

The Georgia Cardiovascular Twin Study

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The Georgia Cardiovascular Twin Study is a longitudinal study of biobehavioral antecedents of cardiovascular disease in youth. It includes roughly equal numbers of African Americans and European Americans, with a total of > 500 twin pairs. Focus of the study is the change in relative influence of genetic and environmental factors on development of risk factors for cardiovascular disease. Future work will explore the influence of polymorphic variation in candidate genes and their potential interaction with the environment on these risk factors.

Major Research Focus

Primary aim of the Georgia Cardiovascular Twin Study is to investigate changes in relative influence of genetic and environmental factors on development of biobehavioral risk factors for cardiovascular disease in youth. Unique aspects of this twin study are its longitudinal design and the inclusion of approximately equal numbers of European American and African American youth.

Recruitment

The twin pairs were recruited through announcements in local media and flyers distributed to public middle and high schools within 120 miles of the study location (Augusta, Georgia, USA). Twins have been seen for a baseline visit between 1997 and 2000 and will be seen an additional two times in the next four years (2001–2005).

Major Achievements

We initially investigated determination of twin zygosity by comparing DNA with several questionnaire indices. The conclusion of this study was that if zygosity determination with DNA markers or blood group typing for all subjects is not feasible, rather than using classification indices based on other studies, an optimal classification scheme can be achieved by using a zygosity questionnaire of which the reliability and validity of the questions is established in a random subsample of the same twin cohort (Jackson et al., 2001).

In a series of preliminary analyses we investigated and compared relative influence of genetics and environment in European and African Americans on fat patterning (Treiber et al., 1999), stress-related coping styles (Turner et al., 1999), left ventricular mass (Cook et al., 2000), resting blood pressure and hemodynamics (Musante et al., 2000; Snieder et al., 2001), cardiovascular responsivity to stress (Treiber et al., 2000) and responses of urinary Na⁺ excretion to stress (Harshfield et al., 2000). Initial results indicate

substantial heritabilities for all these traits with relatively few differences between European and African Americans.

Our first candidate gene study in this twin cohort investigated the effect of two polymorphisms (Arg16Gly and Gln27Glu) in the β 2-adrenergic receptor gene on resting hemodynamics and found significant effects of both polymorphisms in European Americans, but not in African Americans (Snieder, Dong, et al., in press). A follow-up analysis investigated the relationship between the same polymorphism of the β 2-adrenergic receptor gene and blood pressure at rest and in response to three different stress tasks (postural change, social stressor interview and car driving simulation). In European Americans, carriers of the Gly allele of the Arg16Gly polymorphism showed significantly higher SBP levels at rest, during social stressor interview and car driving. European American carriers of the Glu allele of the Gln27Glu polymorphism showed significantly higher levels of both SBP and DBP at rest and during postural change. The only significant finding in African Americans was a higher resting DBP in Glu carriers. No associations were found between these polymorphisms and cardiovascular reactivity (i.e., change scores) to any of the stressors. The findings of these studies thus suggest that particularly in European American youth, these vasodilatory related genetic factors play an important role in control of BP levels at rest and during stress.

Future Plans

Future studies will focus on the effect of candidate genes on the cardiovascular and renal stress response as recently outlined in our model of stress-induced essential hypertension (Snieder, Harshfield, et al., in press).

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Appendix A

Outlines of Twin Registry in Georgia, USA

Name of register	Georgia Cardiovascular Twin Study
Country	Georgia, USA
Kind of Ascertainment	Schools
Opposite sex twins (yes or no)	Yes
Number of pairs (separated by birth range and sex)	1970-1990: European Americans: 308 (108 mm, 122 ff, 78 mf) African Americans: 226 (77 mm, 97 ff, 52 mf)
Primary interest	Longitudinal development of biobehavioral antecedents of cardiovascular disease in youth
Variables measured (+number of pairs in total)	Biobehavioral risk factors of cardiovascular disease measured in all twins
DNA / blood samples (+number of pairs)	DNA and blood samples in all twins
Contact	Harold Snieder
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Major publications	Jackson et al. (2001). Determination of twin zygosity... <i>Twin Research</i> , 4, 12-18 Snieder et al. (2002). Beta-2 adrenergic receptor gene... <i>Am.J.Hyperten.</i> , in press
Major sources of funding	National Heart Lung and Blood Institute (HL56622)
comments	Twins are followed longitudinally
