

## THE ACE ID GENOTYPE AND MUSCLE STRENGTH AND SIZE RESPONSE TO UNILATERAL RESISTANCE TRAINING

Throughout the history of exercise physiology, researchers have worked to understand the responses and adaptations to an exercise challenge. During this time, researchers have noted wide variability in the responses of particular individuals to various exercise stimuli. Despite similar stimuli, some subjects respond strongly and others not at all (1). Certainly, genetic factors contribute to this response variability, yet only in the past decade have exercise physiologists had the tools necessary to begin identifying the key genes and gene variants involved. The Human Gene Map for Performance and Health-Related Fitness Phenotypes published in this journal provides a yearly update on research progress in this area (4).

One of the most studied genes to date is the angiotensin converting enzyme (*ACE*) gene. The *ACE* gene contains an insertion/deletion (I/D) polymorphism that is strongly associated with ACE enzyme levels in the blood, and the I- and D-alleles have been studied for their relationship with a wide variety of traits, including the muscle response to exercise and exercise training. In general, enhanced muscle strength and size responses to exercise training have been correlated with the presence of the D-allele, although the data are inconsistent.

In this issue of the journal, Pescatello et al. (2) examine the association of the *ACE* I/D polymorphism with the response of the elbow flexors to resistance training. This is one of the first papers generated from the recently completed Functional Single Nucleotide Polymorphisms Associated with Human Muscle Size and Strength (FAMuSS) study, which was designed to identify the genetic factors underlying the muscle response to resistance training (3). The FAMuSS study provides fertile ground for identifying key genes: the sample is large, measurements of upper-arm muscle size and strength are state of the art, and the training design allows comparisons of trained unilateral and untrained contralateral limbs.

In their study, Pescatello and colleagues found only minor associations between *ACE* genotype and training responses: *ACE* I-allele carriers demonstrated a greater isometric

strength increase with resistance training than did the D/D group for the trained unilateral arm, but 1RM and muscle size responses were not related to *ACE* genotype. In contrast, the most interesting results were for the untrained contralateral limb, where increases in isometric strength, 1RM, and muscle size were different across the *ACE* genotypes. Overall, the results indicate that the response of muscle to resistance training is not highly related to the *ACE* I/D polymorphism, whereas the contralateral effects of unilateral training are associated with the presence of the D-allele.

Personalized medicine describes the use of genetic information in the treatment and prevention of disease, such that an individual's unique genetic profile is considered when determining the prescription of drugs and other therapies. Exercise certainly qualifies as one such therapy, and the inclusion of genetic factors may someday assist in targeting specific types of exercise or exercise/diet/drug combinations to specific individuals in order to optimize disease treatment. The use of genetics in disease prevention is less certain, as individuals will have to agree to genetic screening in advance of disease symptoms. Whether genetic information will have relevance for exercise promotion or adherence is also an open question. If we ignore for the moment the controversial use of genetic information to enhance sport performance (e.g., genetic screening and gene doping), there is considerable excitement about the future prospects for genetics in exercise science. Answering these complex questions, however, will require large studies and new collaborations similar to those of FAMuSS and other cohorts.

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