sites that define the haplotypes are positioned throughout this length and are subject to crossover. These physical distances result in recombinant or "atypical" β globin haplotypes, especially at the far ends of the gene cluster. Most of the atypical β globin haplotypes found in African American populations are attributed to a highly active "hot spot" of recombination located at the 5' end of the β gene (Chakravarti et al., 1984) and a less active hotspot at the 3' end. The restriction sites utilized in this study do not fall within these hot spots, so atypical haplotypes seen in this sample are attributed to crossover events rather than hotspot activity.

Given the relative homogeneity of Hb S haplotypes within regions of Africa, it is not surprising that recombinant haplotypes are less common in continental Africans and more common in New World populations of African ancestry. In a population with a predominant haplotype there is a great likelihood of inheriting homozygous alleles. Crossover between identical alleles will maintain the original coding through the exchange of genetic material rather than create novel combinations. It follows that a high frequency (or dominance) of a single haplotype in a population results in a low frequency of *detectable* recombinant alleles. Crossover will not be detected because a large percentage (or a majority) of these events will occur between identical alleles.

The history of the African diaspora to the New World clearly suggests that atypical Hb S haplotypes would be more common in North and South America because laborers came from all regions of West Africa. Many researchers support this speculation:

Several investigators... have noticed a higher frequency of atypicals among African-Americans carrying the β s gene. Since this population is admixed 20% with Caucasians (on average)... the β s chromosomes have the opportunity to pair with chromosomes of Caucasian origin... as well as haplotypes of other regions of Africa away from their original geographical origin. —Nagel and Fleming, 1992:336

HAPLOTYPING OF LOWCOUNTRY AFRICAN AMERICANS

Rationale and Considerations

This study was undertaken as a preliminary investigation of Lowcountry African affinity and to describe the contemporary gene pool for subsequent comparison with proposed ancestral groups. As detailed in Chapter 2, Africans were imported into South Carolina from the founding of the Charleston colony (1670) through the end of the legal slave trade (1807). A large percentage of the estimated 120,000 enslaved Africans brought to the Charleston market through the legal slave trade were captives from the rice-growing Upper Guinea and Windward Coast (Senegal, Gambia, Guinea-Bissau, and Sierra Leone), while others were from the Ivory, Slave and Gold Coasts, Congo, and Angola. This history would suggest that a large number of the African Americans native to the South Carolina Lowcountry would express the Senegal or Bantu haplotype.

The late 18th and early 19th centuries witnessed a large influx of African and Creole laborers from the tobacco growing regions of Virginia and Maryland into the cotton-growing regions of the South. Many of these slaves were brought to the Charleston market for sale to the expanding Southern frontier. While the great demand for slave labor was driven by the emergent upcountry cotton agribusiness, contemporary descriptions suggest that Lowcountry planters also absorbed some of the Chesapeake's excess labor. Planters in the Chesapeake region preferred laborers from the Gold Coast

(Littlefield, 1981), which suggests that haplotypes from other regions of Africa are expected in the Lowcountry population in unknown frequencies.

Although the search for the *ancestral* genome of Lowcountry African Americans is a major anthropological goal, identifying the genetic character of the *contemporary* population is more important for the medical research. Like loss of surnames through generations, random and directional loss of informative polymorphisms occurs through time, often altering the expected characteristics of the contemporary gene pool. The contemporary genome will not accurately depict the ancestral population when a population has experienced significant in- or out-migration, increasing or decreasing birth rates or other such changes in population structure. Therefore, all results of Hb S haplotype studies must be considered within the context of population dynamics and conclusions concerning the ancestral gene pool should be viewed with caution.

Materials and Methods

Five polymorphic restriction sites were chosen from the PCR method for the β -globin gene cluster described by Sutton and colleagues (1989) (Figure 13). Of these, four identify a single haplotype and the fifth site (Hinf I 5') identifies both the Senegal and Cameroon haplotypes. The Hinf I site was used to corroborate the Senegal and Cameroon alleles distinguished by the Xmn I and Hinc II (5') sites. This redundancy allowed confirmation of the haplotype in cases of recombination or failed amplification.

The sample was assembled from the patients receiving treatment at the Adult and Pediatric Sickle Cell Clinics of the Medical University of South Carolina. The diagnosis of sickle cell anemia (Hb SS) was confirmed for all individuals by electrophoresis during

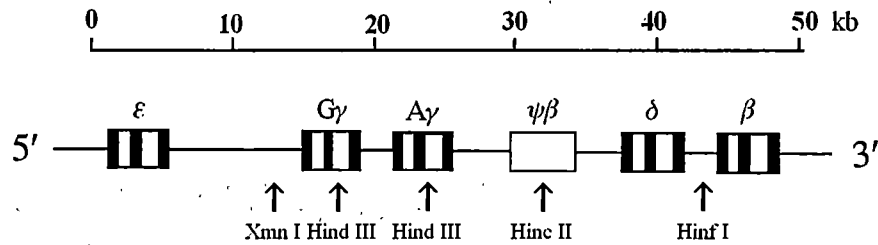


Figure 13: β -globin Like Gene Cluster Restriction Sites Selected for Haplotyping

the tenure of their treatment at the clinics. Most individuals were patients of long-standing with established medical histories. Informed consent was obtained from all individuals included in this analysis. These permissions are on file with Project SuGAR and the Division of Hematology and Oncology at the Medical University of South Carolina (see Appendix 2). Two participants in Project SuGAR reported having SS genotype. These individuals were added to the sickle cell sample following confirmation of these genotypes by the method described by Gurgey and colleagues (1993) as described on page 109.

DNA from participating individuals was isolated from leukocytes using the Qiagen kit (Valencia, CA). The polymerase chain reaction (PCR) was employed to amplify the regions of interest using a Perkin Elmer GeneAmp 9600 thermocycler using three temperature PCR programs appropriate for the primers used. Separate 18 μ l reactions were performed to replicate the five regions of interest using reagents manufactured by Quiagen. Amplicons were then digested by each of the appropriate corresponding restriction endonucleases following manufacturers' instructions (New England Biolabs, Beverly, MA). PCR products were stored at 4° C when delays between amplification and

digestion processes occurred. The digested PCR products were electrophoretically separated in an ethidium bromide stained agarose gel of concentrations appropriate for the fragment sizes generated. Each gel was examined under UV light and photographed for analysis (see Appendix 3, Figure A-3-1).

Haplotypes were determined from the pattern of presence and absence of the five cleavage sites (Table 6). Because family data were unavailable, it was assumed that each individual exhibited major haplotypes rather than atypical types. Data from related individuals was used only when they did not exhibit identical haplotype patterns.

Raw results were recorded to determine the distribution of the four African haplotypes in the Lowcountry sample. Individuals for whom birthplace data were available were classified as either "migrant" or "native" according to their grandparents' birthplace. Although many of the patients interviewed were unaware of their family's complete birthplace information, most indicated they had strong family ties to the area and knew of no immediate relatives from outside the Lowcountry. Therefore natives were defined as those individuals with no data indicating an out-of-state grandparent. (This criterion was applied only to those individuals interviewed for birthplace information.)

Table 6: Haplotype Restriction Patterns

	XmnI $\gamma 5'$	Hind III $\gamma 5'$	Hind III $\gamma 3'$	HincII $\psi \beta 5'$	HinfI $5' \beta$
Bantu	–	+	–	–	–
Senegal	+	+	–	+	+
Benin	–	–	–	–	–
Cameroon	–	+	+	–	+

Shaded cells indicate results that allow haplotype determination from a single site.
+ denotes presence of a restriction site, – denotes absence

Frequencies of the African Hb S haplotypes were used as an indicator of genetic contribution by enslaved Africans ancestral to the Lowcountry population.

Attempted Haplotyping of a Sierra Leone Sample

The published literature reports the Senegal haplotype as predominant in the rice growing regions of Upper Guinea (see Adekile, 1992 for a review). To confirm this, DNA obtained by Project SuGAR from 170 individuals of the Mende and Temne ethnic groups of Sierra Leone was screened for the Hb S mutation for subsequent haplotyping. The region of chromosome 11 containing the Hb S mutation site was amplified following the method described by Gurgey and colleagues (1993). Amplicons were then digested with Dde I following manufacturer's instructions (New England Biolabs, Beverly, MA). The digest products were separated and photographed as previously described. Of the 170 individuals, none were homozygous for the Hb S mutations and only 47 were heterozygous for the mutation. Because no individuals exhibited the SS genotype, haplotyping of individuals with the AS genotype was attempted. Although reference data for the selected restriction sites along the normal Hb A allele is available, variation in the normal Hb A allele is not well documented. Since phase of the restriction patterns could not be determined, the results were deemed too ambiguous for analysis.

RESULTS

Haplotype Distribution in the Lowcountry Sample

The sample's allele distribution shows that a majority of the sampled alleles (59 %) exhibited the Benin haplotype pattern. The same percentage of alleles (20%) displayed the Bantu and Senegal patterns of cleavage sites (Table 7). The genotype distribution also

reflects the predominance of the Benin type, with the highest number of homozygotes (24) consisting of paired Benin alleles (Table 8). The heterozygous combinations of Benin, Bantu, and Senegal make up the next most frequent genotypes. Few Bantu or Senegal homozygotes were present in this sample. The single Cameroon allele was accompanied by a Benin allele.

The Hardy-Weinberg exact probability test for equilibrium available in the GENEPOP population genetics software package (Raymond and Rousset, 1995, 1999) was performed under a model of complete enumeration. The overall population did not diverge from H-W equilibrium, indicated by non-significant Fisher scores and an overall exact p-value of 0.22. (It is important to note that the test measures random assortment of the Hb S *haplotypes* rather than the Hb S mutation. One could not test for Hb S

Table 7: Allele Distribution in the Lowcountry Sample

Benin	Bantu	Senegal	Cameroon
67	23	23	1
59 %	20 %	20 %	1 %

N = 114 alleles from 57 individuals

Table 8: Genotype Distribution in the Lowcountry Sample

Benin / Benin	Bantu / Bantu	Senegal / Senegal	Benin / Bantu	Benin / Senegal	Bantu / Senegal	Benin / Cameroon
24	2	3	10	8	9	1

N = 57 individuals

equilibrium in a sample comprised of only SS individuals.) The random assortment of the Hb S haplotypes is both interesting and somewhat unexpected in light of the varying degrees of severity that have been proposed for the Senegal, Benin, and Bantu alleles. The conformity to Hardy-Weinberg proportions indicates that no selection is acting differentially upon the Lowcountry Hb SS phenotypes.

Birthplace data was collected for 32 individuals from the South Carolina sickle cell sample. Of these, 8 were classified as migrants and 24 as natives. Migrants were grouped with individuals of unknown birthplace to increase sample size in all comparisons. The Benin haplotype was the most common for both groups, accounting for more than one-half of all alleles in both migrants/unknown and Lowcountry natives (Table 9). The small sample size makes conclusions tenuous, but it is interesting to note that the native group exhibits a greater frequency of the Senegal allele and a lower frequency of the Benin allele than the migrant/unknown birthplace group.

Table 9: Comparison of Allele Frequencies in Lowcountry Natives versus Migrants and Individuals of Unknown Birthplace

Alleles	Benin	Bantu	Senegal	Cameroon
Native N = 48	27 56 %	9 19 %	12 25 %	0 0 %
Other N = 66	40 61 %	14 21 %	11 17 %	1 2 %

The Hardy-Weinberg exact probability test calculated for the two groups (native versus migrant/unknown birthplace) using the complete enumeration model (GENEPOP: Raymond and Rousset, 1995, 1999) showed no significant deviation from equilibrium for either group ($X^2 = 5.2$, 4 df, $p = 0.27$).

Recombinant Haplotypes

As stated previously, it was assumed that each genotype consisted of only common haplotypes. This assumption proved reasonable in most cases, as illustrated by easily classifiable haplotype patterns across the five restriction sites. Nevertheless, 11 individuals exhibited conflicting haplotype restriction site patterns. Three genotypes (S20, S35 and S73) exhibited atypical restriction patterns at the 5' Xmn I site, while the remaining 8 atypical haplotypes were affected at the 3' Hinf I site (see Table A-3-1). Because individuals with sickle cell anemia possess two β -S alleles, one cannot determine which of the alleles has been affected by recombination unless 1) an individual is homozygous at all other sites or 2) the phase of the parental types is known.

Based upon the Lowcountry sample's allelic and genotypic distribution, the Senegal and Bantu alleles were more likely to have been affected by recombination because they are more likely to be inherited with Benin alleles than with other Senegal or Bantu alleles. The presence of atypical restriction site patterns in homozygous Senegal alleles confirms this speculation for the Senegal allele. (The presence of atypical sites for Bantu alleles cannot be confirmed because the phase of the affected restriction site cannot be determined in heterozygotes without the aid of parental data.) Benin alleles are more likely to be inherited together, masking crossover events that occur in homozygous

individuals. However, the presence of homozygous Benin genotypes with atypical restriction arrays (ID numbers S57, S75) indicates that the Benin allele is affected in this population despite its predominance.

DISCUSSION

The data presented by Livingstone (1973) shows that many populations in Upper Guinea and the Windward coast do not exhibit the high frequencies of the sickle cell allele (Hb S) that one normally expects to find in West African populations. For example, the frequency of the AS genotype in modern-day Senegal ranges between 8 and 28.6 percent (average = 12.5 percent), while the frequencies in Liberia and Ivory Coast average roughly 16 and 6 percent, respectively. Only the modern country of Sierra Leone has a frequency of AS genotype individuals comparable to other regions of West Africa, ranging from 16.8 to 29.9 percent (average = 21.6 percent) (Livingstone, 1973). The Hb S testing of the Temne and Mende samples from Sierra Leone (page 109) provided a similar estimate, with 47 of the 170 individuals (28 %) exhibiting the Hb AS genotype.

The discrepancy of Hb S frequencies across West Africa suggests that ancestors from the Windward and Upper Guinea Coasts of Africa would be underrepresented at these loci because fewer individuals would have carried the informative Hb S mutation. The results of this study must therefore be interpreted with the realization that the contribution of these African regions to the Lowcountry genome is likely greater than is indicated by the raw data.

Table 10 presents allele frequencies for the Hb S haplotypes in various regions of the world. (Shading indicates populations with the highest frequencies of the Senegal allele.)

Table 10: Comparison of World Hb S Haplotype Distributions

Reference	Population Number of Alleles	Benin (19)	Cameroon (17)	Bantu (20)	Senegal (3)	Arab/Indian (31)	"Other" or Atypical
Schroeder et al., 1990	Senegal N = 140	11 8 %	-	-	121 86 %	-	8 6 %
Schroeder et al., 1990	Ivory Coast N = 29	8 28 %	-	-	21 72 %	-	-
Lavinha et al., 1992	Cape Verde N = 11	2 18 %	-	-	9 82 %	-	-
Schroeder et al., 1990	Gabon N = 34	6 18 %	-	28 82 %	-	-	-
Lavinha et al., 1992	Guinea-Bissau N = 4	1 25 %	-	-	2 50 %	-	1 25 %
Adekile, 1992	Nigeria N = 555	515 93 %	22 4 %	0	6 1 %	0	12 2 %
Lavinha et al., 1992	Angola N = 44	2 5 %	0	42 95 %	0	0	0
Rieder et al., 1991	Brooklyn, NY, Mississippi N = 226	113 50 %	-	36 16 %	18 8 %	-	59 26 %
Schroeder et al., 1990	Baltimore, MD N = 76	45 59 %	-	17 22 %	5 7 %	-	9 12 %
Schroeder et al., 1990	S. California N = 442	269 61 %	-	92 21 %	45 10 %	-	36 8 %
Oner et al., 1992	SE USA N = 371	205 55 %	13 4 %	71 19 %	56 15 %	7 2 %	19 5 %
Hattori et al., 1986	Georgia (USA) N = 196	105 54 %	-	53 27 %	30 15 %	-	8 4 %
Schroeder et al., 1990	Jamaica N = 246	172 70 %	-	32 13 %	11 4 %	-	31 13 %
Muniz et al., 1995	Cuba N = 169	89 53 %	0	68 40 %	12 7 %	-	-
Current Investigation	Lowcountry SC ("Natives") N = 48	27 56 %	0 0 %	9 19 %	12 25 %	-	-

Data for *native* Lowcountry African Americans is presented in the final row. The frequency of the Senegal allele in African Americans from Georgia and California (Hattori et al., 1986; Schroeder et al., 1990) is lower than that for the Lowcountry sample. This result is expected given the Lowcountry's strong historical association with peoples of Upper Guinea and the Windward coast, although it could also be somewhat affected by sampling error caused by small sample size.

The frequency of the Senegal haplotype in the samples described from the "South East United States" and Georgia (Hattori et al., 1986; Oner et al., 1992) are also of interest given the documented importation of enslaved Africans from Upper Guinea to Lowcountry Georgia. Although a large number of slaves from many areas of Africa were brought to the upland regions of Georgia during the cotton era, it is interesting to note the frequencies of the Senegal allele in these two samples are more than double those found in Jamaica, Cuba, and Baltimore (Maryland).⁷ Although there is no direct evidence, this could reflect the colonial slave trade to the Lowcountry and/or migration of individuals from the densely populated Lowcountry of Georgia and South Carolina to other areas of Georgia and the Southeast.

Nagel's (1984) analysis found "a deficiency of Senegal haplotype" in Baltimore that was interpreted as evidence that "carriers of this haplotype were in part re-exported by the Virginia trade" to the South Carolina slave trade (Nagel and Fleming, 1992:349). Nagel hypothesized that 1) the Senegal type would be more prevalent in the deep South and 2) this Senegal haplotype excess would be accompanied by a lack of Benin alleles

⁷ Baltimore is part of the colonial Chesapeake, said to have preferred laborers from the Gold and Slave Coasts (Littlefield, 1981).

due to the well-documented aversion to laborers from the Bight of Benin (Curtin, 1969; Littlefield, 1981). The prediction of higher Senegal type frequency is supported by the Lowcountry haplotype data, but rather than a deficiency of the Benin type there is an unexpected predominance. This result is not explained by the historically documented direct African slave trade to Lowcountry South Carolina.

Many studies report excellent agreement between historically documented movements of enslaved Africans and Hb S haplotype frequencies in modern populations. Using Curtin's classical analysis (1969) of the Atlantic slave trade, Nagel (1984) found that the estimated contributions of African ancestors from each haplotype region agreed well with the historic records of the slave trade to Jamaica (Nagel and Fleming, 1992:349). Similarly, a study of Brazilian sickle cell haplotypes found a strong correlation between documented and estimated contributions of regional enslaved laborers to that country (Figueiredo et al., 1994). Records show that roughly 70% of the Africans taken to Brazil were from Bantu-speaking areas of West Africa, very similar to the 65.9% Bantu contribution estimated by the haplotype data.

Of perhaps more import, the study by Pante-de-Sousa and colleagues (1998) suggests that haplotype frequencies in northern Brazil are the result of the combined effects of the direct African slave trade, the domestic slave trade, and later internal migration. It is very likely that many New World haplotype distributions have been affected by population dynamics, and this may best account for the somewhat unexpected results in this study of Lowcountry African Americans. However, an equally plausible explanation would attribute this unexpected predominance of the Benin type to a largely undocumented importation of enslaved Africans from the Ivory, Gold, and Slave Coasts.

This could be due to poor records or deception carried out within the legal slave trade, or to the undocumented illicit slave trade that continued into the first part of the 19th century. The secondary importation of Africans from the British West Indies may have also been greater than is historically documented. The high frequency of the Benin haplotype in Jamaica (70%) and Cuba (53%) (Table 10, Schroeder et al., 1990; Muniz et al., 1995) suggests that this is a plausible explanation to consider. It is also possible that each of these factors explain a portion of this result, so that the predominance of the Benin haplotype is the result of these factors' combined effects.

These results must also be examined within the context of natural selection. Rather than a relatively small number of Lowcountry ancestors from West Central Africa, the relatively low frequency of the Bantu allele in the Lowcountry sample may be explained by the severity of disease expression believed to be associated with the Bantu allele. If the Bantu haplotype does indeed confer more clinically severe symptoms of sickle cell anemia, then individuals from Angola and Congo (who were likely homozygous for the Bantu allele) would have suffered earlier mortality and morbidity and therefore produced fewer offspring relative people with the Benin, Cameroon, and Senegal haplotypes. However, it is likely that the physical challenges of slavery affected those with sickle cell anemia with similar severity, reducing any differences in relative fitness due to beta-globin haplotype.

While the Benin haplotype is thought to be intermediate between the mildly expressed Senegal and severely expressed Bantu alleles, the haplotype distribution suggests that the difference between them may not significantly affect fitness. The Benin type would not predominate the contemporary distribution if it caused significantly lower

birth rates for affected individuals than the Senegal type. However, it is possible that these results reflect sampling error due to incomplete ascertainment. Pante-de-Sousa and colleagues (1998) suggest that hospital samples used in studies of sickle cell haplotypes may underestimate the frequency of the Senegal allele. Under the working hypothesis of mild clinical expression of sickle cell anemia in patients with homozygous Senegal alleles or with Benin/Senegal genotypes, hospital samples may be inherently biased toward patients with more overt clinical symptoms (i.e., Benin and Bantu genotypes) that require more aggressive treatment.

The results of this study cannot be fully explained without more in-depth study of the Lowcountry African American population dynamics and greater knowledge of the effects each Hb S haplotype has on individual fitness.

Chapter 6: Metric Analysis of Population Affinity

Pollitzer (1957, 1958) provides the most comprehensive analysis of Lowcountry morphology, establishing a baseline for later studies of the more rural James Island population (Pollitzer et al., 1964, 1970). All subsequent studies confirmed that among African American populations, Lowcountry blacks are the most similar to West African populations.

The current investigation sought to elucidate the relationship between Lowcountry African Americans and populations from specific regions of Africa using multivariate methods of population structure analyses. The approach differed from Pollitzer's (1957, 1958) work in two important ways. First, Pollitzer used published data from various African populations to compare the Gullah and other African Americans to a *composite* West African sample designed to represent the ancestral enslaved population:

For the African Negro, values were collected from available studies, grouped within a region, and averaged after weighting by sample size. The procedure not only approaches a measurement of all individuals, but it puts greater emphasis upon the more modern studies which usually utilize a larger sample. *Then the six means for any trait thus obtained were averaged according to the contribution of that region to the Charleston slave trade.* (Italics added) — Pollitzer, 1957:6

For comparison figures have been obtained from the literature on the morphology of the Negroes of West Africa, those of the United States, and the Whites of the United States, averaging the data as previously explained. —Pollitzer, 1957:15

Although averaging the observations for each of the contributing areas was reasonable for comparing Gullah and other black Americans to a West African baseline, it is inappropriate for determining Gullah affinity to *specific* African populations. Although Pollitzer found little difference between the weighted and unweighted analysis (personal

communication), weighting the comparative data based upon historical records could bias the comparison toward the hypotheses that were to be tested by the biological analyses.

The current investigation is also distinguished by its focus on Gullah affinity with only African populations. Because the objective is to elucidate relationships between Lowcountry African Americans and proposed African ancestral groups, European admixture was not a primary concern. Preliminary analysis (data not shown) confirmed Pollitzer's conclusion that Lowcountry African Americans are more similar to West African phenotypes (represented by the populations described later in this chapter) than to European phenotypes (represented by the Irish populations described by Relethford (1983, 1991, 1995) and Relethford and Crawford (1995)).¹ The relationship between the Gullah and other European samples was not considered further in this study.

MATERIALS

Pollitzer graciously made data from his original studies available for the present analysis. Although the data includes categorical measures of pigmentation and prognathism, they were omitted from this study because they were considered more subjective than the continuous measurements (Pollitzer, 1958). Data collected for later studies of more rural populations (Pollitzer et al., 1964, 1970) were not used because they consist of only 3 measurements for which little African comparative data were available.

The original Lowcountry sample was collected through the cooperation of the Medical College of South Carolina (now Medical University of South Carolina) and Roper Hospital, both located in Charleston, South Carolina. The sample is predominantly

¹ The Irish data collection was funded by NSF grant number DBS-9120185 awarded to John Relethford.

female because subjects were recruited through gynecology and obstetrics clinics (Table 11).

Pollitzer's original sample included individuals from 14 to 79 years of age, but his metric analysis included only those 18 years of age and over. This convention was also followed in the present analysis, both for the Lowcountry sample and for comparative samples when ages were reported.

Pollitzer collected 9 anthropometric measurements in the Lowcountry sample following Martin's (1928) standards. Table 12 presents descriptions of each measurement and abbreviations for each that are used throughout this chapter. Suitable raw data for 6 of Pollitzer's 9 metric measurements (NL, NW, FL, FW, StH, SitH) were located in the published literature (Table 13). Because most of the African studies report only a few observations from numerous ethnic groups, observations were grouped by region to increase sample size. Many political boundaries have changed through the twentieth century due to West African political instability. Reported locations of each sample were therefore checked against a recent African ethnolinguistic map (CIA, 1996). The samples were categorized into 7 regions: Angola, Cameroon, Congo, Cote d'Ivoire, Nigeria, Upper Guinea, and Zaire. Resultant sample sizes and regional allocations are presented in Table 13.

METHODS

Preliminary Procedure: Missing Data

Due to difficulties of working with living subjects, missing observations are common in anthropometric data sets. In the case of the Lowcountry data, the female

Table 11: Lowcountry African American Sample Demographics

	N	Mean age	Minimum age	Maximum age
Males	54	33.93 ± 14.77	18*	76
Females	422	48.13 ± 15.29	19	79
Overall	476	36.54 ± 15.74	18	79

* Individuals under the age of 18 were omitted from the present analysis.

Table 12: Pollitzer's Measurements for Lowcountry African Americans

Measurement (abbreviation)	Martin's number	Measurement Description
Nasal length* (NL)	21	Direct distance of nasion from subnasale
Nasal breadth (NW)	13	Maximum width of nasal alae
Lip thickness (LT)	25	Direct distance from labrale superior to labrale inferior; Lips closed but not pursed.
Face length* (FL)	18	Total morphologic; nasion to menton with mouth closed.
Face width: bizygomatic (FW)	6	Direct distance between the two zygia; maximum width.
Shoulder width: biacromial (SW)	35	Direct distance between the two acromia; points located by palpation. Some problems with accuracy due to subjects' clothing:
Hip width: bicristal (HW)	40	Direct distance of the two ilia cristallo from each other; points determined by palpation. Some problems with accuracy due to subjects' clothing and (often) pregnancy.
Stature (StH)	1	Anthropometer pointer on vertex of head. Shoes removed in most cases; if shoes were worn 25 mm was subtracted from measurement.
Sitting height (SitH)	23	Subject seated erect upon table, feet resting on chair to elevate thighs. Lumbar and thoracic spinal curves slightly straightened by observer to insure maximum measurement.

Summarized from Pollitzer (1957), Martin and Saller (1957-66, translated by Jantz, 1998)

* More properly translated as "nasal height" rather than "nasal length."

Table 13: Sources, Descriptions, and Sample Sizes for African Metric Data

Region	Nationality / Ethnic Group*	Source(s)	Males N =	Females N =
Angola	Basoko, Sango	Deniker & Laloy, 1890 Dupont, 1893 Keith, 1911	72	28
Cameroon	Bangala	Dupont, 1893	16	11
Congo	Djabbir, Sappo-Sap, Wangatta (Wangata), Bakongo, Lolongo, Muchikongo	Hambly, 1938 Jacques, 1896-97	42	7
Cote d'Ivoire	Gagou, Gouro	Tauxier, 1924	43	36
Nigeria	Ekoi, Korawp, Uganda, Kabila, Ibo, Efek, Hausa	Keith, 1911 Tremearne, 1911, 1912	162	10
Upper Guinea	Mendi, Timne, Lokkoh, Fulah, Kru, Mandingo (Mandingue), Maures	Deniker & Laloy, 1890 Kramer, 1906 Pales, 1952	87	0
Zaire	Kassai, Bangala, Baluba, Mongo, Katanga	Dupont, 1893 Jacques, 1896-97 Keith, 1911	38	4
		Total	460	96

* Names spelled as listed in original reports.
All variables were not reported for each individual.
These numbers reflect the maximum sample sizes.

sample is not greatly affected by missing observations because of the large number of individuals recruited. Therefore missing data posed no substantive problems for analysis and comparison of the female data with other populations. In contrast, the male sample consists of only 54 individuals and has a considerable amount of missing data, especially for sitting height (SitH) and stature (StH). Table 14 presents the percentage of missing data for each variable in the male and female samples and illustrates the larger problem of missing observations in the Lowcountry male sample. (See also Appendix 5, Tables A-5-1, A-5-2).

To increase the available sample size for Lowcountry males, data augmentation was performed using Schafer's (1999) NORM software, which imputes missing data for multivariate data sets. The program generates summary statistics such as means, standard deviations, variance/covariance matrices, and describes patterns of missing data. The expectation maximization (EM) function uses available data to estimate the missing parameters and provides appropriate starting values for the imputation algorithm. Using these estimated parameters, the data augmentation (DA) function imputes values for the missing data based upon their posterior distributions. The algorithm calculates maximum-likelihood estimates for missing values until specified convergence criteria are met. The

Table 14: Missing Data Percentages for Lowcountry African American Samples

	NL	NW	LT	FL	FW	SW	HW	StH	SitH
Males	0	0	0	0	0	1.85	1.85	22.22	22.22
Females	0	0	0.24	0	0.24	0.47	1.90	1.42	1.42

convergence behavior is dependent upon the degree of missing data: data sets with few missing values converge quickly while those with a number of missing values converge more slowly (Schafer, 1999).

The augmented data set included complete data for 54 individuals, compared with the 42 complete entries in the original data set. The imputation therefore resulted in a 23 percent increase in effective sample size. A multivariate analysis of variance (MANOVA) showed the sample means were not significantly changed by the simulated values (Table 15). The augmented data set for Lowcountry males was therefore used in all further analyses.

Preliminary Procedure: Sexual Dimorphism

The level of sexual dimorphism between Lowcountry males and females was tested by a 7-variable MANOVA (NL, NW, LT, FL, FW, StH, SitH). Table 16 displays the results, which reflect significant differences between the sexes for both the overall model ($F = 27.17$, $p < 0.0001$) and for each individual variable (all $p < 0.05$). With the exception of lip thickness (LT), Lowcountry males are significantly larger than their female counterparts in all dimensions.

Because of this dimorphism the affinities of the male and female samples were analyzed separately. It is acceptable to center both samples on their respective means and then combine them. However, this method was not undertaken because the Lowcountry sample would still overrepresent the female phenotype and all African populations the male phenotype. African samples of unknown sex were not used because they reflect unknown levels of dimorphism that could introduce unwanted statistical "noise."

Table 15: Observed versus Imputed Summary Data: Lowcountry Males

Variable	Observed mean	Imputed mean	MANOVA results
SW	379.45 $\pm$ 21.73	383.07 $\pm$ 22.58	F = 0.63, p = 0.4301
HW	271.88 $\pm$ 20.24	271.46 $\pm$ 19.43	F = 0.01, p = 0.9184
StH	1675.24 $\pm$ 73.46	1677.35 $\pm$ 75.38	F = 0.02, p = 0.8907
SitH	856.45 $\pm$ 37.40	854.89 $\pm$ 40.33	F = 0.04, p = 0.8462

All results are non-significant at $\alpha = 0.05$.

Table 16: MANOVA Results for Sexual Dimorphism in Lowcountry Males and Females

Variable	Male Mean	Female Mean	F	Pr > F
NL	56.89	54.82	13.06	0.0003
NW	46.00	42.13	67.29	< 0.0001
LT	21.07	22.41	5.22	0.0227
FL	126.44	119.46	47.18	< 0.0001
FW	139.33	131.69	83.86	< 0.0001
StH	1677.35	1593.30	83.80	< 0.0001
SitH	854.89	822.77	45.98	< 0.0001

All results are significant at experimentwise $\alpha = 0.05$

Preliminary Procedure: Variables Used in Population Comparisons

Pollitzer omitted two of his 9 original measurements from his analysis because the necessary non-visual methodology for measuring hip width (HW) and shoulder width (SW) resulted in unacceptable levels of interobserver error. These variables were also omitted from the current analysis due to this concern.

All data was systematically checked for errors and possible incompatibility due to different methodology. Although most reports cite the references describing the measurements they observe, few precisely define the measurements they recorded. As an exception, Pollitzer (1957:13) clearly states that his observed "nose length" is "Martin's Cephalometrie No. 21." Martin and Saller (1957-66) state that Martin's measurement No. 21 is more properly translated as "nose height" rather than "nose length." "Nose height" is measured from nasion to *subnasale* as Pollitzer states, but "nose length" is measured from nasion to *ophryon*. Differences between the two measurements are minor, but when precise definitions or primary measurement references are not reported the possibility of different measurements bearing the same name in the literature can introduce error to comparative studies.

Comparison of all available measures of nasal length (NL) and facial length (FL) showed that these variables remained highly disparate following correction of all data entry errors. Based upon Pollitzer's findings (1957,1958), this variation was attributed to interobserver differences in the location of facial landmarks and/or differences in methodology. These two variables were therefore deleted from all subsequent analyses. The remaining 4 variables, nasal width (NW), facial width (FW), stature (StH), and sitting height (SitH), were retained for further analyses.

Multivariate Analysis of Variance (MANOVA)

The four remaining variables (NW, FW, StH, SitH) were used in multivariate analyses of variance (MANOVA) available in the SAS statistical package (SAS Institute, Inc., 1998). Although higher-level models are usually more informative, three-variable models were necessary to include Upper Guinea samples in the analysis because measures of sitting height (SitH) were not reported in the available literature. SAS programs delete cases with missing observations from multivariate analyses. Therefore, the Upper Guinea samples were omitted from all four-variable analyses.

The MANOVA procedure calculates individual significance tests for both class variables (Region, Sex) and for each independent variable (NW, FW, StH, SitH). MANOVA also allows examination of interaction effects between the class variables. The Ryan-Einot-Gabriel-Welsch multiple-range test (REGWQ option) controls type I experimentwise error by adjusting the significance level to account for multiple comparisons (SAS Institute, 1991). This multiple comparison test specifies where significant differences exist within each class and facilitates interpretation of complex effects.

Analysis of Population Structure

In addition to the genetic relationships between the Lowcountry and African populations described in the previous chapter, the population structure of the Lowcountry African Americans and available African samples was examined using coefficients of kinship (R matrices), Wright's *F_{st}*, and generalized distances plotted by the method of principal coordinates. The concept of population structure was first described by Malecot

(1948, 1959, 1966, 1969) and allows more realistic analysis of human populations by avoiding many of the necessary assumptions inherent in theoretical genetic models (Sphuler, 1973). In short, analysis of population structure is:

the study of the effects of internal migration, group composition, mating practices, and other factors on the amount and pattern of genetic drift within an area. — Harpending and Jenkins, 1973:177

Throughout the 1980s, methods for quantitative genetics and population structure analysis were extended to phenetic data under a model of additive genetic variance (see Relethford and Lees, 1982 and Williams-Blangero et al., 1990). These methods are now easily accessible in RMET, a software package for genetic analysis of metric data (version 4.0; Relethford, no date). This program was used to calculate measures of population structure for the Lowcountry and African samples using raw data.

RMET calculates standard errors for elements of the R matrix and *F_{st}* values following methods outlined by Relethford (1997) and offer three options for bias correction. In this study, bias correction included replacement of negative distances by zeros and replacement of diagonal elements that were less than the value represented by $1/(2n_i)$. Because the program does not allow missing data, the largest and most complete data set was chosen, consisting of three variables (FW, NW, StH). Males and females were analyzed separately due to the widely different sample sizes available for the two sexes and the effects of sexual dimorphism.

Estimated census sizes (as opposed to sample sizes) are required for many of RMET's analyses. Although it would have been possible to weight the populations by historic importation census data, this could have biased the study in favor of a particular historical hypothesis of African origins. It is also likely that census data for the 17th, 18th

and 19th century for the populations in question may have changed throughout the centuries of the Atlantic slave trade. Due to these difficulties, all population sizes were assumed to be equal.

Coefficients of Kinship (R matrices)

Harpending and Jenkins (1973, 1974) describe the theoretical population coefficient of kinship (f_{ij}), which represents the probability that randomly chosen alleles at a specified locus are identical by descent in two populations. The population can be defined locally or globally, making this a useful measure of variation for groups as homogeneous as single tribes and those as varied as national or world populations. For two samples i and j , the sample coefficient of kinship (r_{ij}), is a normalized covariance of allele frequencies:

$$r_{ij} = \frac{(P_i - P)(P_j - P)}{P(1-P)}$$

where P is the weighted mean gene frequency across all populations (Harpending and Jenkins, 1973:181). RMET uses a method described by Workman and colleagues (1973) for sample size adjustment to transform the diagonal elements, resulting in an unbiased R matrix.

The information in the R matrix represents the relationships between the populations in question and is interpreted by plotting its principal axes and representing the relationships as a map or by generating a phylogenetic tree. However, since it is difficult to evaluate differences between the various trees that result from different methodologies, Harpending and Jenkins (1973:183) suggest that distance plots of the R matrix

information provide "much more satisfactory visual aids for the interpretation of genetic distances." Therefore, the data in this study are illustrated by a plot of the R matrix's principal coordinates.

Generalized Distances and Principal Coordinates

Harpending and Jenkins (1973) showed that their measure of genetic kinship (r_{ij}) can be easily converted to a scaled, squared generalized distance that is roughly proportional to the more traditional Mahalanobis D^2 (Mahalanobis, 1936) used for multivariate metric analysis (Relethford et al., 1997). RMET uses the Harpending and Jenkins formula as described by Relethford (1997:158):

$$d_{ij} = r_{ii} + r_{jj} - 2r_{ij}$$

Based upon a model of additive genetic variance, Williams-Blangero and Blangero (1989) show that the phenotypic distance between populations represents a minimum estimate of the genetic distance between them for both univariate and multivariate studies. The distance values calculated between the Lowcountry African Americans and available African samples can therefore be compared with subsequent metric and genetic studies of variation as more comparative African data become available.

Given a number of populations, the resulting matrix of kinship coefficients, the relationship matrix (R matrix), can be reduced to principal coordinates and its eigenvectors can be mapped to illustrate minimum genetic distances (i.e., generalized distances) between samples. Although more than two non-zero eigenvectors are usually calculated, the first two usually account for a majority of the variation present between and among populations. RMET calculates the principal coordinates following Gower's

(1966) method and presents the first two eigenvectors scaled by the square root of their eigenvalues. Plotting these principal coordinates allows simple interpretation of generalized distances between populations.

Wright's *Fst*

Wright's *F* statistics (Wright, 1931, 1968, 1969, 1978, among others) permit comparisons of variation between and among various hierarchical levels of a breeding population. Wright's *Fst*, the fixation index, allows measurement of population differentiation due to subdivision (Wright, 1921). More specifically, the fixation index:

equals the reduction in heterozygosity expected with random mating at any one level of a population hierarchy relative to another, more inclusive level of the hierarchy. — Hartl and Clark, 1994:117

Because this method allows the overall breeding population to be defined locally or globally, it has been used extensively by physical anthropologists as measure of population variation. It is easily calculated by averaging the diagonals of the R matrix.

As a ratio of individual to total group variances, possible *Fst* values are bounded by zero and one. An *Fst* of zero indicates that all populations express identical genetically determined phenotypes (or gene frequencies), while an *Fst* of 1.0 indicates no shared characteristics (or complete genetic divergence). Although values as high as 1.0 are possible, observed values are usually well below 0.50 (Table 17) (Hartl and Clark, 1994).

In this study the *total breeding population* is a composite sample composed of all African-derived populations included in this analysis. Each regional classification (Lowcountry, Angola, Cameroon, etc.) is a *subpopulation* of the total breeding

Table 17: Wright's (1978) Guidelines for Interpreting *Fst* Values

<i>Fst</i>	Interpretation
0.00 - 0.05	Little genetic differentiation
0.05-0.15	Moderate genetic differentiation
0.15 - 0.25	Great genetic differentiation
0.25 - 1.00	Very great genetic differentiation

From Hartl and Clark (1994:118-119)

population. The *Fst* index therefore compares the genetic variation within each region to that of the overall composite sample.

Although *Fst* was originally proposed for the analysis of genetic data, quantitative traits can also be used to calculate these statistics because phenotypic variation is, in part, genetically determined. An organism's phenotype is determined by varying degrees of genetic and environmental effects. If the magnitude of each variance is known, the *Fst* value can be adjusted to reflect only the effects of genetic differences.

The ratio of genotypic variance (σ_g^2) to overall phenotypic variance (σ_p^2) is known as broad sense heritability (h^2); i.e., $\sigma_g^2 / \sigma_p^2 = h^2$ (Hartl and Clark, 1994:432). To account for only the genetically determined differences in anthropometric measurements, an estimate of h^2 can be used to calculate the *Fst* index. In a study that confirmed the legitimacy of genetic analysis of anthropometric traits, Konigsberg and Ousley (1995) tested the necessary assumption of proportionality between additive genotypic and phenotypic variance-covariance matrices using anthropometric data for five geographically distinct groups of Native Americans from the Boas data (described in

Jantz and Meadows, 1995). That is, they showed that dividing overall phenotypic *Fst* by the average narrow sense heritability for anthropometric traits provides estimates of genetic *Fst* comparable to that calculated using pedigree data for the same individuals. This study also provides an average h^2 value for common anthropometric traits (0.4017) that compares favorably with the average h^2 for morphometric traits (0.35) calculated by Cheverud (1988). This agreement suggests that these estimates of average heritability for anthropometric traits are not significantly affected by regional effects and may be applicable to other human populations.

RESULTS

Multiple Analysis of Variance (MANOVA)

The two-level MANOVA for all African and Lowcountry samples tested for significant differences due to sex and region. The four-variable model (NW, FW, StH, SitH) showed all variables were significantly different between males and females (all $p < 0.0001$) and also significantly different due to region (Table 18). Similar results were found for the three-variable models (NW, FW, SitH and NW, FW, StH) (data not shown).

When the effects of region were considered within sex classifications, the four-variable model for males indicated significant differences in nasal and facial width (NW, FW) and sitting height (SitH), but no significant differences in stature (StH) (Table 19). Females exhibited no major differences in facial width (FW) despite highly significant differences in the three remaining measurements (NW, StH, SitH). The three-variable model of nasal width, facial width, and stature (NW, FW, StH) included the largest number of individuals and showed highly significant differences for all variables in both

Table 18: Two-level MANOVA Results: Class Variables "Sex," "Region"

	NW		FW		StH		SitH	
	Region	Sex	Region	Sex	Region	Sex	Region	Sex
4 - Males & Females	F = 5.89 p < 0.0001	F = 140.90 p < 0.0001	F = 2.18 p = 0.0342	F = 183.59 p < 0.0001	F = 5.00 p < 0.0001	F = 176.30 p < 0.0001	F = 7.05 p < 0.0001	F = 89.55 p < 0.0001

Shading indicates significant results ($\alpha = 0.05$)

**Table 19: MANOVA Results for Four- and Three-Variable Models:
Class Variable "Region"**

	NW	FW	StH	SitH
4 - Males	F = 5.10 p < 0.0001	F = 3.21 p = 0.0046	F = 1.77 p = 0.1061	F = 2.83 p = 0.0110
4 - Females	F = 4.23 p = 0.0009	F = 1.07 p = 0.3780	F = 6.05 p < 0.0001	F = 11.31 p < 0.0001
3 - Males	F = 4.62 p < 0.0001	F = 6.68 p < 0.0001	F = 4.12 p = 0.0002	
3 - Females	F = 5.09 p < 0.0001	F = 2.13 p = 0.0484	F = 9.39 p < 0.0001	
3 - Males	F = 4.46 p < 0.0001	F = 2.69 p = 0.0103		F = 2.60 p = 0.0129
3 - Females	F = 4.04 p = 0.0006	F = 0.95 p = 0.4603		F = 10.02 p < 0.0001

Shading indicates significant results ($\alpha = 0.05$)

sexes. Although the three-variable female model including nasal width, facial width and sitting height (NW, FW, SitH) showed no significant differences in facial width, in this analysis it is less reliable due to its smaller sample size. The three-variable model for males (NW, FW, SitH) showed significant differences for all variables.

Although these results indicate significant sexual dimorphism and differences in anthropometric measurements, they do not show the pattern of these differences. The Ryan-Einot-Gabriel-Welsch (REGWQ) multiple-range test available through SAS controls experimentwise significance levels for multiple comparisons and indicates where significant differences lie within the data. Although significant differences between African groups were found, only those effects relating specifically to the Lowcountry samples are presented for clarity (Table 20). The REGWQ results indicate that Lowcountry males have significantly shorter sitting heights than those from Cote d'Ivoire and Cameroon. The three-variable model resulting in the largest sample size (NW, FW, StH) shows Lowcountry males have larger nasal widths than males of Upper Guinea, Congo, and Angola. In the dimension of facial width, Lowcountry males are larger than their counterparts from Upper Guinea and smaller than those of Cameroon and Zaire. No significant differences in stature were indicated for the male samples by either model.

Coefficients of Kinship (R matrices)

The genetic relationships between African and Lowcountry males are presented in Table 21 and those between Lowcountry and African females are presented in Table 22. As Relethford explains:

Table 20: Ryan-Einot-Gabriel-Welsch (REGWQ) Multiple-Range Test Results*

Model	Variable	Interpretation
Males: NW, FW, StH, SitH	SitH	Cote d'Ivoire, Cameroon significantly larger than Lowcountry
Males: NW, FW, StH	NW	Lowcountry is significantly larger than Upper Guinea, Congo, and Angola
	FW	Cameroon, Zaire significantly larger than Lowcountry; Lowcountry significantly larger than Upper Guinea
Females: NW, FW, StH, SitH	SitH	Angola is significantly smaller than Lowcountry
Females: NW, FW, StH	—	No significant differences

* All relationships are explained relative to the Lowcountry samples for simplicity. Variables not specified are not significantly different than the Lowcountry sample

Table 21: Unbiased R Matrix for Lowcountry and African Males (NW, FW, StH)

	Angola	Cameroon	Congo	C. d'Ivoire	Nigeria	Upper Guinea	Lowcountry	Zaire
Angola N = 70	0.1030							
Cameroon N = 16	-0.1560	0.1935						
Congo N = 42	0.0131	-0.0287	0.0209					
C. d'Ivoire N = 21	0.0024	-0.0073	-0.0182	0.1201				
Nigeria N = 158	0.0172	-0.0254	0.0140	-0.0452	0.0153			
Upper Guinea N = 26	0.1477	-0.1969	-0.0127	-0.0115	0.0209	0.2167		
Lowcountry N = 54	-0.0490	0.0820	-0.0476	0.0354	-0.0271	-0.0282	0.0693	
Zaire N = 38	-0.0856	0.1074	0.0471	-0.0996	0.0271	-0.1545	-0.0440	0.1890

Shading indicates highest correlations with Lowcountry males
Results from RMET (Relethford, no date)

Table 22: Unbiased R Matrix for Lowcountry and African Females (NW, FW, StH)

	Angola	Cameroon	Congo	C. d'Ivoire	Nigeria	Lowcountry
Angola N = 27	0.1991					
Cameroon N = 11	-0.2278	0.5095				
Congo N = 7	-0.0157	-0.147	0.0145			
C. d'Ivoire N = 24	0.1230	-0.2243	0.0410	0.0782		
Nigeria N = 10	-0.0170	0.0440	-0.0159	-0.0234	0.0036	
Lowcountry N = 415	-0.0080	0.0003	0.0518	-0.0152	-0.0413	0.0833

Shading indicates highest correlation with Lowcountry females
Results from RMET (Relethford, no date)

An R matrix provides estimates of genetic similarity within and among populations relative to the contemporary means of allele frequencies in a region. Positive elements of the R matrix indicate populations that are more closely related than average, and negative elements indicate populations that are less related than average... — Relethford, 1991:157-8

The R matrices indicate that Lowcountry African American males are most similar to males from Cameroon and Cote d'Ivoire, respectively. Lowcountry African American females show greatest affinity with their Congolese counterparts, although the small African sample sizes shed doubt on the value of the analysis. The relationships between Lowcountry males and those from the areas thought to have contributed the largest numbers to the Charleston slave trade (Angola, Congo, Upper Guinea) are all negative, indicating lesser similarity than average within the analysis.

Following Harpending and Jenkins (1973), these relationships were evaluated using the principal coordinates of the generalized distance values calculated from the R matrices. The results of these analyses are presented in the following section.

Generalized Distances and Principal Coordinates

The results of the R matrix and pairwise generalized distances calculated between the African and Lowcountry samples (Tables 23 and 24) are illustrated by plots of their principal coordinates (Figures 14 and 15). The first two eigenvectors account for 89.4% of the variation in males (first = 61.5%, second = 27.9%) and for 93.7% in females (first = 72.7%, second = 21.0). Lowcountry males fall closest to samples from Cote d'Ivoire ($d^2 = 0.1189$), Nigeria ($d^2 = 0.1389$), and Congo ($d^2 = 0.0.1856$) (Table 25, Figure 14). Contrary to the historical and cultural hypotheses, males from Angola and Upper Guinea fall most distant from the Lowcountry sample ($d^2 = 0.2704$ and 0.3425 , respectively).

**Table 23: Unbiased Pairwise d^2 Values between Lowcountry and African males
(NW, FW, SHH)**

	Angola	Cameroon	Congo	C. d'Ivoire	Nigeria	Upper Guinea	Lowcountry	Zaire
Angola N = 70	0							
Cameroon N = 16	0.6085 (0.17)	0						
Congo N = 42	0.0978 (0.05)	0.2718 (0.13)	0					
C. d'Ivoire N = 21	0.2183 (0.09)	0.3283 (0.16)	0.1774 (0.09)	0				
Nigeria N = 158	0.0839 (0.03)	0.2596 (0.11)	0.0081 (0.02)	0.2258 (0.09)	0			
Upper Guinea N = 27	0.02436 (0.04)	0.8040 (0.22)	0.2630 (0.10)	0.3598 (0.14)	0.1901 (0.07)	0		
Lowcountry N = 54	0.2704 (0.07)	0.0988 (0.08)	0.1854 (0.07)	0.1188 (0.08)	0.1388 (0.05)	0.3425 (0.11)	0	
Zaire N = 38	0.4632 (0.11)	0.1677 (0.10)	0.1157 (0.06)	0.5084 (0.15)	0.1501 (0.06)	0.7146 (0.17)	0.3463 (0.10)	0

Standard errors in parentheses.

Shading indicates closest populations to Lowcountry.

Results from RMET (Relethford, no date).

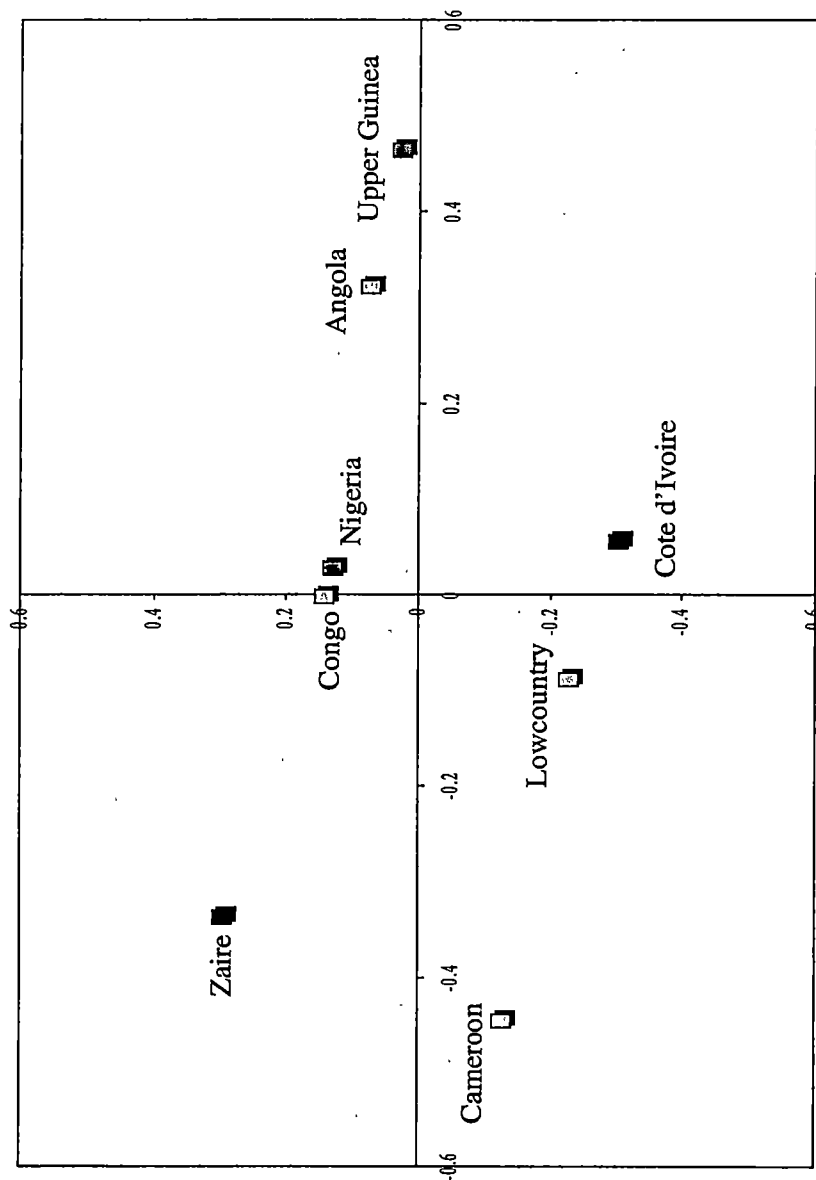


Figure 14: Plot of First and Second Eigenvectors for Lowcountry and African Males
 These eigenvectors account for 89.4% of the total variation.

**Table 24: Unbiased Pairwise d^2 Values Between Lowcountry and African Females
(NW, FW, StH)**

	Angola	Cameroon	Congo	C. d'Ivoire	Nigeria	Lowcountry
Angola N = 27	0					
Cameroon N = 11	1.1642 (0.29)	0				
Congo N = 7	0.2450 (0.18)	0.8182 (0.35)	0			
C. d'Ivoire N = 24	0.0314 (0.06)	1.0364 (0.28)	0.0108 (0.10)	0		
Nigeria N = 10	0.2368 (0.15)	0.4250 (0.23)	0.0498 (0.15)	0.1287 (0.12)	0	
Lowcountry N = 415	0.4426 (0.10)	0.5922 (0.18)	0.0000 (0.07)	0.1920 (0.07)	0.1696 (0.11)	0

Standard errors in parentheses.

Shading indicates closest populations to Lowcountry.

Results from RMET (Relethford, no date).

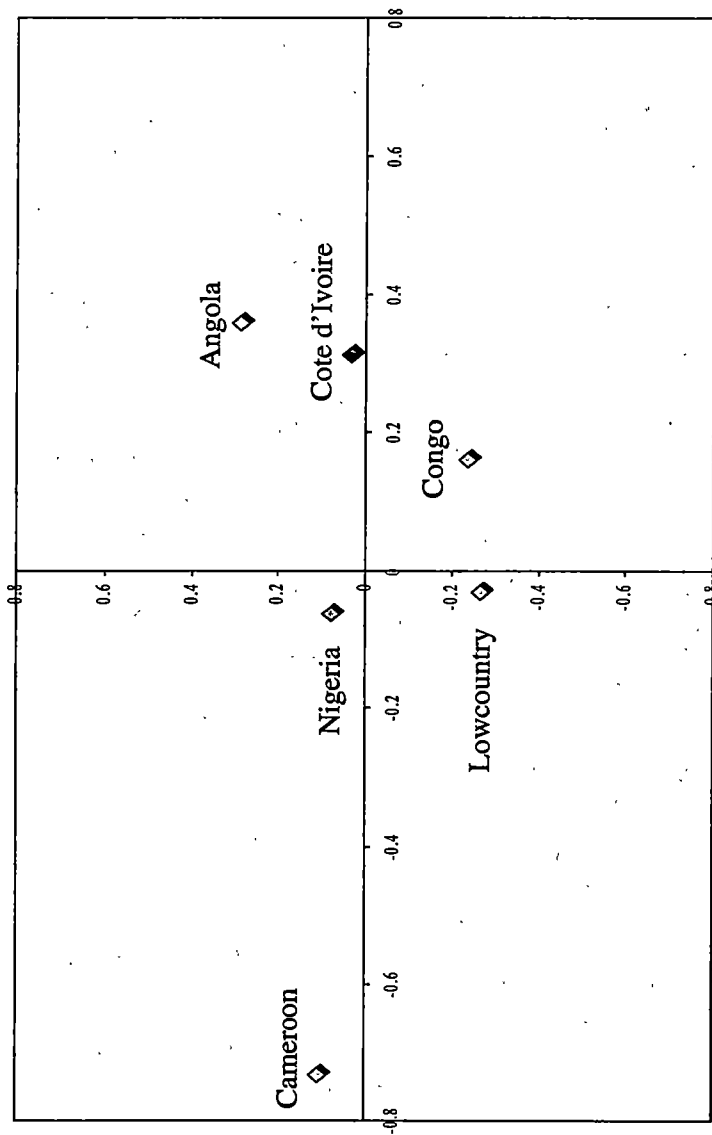


Figure 15: Plot of First and Second Eigenvectors for Lowcountry and African Females
 These eigenvectors account for 93.7% of the total variation.

Like their male counterparts, Lowcountry females fall closest to samples from Congo ($d^2 = 0.0000$), Nigeria ($d^2 = 0.1696$), and Cote d'Ivoire ($d^2 = 0.1920$), with Angola and Cameroon more distant. However, the small samples sizes for females suggests this result may be highly unstable.

Expected affinities among the African samples based upon geography and linguistic similarities are not clearly reflected in these results, casting some doubt on their interpretation. For example, although the Bantu speaking groups of Angola and Congo would be expected to be similar due to geography, Angolan males show a stronger phenotypic affinity with males from the distant regions of Upper Guinea. The populations sampled from the modern region of Zaire should reflect similarities with Angola and/or Congo due to their relative geographic and cultural characters. Zaire shows the greatest affinity with males from Congo ($d^2 = 0.1157$), but it falls quite distant from the Angolan populations ($d^2 = 0.4632$). This could be a true effect, but one would not expect the populations from Zaire to show greater affinity with Nigerian and Cameroon samples than the Angolan sample. These results may reflect effects other than gene flow, i.e., drift or environmental effects. However, it is more likely these relationships reflect artifacts of sampling and the arbitrary grouping of populations within geographic regions.

Wright's *Fst*

As shown in Table 25, although males in this study represent 8 regions and more individuals they reflect less genetic variation than the females. Following Wright's guidelines (Table 17), the male samples exhibit "moderate variation," compared with the female samples, which reflect "great genetic variation." Although equal census sizes were

assumed for all analyses, the effects of sampling error hamper the analysis of females. Due to the more extensive data and more equal sample sizes, the male results are more representative and should better reflect the true relationship between the African and Lowcountry populations.

When compared with the *Fst* values calculated for all African males (excluding Lowcountry), the fixation index for the African and Lowcountry composite sample is slightly lower (0.1308 with the Lowcountry sample versus 0.1362 without). This indicates that Lowcountry males are quite similar to African males because the variation does not significantly increase with their addition to the analysis. The opposite is true for females, where the *Fst* value for all African samples is much greater than that which included the Lowcountry sample. However, this may again be an artifact of inadequate sample sizes for African females rather than actual dissimilarity between African and Lowcountry females. Because the Lowcountry sample comprises 84% of the female sample, removing them from the analysis makes it much more vulnerable to the effects of sampling error.

Table 25: *Fst* Values Across Lowcountry and African Samples

	Biased <i>Fst</i>	Unbiased <i>Fst</i>	Standard Error
Lowcountry and African Males	0.1308	0.1160	0.02
Lowcountry and African Females	0.1826	0.1480	0.03
African Males	0.1362	0.1207	0.02
African Females	0.2032	0.1642	0.03

DISCUSSION

It is unfortunate that the paucity of comparative African data for females decreased the utility of Pollitzer's extensive data for Lowcountry females of African descent. Although observations for Lowcountry females outnumber those for Lowcountry males by more than 8 to 1, the larger sample sizes and greater availability of geographically diverse comparative data made the male analyses more amenable to interpretation. The results of the male analyses are therefore given more weight in the testing of cultural and historical hypotheses.

The preliminary verification of Pollitzer's (1958, 1959) results using Relethford's Irish data (see page 120) confirmed that Lowcountry males and females fall within the cluster of West African phenotypes, removed from the European axis. The MANOVA and REGWQ results showed this West African Lowcountry phenotype more concretely, indicating that males and females were largely indistinguishable from most of their West African counterparts in the dimensions for which reliable data were available. The composite nature of the Lowcountry phenotype is reflected in the population means, which place the Lowcountry samples in the midst of the West African samples in all measures.

The kinship coefficients for Lowcountry and African females are not adequate to support or refute any hypothesis of Lowcountry biological affinity. The relationships between Lowcountry and African males do not support the historical hypotheses of stronger ancestral ties to the rice cultures of Upper Guinea and peoples of Angola and Congo. This suggests the work by Curtin (1969) and Littlefield (1981) may not represent the full story of the African slave trade to South Carolina. As stated in Chapter 2, Curtin's

figures claim that Angola and Congo provided the largest contribution of enslaved Africans to the Lowcountry, but acknowledge relatively large contributions from ethnic groups of Upper Guinea (Senegal, Gambia, Senegambia, Sierra Leone). However, when one categorizes these ethnic groups by shared cultural attributes valued by Lowcountry planters, the contribution of Upper Guinea outweighs that of Angola and Congo (Littlefield, 1981; Richardson, 1991). These results suggest the cultural hypothesis of Opala (1987), which emphasizes the historical relationship with Sierra Leone, also fails to recognize the full diversity of biological heritage. While some regional affinities expected due to geography and linguistic characteristics are not illustrated in this analysis, one cannot assume that they are only an effect of sampling error due to grouping within regions. Increased samples and more intra-regional comparisons are necessary to assess this possibility.

The similarity between Lowcountry and Cameroon males is intriguing. Due to unique population history and numerous ancient migrations through Cameroon, that region has been described as unique among Central West African populations (Spedini et al., 1999). It may be that the historical admixture of West African populations in these two populations accounts for their similarity.

The *Fst* values for Lowcountry African American males and females reflect a diverse ancestry. Although the female sample is much larger, it does not reflect quite as much genetic diversity as the males. Because Lowcountry females comprise an overwhelming majority of the African-derived female sample (84%) it is of little value to consider the African female sample without them. However, the *Fst* for African males without the Lowcountry sample is very similar to that which includes them. This suggests

that the Lowcountry sample is not widely different than the overall composite sample of African males, again supporting the diverse West African origins of the Lowcountry African American population.

The results for females suffer from sparse sample sizes and an overwhelming majority of data from Lowcountry females. However, both the kinship coefficients and minimum genetic distances suggest the closest affinity exists between Lowcountry and Congo females. The d^2 of 0.000 ± 0.07 between the two samples indicates that further investigation of this relationship may prove useful in the investigation of Lowcountry African biological heritage.

With the addition of increased sample sizes, data for more variables, and more even regional representation, analyses of size and shape effects would be quite valuable. If size were accounted for, shape differences between the sexes and among populations might shed more light on the pattern of phenotypic variation in West Africa and provide more information concerning Lowcountry African heritage.

Chapter 7

Conclusions

The primary goal of this investigation was to specifically determine the ancestral origins of the African American population of the South Carolina Lowcountry. Based upon available cultural and historical data, this population was expected to illustrate greater phenotypic and genetic similarity to populations of Upper Guinea and the Windward Coast (Senegal, Guinea, Guinea-Bissau, and Sierra Leone), followed by populations of equatorial Africa (Congo, Angola). Although Africans from the Gold and Slave Coasts were highly valued laborers, the historical and cultural data suggest the numerical contribution of peoples to the Lowcountry was greatest from Upper Guinea, the Windward coasts, and equatorial Africa. The historical hypothesis supports very large influences from both Upper Guinea and equatorial Africa, while the major cultural hypothesis is typified by Opala's (1987) work and emphasizes the contribution of peoples from Sierra Leone, although it recognizes that related cultural contributions could have originated with other rice agriculturalists of Upper Guinea. The latter notion has received a good deal of media attention and is currently popular with many Lowcountry residents.

The genetic data presented in Chapter 5 indicates a dominant influence of alleles from the Gold and Slave Coasts in the Lowcountry African American population. This refutes both the cultural and historical hypotheses of Lowcountry origins. Although the clinical sickle cell patient sample with confirmed genealogical roots in South Carolina has a slightly greater frequency of the Senegal haplotype than other samples described in the literature (see table 10), it is too small for conclusive comparison against frequencies

in the non-native patient population. However, given these results it is possible that 1) the illicit slave trade had a greater effect than is reflected in historical documents; 2) the historical records that account for ports of origin do not accurately correlate with the enslaved's actual national origin, 3) the beta-globin-like gene cluster results are significantly affected by sampling error due to differential mortality and fertility or differences in the number of patients who seek treatment due to the severity of their disease, or 4) migration through the internal slave trade and economic migration following emancipation has altered the allele frequencies of the beta-globin haplotypes in Lowcountry South Carolina.

The likelihood of possibilities 1 and 2 have long been recognized as shortcomings of studies based upon historical documents and are self-evident. Both surely contributed to the pattern of haplotype distribution observed in this study, but the degree to which they acted cannot be adequately assessed. Possibilities 3 and 4 require more thoughtful consideration given the biological nature of this investigation. Both deal with long-term changes in allele frequency or sampling errors that could be introduced in various ways.

The preponderance of the Benin haplotype could be due to a greater survival and fertility of sickle cell sufferers with the Benin haplotype during and following the period of slavery. However, given the great morbidity and mortality among non-industrial populations affected with sickle cell even today at the turn of the 21st century, it is unlikely that individuals with sickle cell disease survived to reproduce. The allele was most likely passed on only by individuals heterozygous for the mutation. Therefore this issue is of consequence only if the fertility and survival of heterozygous individuals were differentially affected by their respective beta-globin haplotype. This has not been

documented in contemporary studies except in cases of low oxygen supply. It is therefore unlikely that differential fertility and morbidity significantly contributed to the observed haplotype distribution.

Sampling error may be introduced by the tendency for individuals with the less severe Senegal haplotype to require less treatment for their disease (Pante de Sousa et al., 1998). Assuming the alleged differential disease severity is factual, patients with the Bantu haplotype would be the most likely to require treatment, followed by patients with the Benin type. Those with the Senegal type would experience the mildest clinical symptoms and therefore be the least likely to require frequent or regular medical treatment. This hospital bias favoring sampling of patients with the Benin and Bantu haplotypes would explain the preponderance of the Benin haplotype observed in this study. However, to fully account for the allele distribution one would have to assume that patients with the Bantu haplotype were indeed less common in the Lowcountry population. If the population was dominated by the Bantu allele one would expect greater representation in the hospital sample due to their more pronounced disease expression.

As discussed in Chapter 3, although the Atlantic slave trade dominated the Lowcountry economy through the turn of the 19th century, the internal slave trade became important after the African slave trade was banned in 1807–1808. Charleston was the dominant market for the sale of enslaved Africans and Creoles from the mid- and Upper South to the new frontiers of the Deep South. However, this steady flow of bondsmen through the Lowcountry would have provided the opportunity for enslaved Africans and Creoles from Virginia, Maryland, and North Carolina to enter the Lowcountry population of African descent. Although Tadman (1989) describes the state

of South Carolina as a major exporter of slaves, he also provides evidence that suggests many local planters participated in the internal slave trade. The South Carolina midland and upstate regions were characterized by a very different agricultural economy and very different needs in terms of labor. Therefore the two regions may have participated in the internal slave trade in very different ways. Further examination of redistribution of enslaved persons in the Lowcountry is necessary to shed light on this possibility.

The contemporary population of Lowcountry African Americans is subject to a great deal of migration as part of an economic strategy. Young adults frequently leave the area for education and more lucrative jobs in other states. Some individuals return home when they have children, sometimes with a spouse from other regions of the United States. This was also the case for the region's Freedmen and their families following emancipation. While local families and individuals left the area, others moved into the area in search of employment and/or family and friends previously "sold away." A better understanding of these patterns of post-emancipation migration would provide some idea of the magnitude of these migrations and allow better assessment of this possibility as concerns the genetic data.

The anthropometric analyses presented in Chapter 6 show that Lowcountry males and females represent a fairly heterogeneous population of diverse West African ancestry. They exhibited a retained West African morphology that made them statistically similar to their West African counterparts in nasal width, facial width, stature, and sitting height. The population means place the Lowcountry samples in the midst of the West African sample cluster, suggesting possible influences from across all regions of West

Africa. This confirms the findings of Pollitzer (1957, 1958, 1988, 1993, 1999) and Pollitzer and colleagues (1964, 1970).

Of more interest to the goal of this research, the metric analyses fail to support the historical hypothesis based upon the work of Curtin (1969), Littlefield (1981) and Richardson (1991). Although Curtin states that the numeric contribution of enslaved Africans was greatest from the regions of Angola and Congo, one can interpret his data after grouping by cultural similarities and conclude that importation from Upper Guinea (Senegal, Senegambia, Sierra Leone) was greater than that of equatorial Africa (Angola, Congo). Littlefield and Richardson offer this latter interpretation of the data. Based upon these works, Lowcountry African Americans were expected to show strongest phenotypic affinity with groups from the Rice and Windward Coasts, followed by those of Congo and Angola.

Contrary to the historical and cultural hypotheses, Lowcountry males were most phenetically similar to their counterparts from Congo and Nigeria. Males from Angola and Congo were less similar to the Lowcountry sample than males from Cote d'Ivoire, which is not known to have played a major part in the Atlantic slave trade. Data for females are less reliable due to a preponderance of data from the Lowcountry and sparse numbers and regional representation for the African groups. Congo and Nigeria exhibited the greatest similarity to the Lowcountry African American sample. In fact, the Congo females were statistically indistinguishable from Lowcountry females ($d^2 = 0.0000 \pm 0.07$). Although this result is somewhat suspect given the possibility of sampling error, it warrants further investigation.

The metric analysis for both males and females may be negatively affected by the limited availability of anthropometric data on West African peoples. Because of the small amount of data, samples were grouped by region to provide better statistical power. However, this was done with little understanding of the variation across the regions in question. There is a great need to better describe and understand variation within and among contemporary African populations. The increased portability of technology and relative convenience of genetic testing means that (with the proper technology and funding) investigators can now collect large amounts of data in a short time. By better understanding African diversity we could better understand the biological heritage of African Americans and provide more insight into diseases that disproportionately affect black Americans.

In conclusion, the genetic and phenetic data suggest two distinct possibilities concerning Lowcountry heritage. Firstly, the cultural and historical records likely provide incomplete descriptions of the ancestral populations that gave rise to the contemporary Lowcountry African American populations. The preponderance of cultural ties to the rice cultures of northern West Africa may be the result of cultural and economic selection rather than greater importation of people from the region. Secondly, this study indicates that the population dynamics at work within the Lowcountry have not received sufficient attention. The biology of the contemporary African American population reflects generations of admixture among numerous African peoples and population dynamics that may mask the individual physical contributions of their ancestors. That is, their biology, like their culture and language, is an amalgam of an untold number of West African

influences shaped by a variety of political, economic, and social factors. Better data and increased understanding of West African biological and genetic variability is needed to untangle the question of Lowcountry biological affinity and apply those results to the treatment and prevention of human disease.

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Appendices

Appendix 1

Definitions for Genetic Terms from Chapter 5

Unless indicated, definitions are excerpted from:

Robert C. King and William D. Stansfield (1997) *A Dictionary of Genetics*, 5th edition.

agarose — a linear polymer of alternating D-galactose and 3,6-anhydrogalactose molecules. The polymer, formed from agar, is often used in gel electrophoresis because few molecules bind to it, and therefore it does not interfere with electrophoretic movement of molecules through it.

allele — a shorthand form of **allelomorph**, one of a series of possible alternative forms of a given gene (cistron, *q.v.*), differing in DNA sequence, and affecting the functioning of a single product (RNA and/or protein). If more than two alleles have been identified in a population, the locus is said to show multiple allelism.

amplicon(s) — a segment of the genome that forms multiple linear copies after exposure of the organism to a compound that inhibits the functioning of a gene in the segment.

amplification — (gene amplification) any process by which specific DNA sequences are replicated to a disproportionately greater degree than their representation in the parent molecules. (This is key process in the polymerase chain reaction).

Dde I — a restriction endonuclease that cleaves DNA at each occurrence of the sequence: 5' C/T N A G 3' [®]

electrophoresis — the movement of the charged molecules in solution in an electrical field. The solution is generally held in a porous support medium such as filter paper, cellulose acetate (rayon), or a gel made of starch, agar, or polyacrylamide. Electrophoresis is generally used to separate molecules from a mixture, based upon differences in net electrical charge and also by size or geometry of the molecules, dependent upon the characteristics of the gel matrix.

endonuclease — an enzyme that breaks the internal phosphodiester bonds in a DNA molecule... Single-strand breaks are essential first steps in replication and recombination. (see also restriction endonuclease).

ethidium bromide — a compound used to separate covalent DNA circles from linear duplexes by density gradient centrifugation. It is also used to locate DNA fragments in electrophoretic gels because of its fluorescence under ultraviolet light.

haplotype(s) — the symbolic representation of a specific combination of linked alleles in a cluster of related genes. The term is a contraction of *haploid genotype* and is often used to describe the combination of alleles of the major histocompatibility complex (*q.v.*) on one chromosome of a specific individual.

Hinc II — a restriction endonuclease that cleaves DNA at each occurrence of the sequence: 5' G T Y/R A C 3' [®]

Hind III — a restriction endonuclease that cleaves DNA at each occurrence of the

[®] Defined by NLR

- sequence: 5' A/A G C T T 3' ⊗
- Hinf I** — a restriction endonuclease that cleaves DNA at each occurrence of the sequence: 5' G/A N T C 3' ⊗
- hotspot** — (recombination hotspot) special regions on chromosomes where the frequency of meiotic crossing over is elevated. Such hotspots are likely to be initiation sites for recombination.
- Hpa I** — a restriction endonuclease that cleaves DNA at each occurrence of the sequence: 5' G T T/A A C 3' ⊗
- leukocyte** — white blood cell.
- Polymerase Chain Reaction (PCR)** — a technique for copying the complementary strands of a target DNA molecule simultaneously for a series of cycles until the desired amount is obtained. First, primers are synthesized that have nucleotide sequences complementary to the DNA that flanks the target region. The DNA is heated to separate the complementary strands and then cooled to let the primers bind to the flanking sequences. A heat-stable DNA polymerase is added, and the reaction is allowed to process for a series of replication cycles. Twenty will yield a millionfold amplification; 30 cycles will yield an amplification factor of 1 billion.
- primer** — single-stranded DNA used in the PCR process. Used in pairs, these sequences are designed to target a specific region of the DNA. One primer matches the 5' end of the sequence of interest, the other matches the sequence at the 3' end. ⊗
- Recombination** — The occurrence of progeny with combinations of genes other than those that occurred in the parents, due to independent assortment or crossing over.
- Restriction endonuclease** — any one of many enzymes that cleave foreign DNA molecules at specific recognition sites. Restriction endonucleases are coded for by genes called restriction alleles. The enzymes are named by a symbol that indicates the bacterial species from which they were isolated, followed by a Roman numeral that gives the chronological order of discovery when more than one enzyme came from the same source.
- thermocycler** — a machine that alternately heats and cools specimens to specified temperatures through a specified number of cycles; automates the PCR process. ⊗
- UV light** — ultra-violet light: used to illuminate ethidium bromide-stained DNA in gels following electrophoresis.
- μl** — microliters: unit of volume used in PCR reactions.
- Xmn I** — a restriction endonuclease that cleaves DNA at each occurrence of the sequence: 5' G A A N N/N N T T C 3' ⊗

Appendix 2

Human Subjects Compliance Information

The data in Chapter 5 is used with the generous permission of W. Timothy Garvey, M.D., principal investigator of Project SuGAR at the Medical University of South Carolina (MUSC). A copy of this permission is on file with the University of Tennessee Office of Research.¹

Human subject procedures and permissions were reviewed and approved by the MUSC Internal Review Board and the National Science Foundation (NSF). Copies of these documents are on file with the University of Tennessee Office of Research. A majority of the samples were collected with the cooperation of Dr. Chris Brunson and her staff at the MUSC Adult Sick Cell Clinic. A few samples were collected with the cooperation of Dr. Miguel Abboud of the Pediatric Sick Cell Clinic and his staff at MUSC. Copies of signed patient permission forms acknowledging informed consent are on file with the Division of Hematology² and Project SuGAR offices³ at MUSC.

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Appendix 3

Haplotype Data for Lowcountry Sample

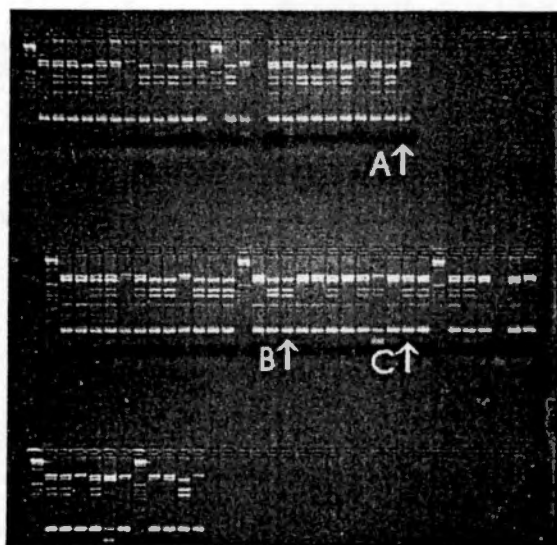


Figure A-3-1: Example of Gel used for Genetic Analysis

A = Homozygous absence of restriction site
B = Homozygous presence of restriction site
C = Heterozygous: one allele has restriction site, the second does not

Table A-3-1: Haplotype Data, Atypical Genotypes and Birthplace Classification

ID	Xmn I	Hind III	Hind III	Hinc II	Hinf I	Atypical	Birthplace Classification
S1	--	--	--	--	--		N
S2	--	-+	--	--	--		M / U
S3	-+	-+	--	-+	-+		N
S4	-+	++	--	-+	-+		N
S5	--	-+	-+	--	-+		M / U
S6	--	--	--	--	--		N
S7	--	-+	--	--	--		M / U
S8	-+	++	--	-+	-+		N
S9	-+	++	--	-+	-+		N
S10	-+	++	--	-+	-+		N
S12	--	-+	--	--	--		N
S13	--	++	--	--	--		M / U
S14	--	--	--	--	--		M / U
S15	--	-+	--	--	--		N
S16	--	-+	--	--	-+	yes - Hinf I 3'	N
S17	-+	++	--	-+	++	yes- Hinf I 3'	M / U
S18	-+	++	--	-+	-+		M / U
S19	-+	-+	--	-+	-+		N
S20	-+	++	--	++	++	yes - Xmn I 5'	M / U
S21	--	--	--	--	--		N
S25	--	--	--	--	--		N
S26	--	--	--	--	--		M / U
S27	--	-+	--	--	--		M / U
S28	-+	-+	--	-+	-+		N
S30	--	-+	--	--	--		M / U
S31	--	++	--	--	--		M / U
S35	-+	++	--	++	++	yes - Xmn I 5'	M / U
S37	--	--	--	NP	--		M / U
S40	--	--	--	--	--		M / U
S43	--	--	--	--	--		M / U
S45	--	-+	--	--	-+	yes- Hinf I 3'	N

NP = no product

N = Native, M / U = Migrant / Unknown birthplace

Table A-3-1 (continued)

ID	Xmn I	Hind III	Hind III	Hinc II	Hinf I	Atypical	Birthplace
S53	--	--	--	--	--		N
S54	--	--	--	--	--		M / U
S55	-+	-+	--	-+	-+		M / U
S56	-+	-+	--	-+	-+		M / U
S57	--	--	NP	--	-+	yes- Hinf I 3'	M / U
S58	-+	-+	--	-+	-+		M / U
S61	--	--	--	--	--		M / U
S62	--	--	--	--	--		N
S64	--	--	--	--	--		M / U
S66	--	-+	--	--	--		M / U
S68	--	--	--	--	--		M / U
S69	--	--	--	--	--		M / U
S71	-+	++	--	-+	NP	yes- Hinf I 3'	M / U
S72	--	--	--	--	--		N
S73	-+	++	--	++	++	yes - Xmn I 5'	N
S74	-+	-+	--	NP	++	yes- Hinf I 3'	M / U
S75	--	--	--	--	-+	yes- Hinf I 3'	N
S76	-+	-+	--	-+	-+		N
S77	--	-+	--	--	-+	yes- Hinf I 3'	N
S78	-+	++	--	-+	-+		M / U
S80	--	++	--	--	--		M / U
S81	--	--	--	--	--		M / U
S82	--	--	--	--	--		M / U
S83	--	-+	--	--	--		M / U
G189	--	-+	--	--	++		N
G335	-+	-+	--	NP	-+		N
N = 57						N = 11	Native = 24 Migrant / Unknown = 33

NP = no product

N = Native, Nn / U = Migrant / Unknown birthplace

Appendix 4

Variance/covariance Matrices for Lowcountry African Americans

Table A-4-1: Variance/covariance Matrix for Lowcountry Males (with missing data)

	NL	NW	LT	FL	FW	SW	HW	StH	SitH
NL	12.06								
NW	-0.7593	11.85							
LT	-1.158	3.741	20.48						
FL	4.494	-3.556	8.171	62.17					
FW	0.5185	3.093	-2.469	1.00	32.63				
SW	-12.21	5.201	3.276	6.235	44.83	488.9			
HW	4.579	13.12	-8.887	13.56	45.82	177.3	375.9		
StH	69.22	-23.52	16.30	200.8	60.68	539.2	425.7	5099	
SitH	8.997	-5.795	8.405	75.26	16.53	283.2	212.7	2033	1354

**Table A-4-2: Variance/covariance Matrix for Lowcountry Females
(with missing data)**

	NL	NW	LT	FL	FW	SW	HW	StH	SitH
NL	16.08								
NW	1.343	10.48							
LT	-0.7715	-0.1034	15.91						
FL	15.55	2.293	5.785	47.61					
FW	3.282	8.284	-1.333	7.210	33.25				
SW	13.40	14.08	6.116	40.19	45.25	316.5			
HW	4.955	17.34	-1.455	18.29	57.04	159.2	452.0		
StH	45.06	20.83	47.97	135.2	97.79	528.3	328.8	3823	
SitH	10.51	5.400	14.57	47.94	39.70	234.5	126.5	1456	991.4

Table A-4-3: Mean Measurements for Lowcountry African Americans*

		NL	NW	LT	FL	FW	SW	HW	StH	SitH
Males	x	56.89	46.00	21.07	126.44	139.33	382.47	271.60	1675.24	856.45
	σ	3.51	3.47	4.57	7.96	5.77	22.35	19.59	73.46	37.40
Females	x	54.82	42.13	22.41	119.46	131.68	356.91	265.78	1593.38	822.47
	σ	4.01	3.24	3.99	6.91	5.78	17.78	21.28	62.01	31.52

*(Before imputation)

Appendix 5

Summary of Missing Data for Lowcountry Metric Samples

**Table A-5-1: Missing data summary for Lowcountry
African American Males**

Number Missing Values	N =	Pattern	Missing measurements
0	42	111111111	none
2	11	111111100	StH, SitH
4	1	111110000	SW, HW, StH, SitH

For "Pattern" category 1 = observed data, 0 = missing data

**Table A-5-2: Missing data summary for Lowcountry
African American Females**

Number Missing Values	N =	Pattern	Missing measurements
0	405	111111111	none
1	1	110111111	LT
1	1	111101111	FW
1	6	111111011	HW
1	1	111111101	StH
1	1	111111110	SitH
2	2	111110011	SW, HW
2	5	111111100	StH, SitH

For "Pattern" category 1 = observed data, 0 = missing data

Appendix 6

Resources for the Study of Lowcountry African and African American Heritage and History

The Avery Research Center
Associated with the College of Charleston

<http://www.cofc.edu/~averyrsc/front.html>
125 Bull Street 29401
Charleston, SC 29424
Voice: (843) 953-7609
Fax: (843) 953-7607
Archives: (843) 953-7608

Gullah/GeeChee Sea Island Coalition
Sponsored by the African Kultural Arts Network (AKAN™)

Sea Island Coalition
<http://users.aol.com/queenmut>
GullGeeCo@aol.com, Gullah-Geechee@InterCHANGE.org
(843) 838-1171

P.O. Box 1207
St. Helena Island, SC 29920

Hunnah Home

Featuring Gullah Roots tours and the Hunnah Home Cottage that is available for short-term rental.

AKAN™
http://users.aol.com/queenmut/Afrikan_Network.html
AfriKuNet@aol.com
(212) 439-1026

Penn Center

Located on St. Helena Island, Penn center is dedicated to "Education, History & Cultural Preservation." It is housed in the former Penn School (est. 1862) and is within a National Historic Landmark District.

Although Penn Center does not yet have an official web site, the site sponsored by the Native Island Business & Community Association, Ms. Deborah Robertson, and TRS & Company provides a brief description of the Center.
<http://www.angelfire.com/sc/jhstevens/penncenter.html>

110 Martin Luther King Drive
P.O. Box 126
St. Helena Island, SC 29920
Voice: (843) 838-2432

South Carolina Archives and History Center

<http://www.state.sc.us/scdah/homepage.htm>

8301 Parkland Road
Columbia, SC 29223-4905
Voice: (803) 896-6191
Fax: (803) 896-6198

Vita

Nikki L. Rogers was raised in West Virginia and Florida. She holds a bachelor's degree in Anthropology from Florida State University and two graduate degrees in Physical Anthropology from the University of Tennessee. Her main research interests include human variation, quantitative methods, medical research, the interaction of culture and biology, and the philosophy of science. She is married to the most wonderful man she's ever met, loves college football and spending time with her family and friends. She and her husband have three cats that keep them busy and out of trouble.

Contact from persons interested in this work is welcomed. A current business address is always available through the American Association of Physical Anthropologists, the primary professional association in the field of Physical Anthropology. Their internet address as of May 2000 was <http://www.physanth.org/>