.

# Nature vs. Nurture in Sport, Exercise and Physical Activity

**Course teacher**: Dr. Sigal Ben-Zaken

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**Course Outline:**

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| 1-2 | • Introduction – what is genetics?<br>• Basic terms in genetics: Inheritance, gene, chromosome, DNA. |
| 3-4 | • How to study the genetic basis of specific traits?<br>• Inherited and acquired traits, single gene traits vs. quantitative traits, performance as multi-factorial trait |
| 9-5 | • Mendelian heritability, pedigree, single gene traits |
| 7-8 | • Quantitative heritability, twin studies, quantitative multi-factorial traits (athletic performance, intelligence, motivation, behavior, etc.) |
| 9-10 | • Heritability: how much is “nature” and how much is “nurture”? |
| 11-12 | • Genetic polymorphism, Allelic Variation: association between genetic polymorphism and performance, Performance' genes |
| 13-14 | • Gene expression, gene-environment interaction, Epigenetics |

**B. Prerequisites or Co-requisites:** none

**C. Rationale/Objectives/Description**

The role of nature vs. nurture in human performance in various fields like sports, arts, cognition, etc has intrigued scientists for many years. Questions like '*are champions born or built?*'; '*Is motivation inheritable or acquired?*'; '*Why do some people perform very well in specific areas while others do not?*' and many others were the focus of many studies. However, the large amount of knowledge that has accumulated in the field of genetics shed new light on studies regarding human performance. Genes have been known to affect many traits and phenotypes to some degree. Therefore, a better understanding of their role or of how to explore their role provides a complete picture on the complex phenomena of human performance.

This course

**Objectives**

The main goal of this course is to explore the possible role of genetics in human performance in various fields. Though the main objective is to acquire knowledge in this particular area, the overall objective, is to explore ways in which various scientific fields can be synergistically combined to answer questions regarding the interplay of nature and nurture in human performance. This multidisciplinary approach will enable students to combine genetic aspects in their research topics, that eventually will give them new and complete insights on complex phenomena related to human performance. The formal objectives of the course are:

1. Acquire basic knowledge in genetic and performance
2. Demonstrate competence in presenting, discussing, and elaborating on topics related to nature vs, nurture in human performance.
3. Offer possible methods to combine genetic aspects in their research field.

## D. Required Texts, Readings, and/or other Resources

Articles distributed in class.

## E. Topical Course Outline

- Basic terms in genetics: gene, chromosome, DNA.
- Basic Inheritance, Pedigree Analysis
- Quantitative Genetics
- Heritability: how much is “nature” and how much is “nurture”?
- Varieties of gene-environment interplay
- Overview of Individual Differences & performance
- Genetic polymorphism
- Allelic Variation: association between genetic polymorphism and performance
- Research methods in genetics and heritability
- Gene expression
- Epigenetics

## F. Teaching Strategies

Class sessions consist of teachers' presentations. Students will be asked to present pedigree and/or heritability assignment in class. The presentations in class will incorporate the use of a power-point computer software.

The majority of the classes will be divided into the following segments:

1. Introduction to course contents, requirements, policy, and philosophy.
2. Teaching the main concepts of genetic and performance
3. Students' presentations

## G. Expectations/Attendance

- Active participation in class
- Quality of the creative and critical elaborations

It is expected that students will be present in all classes, be active, and share knowledge with their peers in class. Assignments produced with low quality, or of limited scope and comprehensiveness, and/or substantial absence from class (25% of the classes and more), may lead to an "incomplete" or a low letter grade. However, it is expected that students in advanced stages of their studies, as those in this class, will gain an A grade for their effort and assignment quality.

## I. Grading/Evaluation

TBA

**Bibliography**

**Books**


1. Brown TA. ***Introduction to Genetics: A Molecular Approach*****.** Taylor & Francis Group; 2011.
2. Hyde DR. ***Introduction to Genetic Principles***. 1st ed. Companies, McGraw-Hill; 2009.
3. Plomin R. ***Nature and Nurture: An Introduction to Human Behavioral Genetics****.* Belmont, CA, US: Thomson Brooks/Cole Publishing Co; 1990.


**Articles**

Nature, Nurture and Performance


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2. Baker J. ***Nature and nurture interact to create expert performers***. *High Abil Stud*. 2007;18(1):57-58.

3. Krubitzer L, Kahn DM. ***Nature versus nurture revisited: an old idea with a new twist***. *Prog Neurobiol*. 2003;70(1):33-52.

4. Plomin R, Shakeshaft NG, McMillan A, Trzaskowski M. ***Nature, Nurture, and Expertise***. *Intelligence*. 2014;45:46-59.

Heritability and Behavior

5. Johnson AM, Vernon PA, McCarthy JM, Molson M, Harris JA, Jang KL. Nature vs nurture: are leaders born or made? **A behavior genetic investigation of leadership style**. *Twin Res*. 1998;1(4):216-223.

6. Trouton A, Spinath FM, Plomin R. **Twins early development study (TEDS): a multivariate, longitudinal genetic investigation of language, cognition and behavior problems in childhood**. *Twin Res*. 2002;5(5):444-448.

Genetic of Athletic Performance

7. Klissouras V. ***The nature and nurture of human performance***. *Eur J Sport Sci*. 2001;1(2):1-10.

8. Donato AJ, Edwards AG. ***What for nature, and who to nurture?*** J Appl Physiol. 2011;110(1):283; discussion 294.

9. Brutsaert TD, Parra EJ. ***Nature versus nurture in determining athletic ability***. Med Sport Sci. 2009;54:11-27

10. Appell Coriolano H-J, Duarte JA. ***Studies on gene polymorphisms in sports fancy fashion or important field of research?*** Int J Sports Med. 2012;33(6):419-420

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Heritability of Motor learning and Motor Skills

12. Williams LR, Hearfield V. ***Heritability of a gross motor balance task***. Res Q. 1973;44(1):109-112.

13. Fox PW, Hershberger SL, Bouchard TJ. ***Genetic and environmental contributions to the acquisition of a motor skill***. Nature. 1996;384(6607):356-358

Heritability and Personality

14. Krueger RF, Markon KE, Bouchard TJ. ***The extended genotype: the heritability of personality accounts for the heritability of recalled family environments in twins reared apart.*** J Pers. 2003;71(5):809-833.

15. Rosenman RH, Rahe RH, Borhani NO, Feinleib M. ***Heritability of personality and behavior pattern.*** Acta Genet Med Gemellol (Roma). 1976;25:221-224.

16. Krueger RF, South S, Johnson W, Iacono W. ***The heritability of personality is not always 50%: gene-environment interactions and correlations between personality and parenting.*** J Pers. 2008;76(6):1485-1522.

17. Bouchard TJ. ***Genes, environment, and personality***. Science. 1994;264(5166):1700-1701.

18. Floderus-Myrhed B, Pedersen N, Rasmuson I. ***Assessment of heritability for personality, based on a short-form of the Eysenck Personality Inventory: a study of 12,898 twin pairs***. Behav Genet. 1980;10(2):153-162

Heritability and Genetics of Intelligence

19. Kan K-J, Wicherts JM, Dolan C V, van der Maas HLJ. ***On the nature and nurture of intelligence and specific cognitive abilities: the more heritable, the more culture dependent***. *Psychol Sci*. 2013;24(12):2420-2428.

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Genetics of Motivation, Self-Efficacy, and Decision Making

25. Waaktaar T, Torgersen S. ***Self-efficacy is mainly genetic, not learned: a multiple-rater twin study on the causal structure of general self-efficacy in young people***. Twin Res Hum Genet. 2013;16(3):651-660.

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