Skin Color, Culture, and Blood Pressure in Southeastern Puerto Rico

H.Russell Bernard (PI)
Clarence C. Gravlee (Co-PI)

SPECIFIC AIMS

The goal of this project is to help solve what a recent issue of *Scientific American* called "The Puzzle of Hypertension in African-Americans" (Cooper, et al. 1999). One key piece of this puzzle is the relationship between darker skin color and higher blood pressure within populations of African descent. This relationship has been interpreted as evidence of either a genetic or a sociocultural mechanism, but existing research does not provide a sufficient means of evaluating these alternatives. The proposed research aims to fill this gap in knowledge by isolating the sociocultural factors that mediate the relationship between skin color and blood pressure.

The major hypothesis to be tested is that the ascription of low social status on the basis of skin color affects variation in blood pressure independently of actual skin tone and other known risk factors. This hypothesis depends on the distinction between skin color as a phenotype and skin color as a criterion of social status—a distinction that has not been operationalized in previous research. This study introduces a novel approach that aims to isolate the effects of these distinct variables on blood pressure variation. This strategy focuses on the following three objectives:

O_1: *Cultural significance of skin color.* The first objective is to elicit the cultural model of "color" in Puerto Rico in order to describe the salience of skin color as a criterion of social status.

O_2: *Cultural consonance in lifestyle.* The second aim is to extend an anthropological model of psychosocial stress and blood pressure that focuses on the modifying effect of cultural context (Dressler, et al. 1999).

O_3: *Skin color and blood pressure.* The final objective is to test the independent effect of cultural context on the skin color-blood pressure relationship in a representative sample of the population in Arroyo, Puerto Rico.

BACKGROUND

Throughout the Western Hemisphere, populations of African descent tend to have higher average blood pressures and higher rates of hypertension than do other groups in the same societies. This pattern is well known in the United States (Burt, et al. 1995; Lackland and Keil 1996), where the reduction of racial disparities in hypertension has been made a national priority (JNC 1997). However, the trend toward higher average blood pressure in African-derived populations has also been observed in parts of Latin America and the Caribbean (Frisancho, et al. 1999; Halberstein 1999; James, et al. 1991), including Puerto Rico (Costas, et al. 1981). As a rule, black-white differences are not as great elsewhere in the Americas as they are in the US (Cooper, et al. 1997b; Costas, et al. 1981; Ordúñez-García, et al. 1998), but a pattern of elevated blood pressure among African-derived populations is clear nonetheless.

There is little consensus as to *why* this pattern exists. The most basic debate concerns the relative importance of genetic versus environmental factors in explaining the excess prevalence of hypertension in blacks. The prevailing assumption among many clinicians and health researchers is that blacks are genetically predisposed to develop hypertension (Cooper and Kaufman 1998; Muntaner, et al. 1996). However, this conclusion is unwarranted on several grounds. First, it echoes the fundamental error of racial thinking by inferring genetic difference from culturally constructed categories like "black" and "white." The evidence is overwhelming that such categories correspond poorly to human genetic variation (Marks 1995; Montagu 1997). Second, it assumes that population

differences in blood pressure are primarily determined by genetic variation. This assumption is untenable given that blood pressure is not under strict genetic control (Crews and Williams 1999; Ward 1995) and that cross-cultural variability in blood pressure can be traced to complex factors in the social environment (Kaufman, et al. 1999; Waldron, et al. 1982). Finally, there remains no molecular evidence that people of African ancestry are genetically susceptible to hypertension (Cooper and Kaufman 1998). These objections point to the conclusion recently endorsed by the American Anthropological Association: that race is fundamentally a social and cultural fact (AAA 1998). The challenge is to measure the implications of this fact for the well being of racially defined groups.

Health researchers outside of anthropology are increasingly aware of the problems with race as biology (Cooper 1984; Williams 1997), but the operationalization of race as a social reality remains elusive. An example of this problem is research on the relationship between skin color and blood pressure within populations of African descent. Epidemiologists' attempts to explain this relationship in nongenetic terms focus on socioeconomic status (SES), a construct typically measured by a combination of income, education and occupation. This emphasis is justified by the fact that lower SES is associated with both darker skin color (Keith and Herring 1991) and higher blood pressure (HDFP 1977). Therefore, the root cause of blood pressure variation might be socioeconomic inequality along ethnic lines. This research strategy has produced conflicting results. Some studies report that the relationship between skin color and blood pressure disappears entirely after controlling for SES (Keil, et al. 1977, 1981), while others reveal a persistent association even within levels of education, occupation, or income (Gleiberman, et al. 1995; Harburg, et al. 1978). Accounting for variation in known risk factors like diet, obesity, and physical activity level also fails to explain away the relationship (Costas, et al. 1981; Klag, et al. 1991).

Two broad hypotheses have been advanced to explain the residual relationship between skin color and blood pressure. The first is that dark skin color, as a marker of African admixture, is linked to a genetic predisposition for hypertension (Boyle 1970). This hypothesis makes explicit one of the basic tenets of the biological concept of race in assuming that a single phenotype like skin color is a reliable indicator of genetic differences between populations. A cornerstone of the anthropological critique of race is that this assumption does not hold (Goodman 1995:221). The second hypothesis is that dark skin color, as a marker of subordinate social status, exposes dark-skinned individuals to a host of social stressors related to elevated blood pressure (Dressler 1991; Tyroler and James 1978). This hypothesis recognizes that skin color itself is a primary determinant of social status in color-conscious societies (Omi and Winant 1994; Smedley 1998:107). The consequences of this fact for dark-skinned individuals include not only socioeconomic inequalities measured by SES, but also exposure to racial discrimination in the course of everyday social interaction (Essed 1991; Feagin 1991). There is suggestive evidence that this exposure is a chronically stressful experience related to repeated autonomic arousal and sustained elevated blood pressure (Armstead, et al. 1989; Dressler 1996b; James, et al. 1983; Krieger, et al. 1998).

The hypothesis that skin color is linked to blood pressure variation through its social status effect rather than through a genetic mechanism has not been tested directly in previous research. A likely cause of this limitation is the lack of a clear distinction between skin color as a phenotype and skin color as a criterion of social classification. The hypothesis that skin color is linked to a genetic predisposition for high blood pressure refers to the *phenotype* of skin color. By contrast, the hypothesis that skin color is a marker of psychosocial stress related to high blood pressure refers to the *cultural significance of skin color* as a basis for assigning status to individuals and groups. The variables of interest in these two hypotheses are therefore conceptually distinct; one refers to the amount of light reflected by the skin (etic), and the other refers to the ascription of social status on the basis of skin color and other criteria (emic). The problem is that all existing studies of skin color and blood pressure have operationalized skin color as the amount of light reflected by the skin, as

measured by reflectance spectrophotometry (Boyle 1970; Keil, et al. 1977, 1981; Klag, et al. 1991), observer ratings (Dressler 1991; Dressler, et al. 1999; Gleiberman, et al. 1995; Harburg, et al. 1973, 1978), or comparison to standardized color chips (Costas, et al. 1981). No study has deliberately measured ascribed color as an independent variable, even though this is the main variable of interest in the psychosocial hypothesis.

This limitation of existing research stems from the fact that nearly all work on skin color and blood pressure has been done in the mainland United States, where there is little divergence between phenotype and ascribed color. The social reality of race in the United States is such that it is nearly impossible for two individuals of identical phenotype to be assigned different racial status (Harris 1964). If both were equally dark-skinned with similar physical features, both would be considered "black." Consequently, the researcher who hopes to isolate the social and biological dimensions of skin color faces a practically impossible task. This predicament leads some to argue that the epidemiologic method is ill suited to explain racial differences in health—an argument that points to the relevance of an anthropological perspective. Kaufman and Cooper point out that causal reasoning in epidemiology is based on a counterfactual framework that asks, "What would the outcome have been if the exposed individual were not exposed to the alleged cause?" When the alleged cause is race, they argue, this model breaks down, because there is no logical counterfactual state: "a Black person who is not Black cannot be considered the same person" (Kaufman and Cooper 1999:115). However, the constraint on this counterfactual state is empirical, not logical. To imagine a black person who is not black, it is necessary only to distinguish between two possible exposures: having dark skin and being socially defined as "black." In the United States, it is difficult to test the causal effect of these distinct exposures, because dark-skinned individuals are uniformly defined as black. However, cross-cultural research shows that the relative salience of skin color as a basis of social classification is variable across societies, so that—in Brazil, Cuba, and Puerto Rico, for example—individuals with similar features can be assigned different racial status (Degler 1971; Harris 1964; Wade 1997).

This cross-cultural variability in the relationship between phenotype and social classification makes Puerto Rico a particularly good place to study the skin color-blood pressure relationship. The ascription of color in Puerto Rico is influenced not only by skin color and other physical features, but also by markers of social status like wealth and occupation (Duany 1998; Seda Bonilla 1972; Torres 1995). The result is that distinctions in social status are likely to be reflected in the different color terms assigned to individuals of identical skin color but unequal status. Depending on other factors, an individual with given skin tone may be referred to by any number of terms, including *negro* (black), *moreno* (dark-skinned with ambiguous other features), *trigueño* (literally, wheat-colored), and others. Such variability in the social classification of individuals with a given skin tone makes it possible to tease apart the social and biological dimensions of color. Moreover, there is ample evidence of color-based discrimination in Puerto Rico, despite the popular belief that such discrimination does not exist (Muñoz Vázquez and Alegría Ortega 1999; Torres 1995; Zenón Cruz 1974). This fact suggests that individuals who are assigned to lower-status color categories are more likely to experience more frustrating social interactions, greater psychosocial stress, and elevated blood pressure.

A model recently developed by Dressler (1996a) provides a framework for testing these ideas. The central concept in Dressler's model is *cultural consonance*, the degree to which an individual's behavior approximates the cultural ideal in any given domain. The first step in specifying the model is to identify the set of shared beliefs about what is culturally appropriate or desirable in a particular domain. It is then possible to calculate the similarity between an individual's actual behavior and the cultural ideal and to relate this measure to health outcomes like blood pressure. Field studies in Brazil (Dressler, et al. 1998a, 1999) and the southern United States (Dressler, et al. 1998b) show that individuals whose actual behavior most closely approximates the cultural model of a successful

lifestyle also have the lowest blood pressure. This relationship holds independent of age, sex, diet, obesity, and conventional measures of socioeconomic status.

The findings from Brazil are particularly relevant here, because the effect of cultural consonance on blood pressure is different for darker-skinned Brazilians than for their lighter-skinned counterparts. As individuals are better able to achieve the culturally desirable lifestyle, blood pressure decreases more rapidly among darker- than among lighter-skinned Brazilians. Indeed, the lowest average blood pressures are found among dark-skinned Brazilians who score high in cultural consonance. To explain this finding, Dressler et al. suggest that achieving a culturally desirable lifestyle helps overcome the stigma of having dark skin in Brazilian society. This interpretation fits with what we know about the nature of color classification in Brazil: "money whitens" (Degler 1971:105). The cultural consonance model goes a step further than conventional explanations of color classification by specifying the cultural mechanism that may be at work. As one is better able to live in accord with the norms of Brazilian society, ascribed color status becomes progressively lighter—even for the darkest-skinned individuals. This improvement in social status results in less exposure to frustrating social interactions and in lower mean blood pressure. Puerto Rico, which "offers certain similarities to Brazil" (Hoetink 1967:38) with regard to the cultural significance of skin color, provides an appropriate setting for the first empirical test of this interpretation.

RESEARCH DESIGN AND METHODS

The research design consists of both exploratory and explanatory components. The exploratory phase will combine qualitative and quantitative ethnographic methods aimed at describing the cultural model of "color" in Puerto Rico. Specific goals of this phase are: (a) to elicit the cultural significance of skin color as a determinant of exposure to psychosocial stress, and (b) to specify a model of cultural consonance in lifestyle that can be used to predict variation in blood pressure. The explanatory phase will incorporate the results into a test of competing hypotheses about the relationship between skin color and blood pressure. The following hypotheses can be specified in advance:

H_1: Cultural consonance in lifestyle will be associated with lower average blood pressure.

H_2: Cultural consonance in lifestyle will be associated with lighter (higher-status) ascribed color.

H_3: Darker (lower-status) ascribed color will be associated with higher average blood pressure, controlling for actual skin tone.

H_4: These associations will be observed after controlling for other known risk factors, including age, obesity, socioeconomic status, and self-perceived discrimination.

The research will take place during 12 months of fieldwork in Arroyo, Puerto Rico. Arroyo is a suitable location for this research for a number of reasons. First, it is located in the southeastern coastal zone where sugar production was heavily concentrated for more than a century (Scarano 1984; Steward, et al. 1956). The plantation economy that sprang up around the neighboring *municipio* (municipality) of Guayama led to the importation of African slaves to the region, and today's population is therefore somewhat darker in complexion than is the island's population as a whole. Second, with a population of less than 20,000 in the entire *municipio* and less than 10,000 in the town center (US Census Bureau 1994), Arroyo is small enough to make a detailed study of the town feasible. Yet the ongoing economic development in the region ensures sufficient socioeconomic diversity to expect variation in the distribution of psychosocial stressors and blood

pressure. Third, the proximity of Arroyo to universities in Guayama and Ponce will facilitate collaboration with Puerto Rican scholars.

Data Collection: Ethnography

(a) *Participant observation.* The primary method of data collection over the 12 months of fieldwork will be participant observation (Dewalt, et al. 1998). As a participant observer, I will establish residence in Arroyo, make new acquaintances, take part in community activities, work to establish rapport, and attempt to understand how considerations of color play into everyday life. My main task will be to make a systematic record of day-to-day interactions, observations, and informal conversations by writing field notes on a daily basis (Bernard 1994:180-207). As part of an iterative process, writing field notes will help me identify important questions and domains of life that need to be examined in greater detail. Questions that will guide my early work include the following: How important is skin color relative to other attributes in determining one's social status? How significant is color in the context of personal relationships, including friendship and marriage? Does color matter at work, in the neighborhood, in schools, or at church? To what extent do dark-skinned individuals experience discrimination or other frustrating social interactions? Participant observation is an appropriate method for addressing sensitive questions such as these. It will extend the internal and external validity of the study by helping me understand the *meaning* of observations, and it will help me formulate sensible questions for later stages of research (Bernard 1994:141).

(b) *Free Listing*. To determine the relevant categories people use in the ascription of color to themselves and others, I plan to collect free lists (Weller and Romney 1988:9) of emic color categories. Free listing involves asking a sample of informants to "name all the X's" there are in a given domain. The goal is to identify and define the salient items in a domain, so that subsequent data collection is framed in appropriate terms. Pre-testing of this technique during a predissertation trip to Arroyo in June 1999 demonstrated the feasibility of asking informants to generate lists of color categories, and it stimulated further discussion about the significance of color in Puerto Rico.

I plan to collect free lists from 20 to 30 informants, a sufficient sample size for most domains (Weller and Romney 1988:14). This technique—like others described below—does not require random sampling, but it does require sampling the full range of cultural knowledge about the domain (Handwerker and Wozniak 1997). Therefore, to improve external validity, informants will be selected deliberately to maximize heterogeneity with respect to socioeconomic background, skin color, sex, and age. The anticipated sampling strategy is to recruit informants from the five distinct *barrios* (neighborhoods), which are associated with differences in class and color (Torres 1995:34). Final appropriate sample size will be adjusted to ensure that few new items are being mentioned by additional informants (Weller 1998:372).

(c) *Unstructured and semistructured interviewing.* The initial phase of interviewing will focus on unstructured and semistructured interviews (Bernard 1994:209-10; Spradley 1979). The initial goal of these in-depth, open-ended interviews will be to gain a broad understanding of the relevant topics and terminology, and to discover the right questions to ask. I will encourage informants to express themselves in their own terms and to determine the pace of the interview. I plan to conduct approximately 20 in-depth interviews with a purposeful sample of informants selected to maximize heterogeneity. Previous researchers' experience suggests that this sample size should be adequate to identify the most salient themes (Handwerker and Wozniak 1997). All interviews will be tape recorded with the permission of each informant.

These interviews will focus on two broad sets of questions. The first concerns the cultural model of "color" in Puerto Rico. Most of the specific questions will emerge from my first-hand experience

in Arroyo, but a number of topics can be anticipated. For example, how is Puerto Rico different than the United States in terms of color or race? Does racial discrimination exist in Puerto Rico? What attributes determine a person's success in life? Is color important in the context of work, church, friendships, politics, or marriage? Is it better or worse to be of a certain color? The second set of questions will be designed to generate a list of the behaviors and material goods that are indicative of having achieved success. This list will be presented to others in subsequent interviews to obtain ratings of each item's importance. These ratings are necessary to develop the measure of cultural consonance in lifestyle (Dressler 1996a).

(d) *Structured interviewing*. To complement earlier phases of exploratory interviewing, another sample of informants will be recruited for structured interviews. These interviews will present each informant with the same questions, permitting systematic comparisons across individuals and groups. The sample will consist of 30 to 40 informants purposefully selected to maximize heterogeneity according to the sampling strategy noted above. Structured interviews will be tape recorded with permission of each informant.

Two tasks will be administered in the structured interviews. The first is a replication of Harris's (1970) technique for eliciting color categorizations of standardized facial drawings. The instrument in this test is a deck of 36 male and 36 female drawings generated by permuting three skin tones, three hair forms, two nose widths, and two lip sizes for each sex; all other features are held constant. With the help of Puerto Rican informants, I will make any necessary adjustments to ensure that the set of cards is emically valid before administering the test. Following Harris, I will present the cards to informants in randomized order and allow each informant to glance through the deck before identifying the first drawing. Then, I will ask informants to describe each drawing; if necessary to initiate response, I will prompt them to consider color. After informants have identified the entire deck, I will ask them to describe their own color and to select the drawing that most closely resembles them. The results of this task will provide (a) a validity check of the free list results, (b) a measure of the relative importance of skin color and other physical features in assigning color status, and (c) a measure of the agreement among informants.

The second task will provide the ratings necessary for a subsequent test of the cultural consonance model. I will compile a list of behaviors and material goods from earlier interviews and previous tests of the model (Dressler, et al. 1999, 1998b). Then I will ask informants to rate the importance of each item with regard to defining an individual as a success in life. To ensure comparability with other research, ratings will be based on a three-point scale of "not at all important," "somewhat important," or "very important."

Data Analysis: Ethnography

The aims of the project require preliminary analysis of the ethnographic data to begin early during the course of research, as results from each step of exploratory interviewing and observation will shape the questions posed in each subsequent step. Preliminary analysis of the structured interview data must be complete before the survey component can begin, since at least two key instruments will be derived from these interviews. Consequently, I plan to return to the University of Florida for one month at the end of the exploratory phase to concentrate on the analysis of ethnographic data and the finalization of procedures for the survey component.

(a) *Free Lists*. The analysis of free list data will concentrate on two measures of an item's salience. The first is simply the frequency with which each term is mentioned by any informant, and the second is the salience index as computed by ANTHROPAC (Borgatti 1996). These measures will be used to estimate the cultural salience of individual color categories and to define the boundaries of

the domain. An additional measure of interest is the correlation between each informant's responses and the group as a whole. This measure is useful for identifying knowledgeable informants who may be selected for more intensive interviewing (Borgatti 1992).

(b) *Unstructured and semistructured interviewing*. Open-ended interviews will be partially transcribed and coded according to the grounded theory method (Strauss and Corbin 1990). The strength of this method is that it provides a rigorous procedure for identifying themes in the text and for developing theoretical models of the relationships among themes (Bernard and Ryan 1998). It is thus well suited to the exploratory aims of these interviews.

(c) *Structured interviews*. The results of the card drawings will form a matrix of *N* informants by 72 variables in which the cells contain the color term assigned to each drawing. This matrix can be analyzed using the cultural consensus model (Romney, et al. 1986) routine in ANTHROPAC (Borgatti 1996). This model does three things: (1) tests whether there is a single cultural model underlying the ascription of color; (2) estimates the "cultural competence" of each informant; and (3) identifies the consensus responses for the appropriate categorization of each card drawing—a sort of cultural answer key. I intend to use these results for the measurement of ascribed color in the survey component, as described below.

The results of the lifestyle ratings will form a matrix of *N* informants by *X* variables in which the cells contain the ratings assigned to each item. Cultural consensus analysis will be used to test whether informants share a single cultural model of success in lifestyle and to specify the consensus ratings of all lifestyle items. Behaviors and material goods that receive a consensus rating of at least "somewhat important" will be regarded as part of the culturally desirable lifestyle. These items form the cultural ideal to which individual behavior will be compared in order to derive a measure of cultural consonance in lifestyle.

Data Collection: Survey

(a) *Sampling*. I plan to use a two-stage area probability sampling strategy to select a representative sample of households in Arroyo (Fowler 1993). In the first stage, I will select census blocks at random. Then, I will sample households from each census block using the probability proportionate to size technique (Bernard 1994:98). This procedure ensures that all units have an equal probability of being chosen for the sample. Households will be contacted and invited to participate in the research; the aims of the research and the informed consent procedure will be explained during this initial contact. If the household refuses to participate or cannot be reached after three attempts, another will be substituted at random. The respondent for each household will be an adult between the ages of 25 and 55 to be chosen at random. This age range is appropriate, because it should provide the greatest blood pressure variation (Dressler 1993:80).

The desired sample size is 200 individuals. This sample size is reasonable given the constraints on time and resources, and previous research suggests that it is sufficient to provide stable parameter estimates (Dressler, et al. 1999:52). Based on previous research (Dressler, et al. 1999; Hutchinson 1984; Sorlie, et al. 1988), I anticipate a response rate of approximately 70%. Therefore, to ensure a final sample size of 200, the initial sample will be designed to select 300 households. Interviews will be conducted in the home of each respondent.

(b) *Selection and training of assistant*. I will recruit and train an assistant to help administer the survey. Preference will be given to local anthropology or other university students who may benefit from the experience, but no background in interviewing is necessary. The assistant will have two roles. The first will be to help conduct the interview, including the measurement of height and

weight. I will provide the necessary training and monitor data collection throughout the survey phase. The second role will be to provide a culturally appropriate measure of each respondent's ascribed color. The goal will be to estimate the emic color category to which each respondent would be assigned by other members of the community. To evaluate the validity of the assistant's rating, I will administer the card drawing task and use the results to calculate his or her "cultural competence" as measured by cultural consensus analysis (Romney, et al. 1986). I will also interview the assistant to determine whether his or her knowledge of the cultural model of "color" is typical of others in the community.

(c) *Measurement of blood pressure*. Blood pressure measurements will be made using an automatic blood pressure monitor, Omron Model HEM-737AC (Omron Healthcare Inc, Vernon Hills, IL). This automated device has been validated for use in population-based studies (Anwar, et al. 1998), and it virtually eliminates observer error in blood pressure measurement (Cooper, et al. 1997a). Three blood pressure readings will be taken at standardized intervals, and subsequent analyses will be based on the average of the three. Both systolic and diastolic blood pressure will be recorded.

(d) *Measurement of skin color and ascribed color*. Three measurements of color will be taken in order to isolate the effect of skin color as phenotype from skin color as status marker. Actual skin tone will be measured by using a Photovolt ColorWalk instrument, a handheld tristimulus colorimeter that produces a measure of lightness (L*) used in dermatological skin color studies (Shriver and Parra in press; Takiwaki, et al. 1994). Two emic measurements of each respondent's color will also be made. The first will be the assistant's rating of ascribed color. This rating is designed to estimate the color status implicitly ascribed to a respondent in the course of everyday social interaction. The specific form of the rating will be determined during the exploratory phase of research, but I anticipate a five-point scale ranging from *negro* to *blanco*, with a midpoint of *trigueño*. The second measurement will be the respondent's self-identification of his or her own color. Previous researchers have reported difficulty in asking respondents to identify their color status (Duany 1998:157), so one aim of the exploratory interviews will be to develop an appropriate instrument.

(e) *Measurement of cultural consonance in lifestyle*. Respondents will be asked to self-report ownership of material goods and adoption of behaviors that received consensus ratings of at least "somewhat important" in defining success in life. Cultural consonance, or the degree of adherence to the cultural model of lifestyle, can be calculated as the proportion of items owned that belong to the cultural model. This proportion is multiplied by 100 to derive a measure that ranges from zero (ownership or adoption of no items) to 100 (ownership or adoption of all items) (Dressler 1996a).

(e) *Measurement of covariates*. All the usual sociodemographic variables measured in blood pressure research will be recorded to control for competing explanations of the observed relationships. These variables include: sex, age, socioeconomic status, weight, height, and physical activity level. Socioeconomic status will be measured by income, education, and occupational rank of both head of household and spouse, if present. These individual-level data can be aggregated to derive a measure of household socioeconomic status (Krieger, et al. 1997). Weight will be measured in kilograms using a Tanita Scale (TBF 521, Tanita Corp., Arlington Heights, IL), and height will be measured in centimeters using a portable measuring board (PE-AIM-101, Perspective Enterprises, Kalamazoo, MI). These measures will be used to calculate body mass index (BMI, weight in kg/height in m^2), a measure of obesity. Physical activity level will be estimated by asking a single question used in the Puerto Rico Heart Health Program (Costas, et al. 1981). Finally, reports of self-

perceived discrimination will be based on an adaptation of existing instruments (Krieger 1999). Dietary data will not be collected, because previous research shows that the skin color and cultural consonance effects are independent of diet (Costas, et al. 1981; Dressler, et al. 1999). In addition, the collection of high quality dietary data is labor-intensive and could therefore compromise the collection of other relevant information (Nelson and Bingham 1997).

Data Analysis: Survey

(a) *Exploratory analysis*. Data analysis will begin with careful inspection of the data using descriptive statistics and graphical displays. This initial phase of analysis is designed to check for potential violations of assumptions regarding normality, constant variance, and linearity. All analyses will be conducted separately for systolic and diastolic blood pressure.

(b) *Multivariate analysis*. The major analytic tool will be multiple regression analysis (Glantz and Slinker 1990). To test the hypothesis that blood pressure is inversely related to cultural consonance in lifestyle (H_1), systolic and diastolic blood pressure will be regressed separately on the measure of cultural consonance. This model will be extended to test for the interaction effect between skin color and cultural consonance observed by Dressler et al. (1999). This interaction will be formed as a cross-product term between skin color and cultural consonance, with the consonance measure converted to a z-score (m = 0.0; sd = 1.0).

The hypothesis that the relationship between actual skin tone and blood pressure is modified by the ascription of color status (H_3) will also be modeled with multiple regression. The effect of ascribed color will be operationalized as a cross-product interaction term between actual skin tone and ascribed color. For this analysis, ascribed color will be dichotomized into light and dark categories coded as –1.0 and +1.0, respectively. This form of "contrast coding" helps to reduce collinearity problems resulting from including a cross-product term with a dummy variable (Glantz and Slinker 1990). However, this coding strategy will not eliminate the collinearity introduced by the expected correlation between skin color and ascribed color. It will be necessary to inspect the variance inflation factor and to consider alternative analytic strategies if collinearity remains a problem (Glantz and Slinker 1990). To control for competing explanations (H_4), both models (H_1 and H_3) will be extended to allow covariates to enter on a stepwise basis. The explanatory power of the models will be tested with an *F*-statistic, and confidence intervals will be estimated for individual regression coefficients.

I will test the hypothesis that ascribed color is associated with cultural consonance in lifestyle (H_2) using multiple logistic regression (Agresti 1996). Ascribed color will be coded as an ordinal response variable with three levels: light, intermediate, dark. I will then assess the relationship between ascribed color and cultural consonance in lifestyle using a cumulative logit model (Agresti 1996:211). A confidence interval for the odds ratio (e^{β}) will estimate the strength of the association between cultural consonance and ascribed color.

SIGNIFICANCE

This research is important for four main reasons. First, it contributes to the anthropological critique of "race" as a biological concept. Recent discussions (Mukhopadhyay and Moses 1997; Harrison 1998) illustrate that a central task facing the discipline is to reintroduce the anthropological voice in discussions of race at every level of American society. One of the most important arenas for making this voice heard is health research, where the view of "race" as a legitimate biological concept still prevails (Muntaner, et al. 1996; Williams 1997). I have chosen to study the case of hypertension in African-derived populations because it is regarded as "the key potential exception to

the proposition that racial differentials in common disease are social in origin" (Cooper 1984:722). This project marks the beginning of my efforts to test the limits of this claim.

Second, this study adds to the anthropological literature on sociocultural correlates of psychosocial stress and health (e.g., Bindon, et al. 1997; Dressler 1999b; Janes 1990). In particular, it provides a comparative, theory-building extension of the cultural consonance model (Dressler, et al. 1999). Third, the project builds on recent efforts to stimulate biocultural research in anthropology, including a call to study the biological consequences of racism (Goodman and Leatherman 1998:29).

Finally, the problem of hypertension in African-derived populations is not just an academic curiosity; it is a matter of substantial differences in life and death. By adding new knowledge to our understanding of social variation in blood pressure, this project may contribute to a reduction of health disparities among ethnic groups.

RESEARCH TIMETABLE

The project will involve 12 months of fieldwork. The first eight months will be devoted to ethnographic research in Arroyo. The sequence of data collection, described in detail above, will progress from relatively unstructured to highly structured techniques. During this period, I will refine survey questions and begin training a field assistant. I will return to the University of Florida for one month to concentrate on preliminary analysis of the ethnographic data and to make final preparations for the survey component. Funding is not requested for this month. The final four months of fieldwork are allotted to complete the survey. Participant observation will continue throughout this period, and final follow-up interviews will be conducted before leaving the field.

FEASIBILITY

During a predissertation trip to Puerto Rico in June 1999, I met with Prof. David Hernandez, the Chair of Anthropology and Sociology at the University of Puerto Rico-Rio Piedras. Dr. Hernandez confirmed the relevance of the issues raised by my project, and he put me in contact with other Puerto Rican scholars who may offer assistance during my research. I also met with *municipio* officials in Arroyo, who expressed support for my research and recalled the work of another anthropologist in the town (Torres 1995). I have received extensive training in field methods and have used the relevant interview techniques in research in Gainesville, Florida and Cologne, Germany. I have studied Spanish for five years and will enroll in an intensive language course for one month prior to starting my research (funding not requested). Finally, coursework in multivariate statistics and categorical data analysis has prepared me for the statistical work.

REFERENCES CITED

Agresti, Alan
1996 An Introduction to Categorical Data Analysis. New York: John Wiley & Sons.

American Anthropological Association
1998 AAA Statement on Race. American Anthropologist 100(3):712-713.

Anwar, Y. A., et al.
1998 Evaluation of the efficacy of the Omron HEM-737 IntelliSense device for use on adults according to the recommendations of the Association for the Advancement of Medical Instrumentation. Blood Press Monitoring 3(4):261-265.

Armstead, C. A., et al.
1989 Relationship of Racial Stressors to Blood Pressure Responses and Anger Expression in Black College Students. Health Psychology 8:541-556.

Bernard, H. Russell
1994 Research Methods in Anthropology: Qualitative and Quantitative Approaches. Walnut Creek, CA: AltaMira.

Bernard, H. Russell, and Gery W. Ryan
1998 Text Analysis: Qualitative and Quantitative Methods. *In* Handbook of Methods in Cultural Anthropology. H.R. Bernard, ed. Pp. 595-646. Walnut Creek, CA: AltaMira.

Bindon, James R., et al.
1997 Social Context and Psychosocial Influences on Blood Pressure Among American Samoans. American Journal of Physical Anthropology 103:7-18.

Borgatti, Stephen P.
1992 ANTHROPAC 4.0 Methods Guide. Columbia: Analytic Technologies.
1996 ANTHROPAC. Columbia: Analytic Technologies.

Boyle, Edwin, Jr.
1970 Biological Patterns in Hypertension by Race, Sex, Body Weight, and Skin Color. JAMA 213(10):1637-1643.

Burt, Vicki L., et al.
1995 Prevalence of hypertension in the US adult population: Results from the Third National Health and Nutrition Examination Survey, 1988-1991. Hypertension 25:305-313.

Cooper, Richard S., et al.
1997a Evaluation of an electronic blood pressure device for epidemiological studies. Blood Press Monitoring 2(1):35-40.
1997b The Prevalence of Hypertension in Seven Populations of West African Origin. American Journal of Public Health 87(2):160-168.

Cooper, Richard S.
1984 A Note on the Biologic Concept of Race and its Application in Epidemiologic Research. American Heart Journal 108(3, Part 2):715-23.

Cooper, Richard S., and Jay S. Kaufman
1998 Race and Hypertension: Science and Nescience. Hypertension 32:813-816.

Cooper, Richard S., Charles N. Rotimi, and Ryk Ward
1999 The Puzzle of Hypertension in African-Americans. *In* Scientific American. Pp. 56-63, Vol. 280.

Costas, Raul, Jr., et al.
1981 Coronary Heart Disease Risk Factors in Men With Light and Dark Skin in Puerto Rico. American Journal of Public Health 71(6):614-619.
Crews, Douglas E., and Sharon R. Williams
1999 Molecular Aspects of Blood Pressure Regulation. Human Biology 71(4):475-503.
Degler, Carl N.
1971 Neither Black Nor White: Slavery and Race Relations in Brazil and the United States. Madison: University of Wisconsin Press.
Dewalt, Kathleen M., Billie R. Dewalt, and Coral B. Wayland
1998 Participant Observation. *In* Handbook of Methods in Cultural Anthropology. H.R. Bernard, ed. Pp. 259-299. Walnut Creek, CA: AltaMira Press.
Dressler, William W.
1991 Social Class, Skin Color, and Arterial Blood Pressure in Two Societies. Ethnicity and Disease 1(1):60-77.
1993 Social and Cultural Dimensions of Hypertension in Blacks: Underlying Mechanisms. *In* Pathophysiology of Hypertension in Blacks. J.C.S. Fray and J.G. Douglas, eds. Pp. 69-89. New York: Oxford University Press.
1996a Culture and Blood Pressure: Using Consensus Analysis to Create a Measurement. Cultural Anthropology Methods 8(October 1996):6-8.
1996b Hypertension in the African American Community: Social, Cultural, and Psychological Factors. Seminars in Nephrology 16(2):71-82.
1999 Modernization, stress, and blood pressure: new directions in research. Human Biology 71(4):583-605.
Dressler, William W., Mauro Campos Balieiro, and Jose Ernesto Dos Santos
1998a Culture, Socioeconomic Status and Physical and Mental Health in Brazil. Medical Anthropology Quarterly 12(4):424-446.
1999 Culture, Skin Color, and Arterial Blood Pressure in Brazil. American Journal of Human Biology 11:49-59.
Dressler, William W., James R. Bindon, and Yasmin H. Neggers
1998b Culture, Socioeconomic Status, and Coronary Heart Disease Risk Factors in an African American Community. Journal of Behavioral Medicine 21(6):527-544.
Duany, Jorge
1998 Reconstructing Racial Identity: Ethnicity, Color, and Class among Dominicans in the United States and Puerto Rico. Latin American Perspectives 25(3):147-172.
Essed, Philomena
1991 Understanding Everyday Racism: An Interdisciplinary Theory. Newbury Park, CA: Sage.
Feagin, Joe R.
1991 The Continuing Significance of Race: Antiblack Discrimination in Public Places. American Sociological Review 56(1):101-116.
Fowler, Floyd J., Jr.
1993 Survey Research Methods. Volume 1. Newbury Park: Sage.
Frisancho, A. Roberto, et al.
1999 Role of Genetic and Environmental Factors in the Increased Blood Pressures of Bolivian Blacks. American Journal of Human Biology 11(4):489-498.

Glantz, S. A., and B. K. Slinker
1990 Primer of Applied Regression and Analysis of Variance. New York: McGraw-Hill.
Gleiberman, L., E. Harburg, and M. L. Cooper
1995 Skin Color, Measures of Socioeconomic Status, and Blood Pressure. Annals of Human Biology 22(1):69-73.
Goodman, Alan H.
1995 The Problematics of "Race" in Contemporary Biological Anthropology. *In* Biological Anthropology: The State of the Science. N.T. Boaz and L.D. Wolfe, eds. Pp. 215-239. Bend, OR: International Institute for Human Evolutionary Research.
Goodman, Alan H., and Thomas L. Leatherman
1998 Traversing the Chasm between Biology and Culture: An Introduction. *In* Building a New Biocultural Synthesis: Political-Economic Perspectives on Human Biology. A.H. Goodman and T.L. Leatherman, eds. Pp. 3-41. Ann Arbor: University of Michigan Press.
Halberstein, Robert A.
1999 Blood Pressure in the Caribbean. Human Biology 71(4):659-684.
Handwerker, W. Penn, and Danielle F. Wozniak
1997 Sampling Strategies for the Collection of Cultural Data: An Extension of Boas's Answer to Galton's Problem. Current Anthropology 38(5):869-875.
Harburg, Ernest, et al.
1973 Socio-Ecological Stress, Suppressed Hostility, Skin Color, and Black-White Male Blood Pressure: Detroit. Psychosomatic Medicine 35(4):276-296.
1978 Skin Color, Ethnicity, and Blood Pressure I: Detroit Blacks. American Journal of Public Health 68(12):1177-1183.
Harris, Marvin
1964 Patterns of Race in the Americas. Westport, CT: Greenwood Press.
1970 Referential Ambiguity in the Calculus of Brazilian Racial Identity. Southwestern Journal of Anthropology 26(1):1-14.
Harrison, Faye V.
1998 Introduction: Expanding the Discourse on "Race." American Anthropologist 100(3): 609-631.
Hoetink, H.
1967 Caribbean Race Relations: A Study of Two Variants. New York: Oxford University Press.
Hutchinson, Janice Faye
1984 A Biocultural Analysis of Blood Pressure Variation Among the Black Caribs and Creoles of St. Vincent, West Indies. Ph.D., University of Kansas.
Hypertension Detection and Follow-up Program Cooperative Group
1977 Race, Education, and Prevalence of Hypertension. American Journal of Epidemiology 106:351-361.
James, S, N Aleida-Filho, and JS Kaufman
1991 Hypertension in Brazil: A Review of the Epidemiologic Evidence. Ethnicity and Disease 1:91-98.
James, Sherman A., S. A. Hartnett, and W. D. Kalsbeek
1983 John Henryism and Blood Pressure Differences Among Black Men. Journal of Behavioral Medicine 6:259-278.

Janes, Craig R.
1990 Migration, Social Change, and Health: A Samoan Community in Urban California. Stanford: Stanford University Press.
Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure
1997 The Sixth Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Archives of Internal Medicine 157(November 24, 1997):2413-2446.
Kaufman, Jay S., and Richard S. Cooper
1999 Seeking Causal Explanations in Social Epidemiology. American Journal of Epidemiology 150(2):113-120.
Kaufman, Jay S., et al.
1999 Blood Pressure Change in Africa: Case Study from Nigeria. Human Biology 71(4):641-657.
Keil, Julian E., et al.
1977 Hypertension: Effects of Social Class and Racial Admixture. American Journal of Public Health 67(7):634-639.
1981 Skin Color and Education Effects on Blood Pressure. American Journal of Public Health 71:532-534.
Keith, V. M., and C. Herring
1991 Skin Tone and Stratification in the Black Community. American Journal of Sociology 97:760-778.
Klag, Michael J., et al.
1991 The Association of Skin Color with Blood Pressure in US Blacks with Low Socioeconomic Status. JAMA 265(5):599-602.
Krieger, Nancy
1999 Embodying Inequality: A Review of Concepts, Measures, and Methods for Studying Health Consequences of Discrimination. International Journal of Health Services 29(2):295-352.
Krieger, Nancy, Stephen Sidney, and Eugenie Coakley
1998 Racial Discrimination and Skin Color in the CARDIA Study: Implications for Public Health Research. American Journal of Public Health 88(9):1308-1313.
Krieger, Nancy, David R. Williams, and N. E. Moss
1997 Measuring Social Class in US Public Health Research: Concepts, Methodologies, and Guidelines. Annual Review of Public Health 18:341-378.
Lackland, Daniel T., and Julian E. Keil
1996 Epidemiology of Hypertension in African Americans. Seminars in Nephrology 16(2):63-70.
Marks, Jonathan M.
1995 Human Biodiversity: Genes, Race, and History. New York: Aldine de Gruyter.
Montagu, Ashley
1997 Man's Most Dangerous Myth: The Fallacy of Race. Walnut Creek, CA: AltaMira Press.
Muñoz Vázquez, Marya , and Idsa E. Alegría Ortega
1999 Discrimen por razón de raza en los sistemas de seguridad y justicia en Puerto Rico. San Juan, PR: Comisión de Derechos Civiles.

Mukhopadhyay, Carol C., and Yoland T. Moses
1997 Reestablishing "Race" in Anthropological Discourse. American Anthropologist 99(3):517-533.
Muntaner, Carles, F. Javier Nieto, and Patricia O'Campo
1996 The Bell Curve: On Race, Social Class, and Epidemiologic Research. American Journal of Epidemiology 144(6):531-6.
Nelson, Michael, and Sheila A. Bingham
1997 Assessment of Food Consumption and Nutrient Intake. *In* Design concepts in nutritional epidemiology. B.M. Margetts and M. Nelson, eds. Pp. 123-169. New York: Oxford University Press.
Omi, Michael, and Howard Winant
1994 Racial Formation in the United States: From the 1960s to the 1990s. New York: Routledge.
Ordúñez-García, PO, et al.
1998 Hypertension in Cuba: evidence of a narrow black-white difference. Journal of Human Hypertension 12:111-116.
Romney, A. Kimball, Susan C. Weller, and William H. Batchelder
1986 Culture as Consensus: A Theory of Culture and Informant Accuracy. American Anthropologist 88:313-339.
Scarano, Francisco A.
1984 Sugar and Slavery in Puerto Rico: The Plantation Economy of Ponce, 1800-1850. Madison, WI: University of Wisconsin Press.
Seda Bonilla, Eduardo
1972 Requiem Para una Cultura: Ensayos sobre la Socialización del Puertorriqueno en su Cultura y en el Ámbito del Poder. Rio Piedras: Ediciones Bayoan.
Shriver, Mark D., and Esteban J. Parra
in press Comparison of narrow-band reflectance spectroscopy and tristimulus colorimetry for measurements of skin and hair color in persons of different biological ancestry. American Journal of Physical Anthropology: in press.
Smedley, Audrey
1998 Race in North America: Origin and Evolution of a Worldview. Boulder, CO: Westview Press, Inc.
Sorlie, Paul D., Mario R. Garcia-Palmieri, and Raul Costas
1988 Left ventricular hypertrophy among dark- and light-skinned Puerto Rican men: The Puerto Rico Heart Health Program. American Heart Journal 116(3):777-783.
Spradley, James P.
1979 The Ethnographic Interview. Orlando, FL: Harcourt Brace Jovanovich.
Steward, Julian H., et al.
1956 The People of Puerto Rico: A Study in Social Anthropology. Urbana: University of Illinois Press.
Strauss, Anselm, and Juliet Corbin
1990 Basics of Qualitative Research: Grounded Theory Procedures and Techniques. Newbury Park, CA: Sage Publications, Inc.
Takiwaki, H., L. Overgaard, and J. Serup
1994 Comparison of narrow-band reflectance spectrophotographic and tristimulus colorimetric measurements of skin color. Skin Pharmacology 7:217-225.

Torres, Arlene
1995 Blackness, Ethnicity and Cultural Transformations in Southern Puerto Rico. Ph.D., University of Illinois at Urbana-Champaign.
Tyroler, H. A., and Sherman A. James
1978 Blood Pressure and Skin Color. American Journal of Public Health 68(12):1170-1172.
US Census Bureau
1994 1990 Census of Population: General Population Characteristics, Puerto Rico. Washington, D. C.: Government Printing Office.
Wade, Peter
1997 Race and Ethnicity in Latin America. Chicago: Pluto Press.
Waldron, Ingrid, et al.
1982 Cross-Cultural Variation in Blood Pressure: A Quantitative Analysis of the Relationships of Blood Pressure to Cultural Characteristics, Salt Consumption and Body Weight. Social Science and Medicine 16:419-430.
Ward, Ryk
1995 Familial aggregation and genetic epidemiology of blood pressure. *In* Hypertension: Pathophysiology, Diagnosis, and Management. J.H. Laragh and B.M. Brenner, eds. Pp. 67-88, Vol. 1. New York: Raven Press.
Weller, Susan C.
1998 Structured Interviewing and Questionnaire Construction. *In* Handbook of Methods in Cultural Anthropology. H.R. Bernard, ed. Pp. 365-409. Walnut Creek: AltaMira.
Weller, Susan C., and A. Kimball Romney
1988 Systematic Data Collection. Volume 10. Newbury Park, CA: Sage.
Williams, David R.
1997 Race and Health: Basic Questions, Emerging Directions. Annals of Epidemiology 7(5):322-33.
Zenón Cruz, Isabelo
1974 Narciso Descubre Su Trasero: El Negro en la Cultura Puertorriquena. 2 vols. Humacao: Furidi.