

## Take Home Lessons from Today 10-10-24

1. The “Happiness & Health: The Biological Factors- Systematic Review Article” was fairly superficial and represents a summary of what we have largely already learned. However, the paper did make a couple of important points. There is a nice table (Table 1) of genes that would be expected to contribute to happiness because they are important for establishing or maintaining the levels of neurotransmitters in the brain related to happiness (dopamine, etc.). The paper also makes a nice point that more oxytocin leads to better relationships which leads to more happiness, which leads to better relationships, an example of a positively-reinforcing cycle of happiness.
2. The “Heritability and Genome-Wide Linkage Scan of Subjective Happiness” article is important because it concludes there is a strong link between happiness and inherited genes, in other words, your genetic makeup determines a significant amount of one’s overall happiness.
3. The study utilized a widely-used four question survey to assess happiness in both identical and fraternal twins. The results with identical twins (identical genetics) were compared with other siblings (different genetics but same environment) to see how important genetics are to the way the surveys are answered. Fraternal twins were also studied as an example of different genetics but same environment.
4. **After quantifying the similarity of how identical twins filled out each question of the survey, the authors concluded that individual differences in happiness are 22% accounted for by genetic factors in men and for 41% in women.** In other words, identical twins filled out the surveys more similar to each other than two non-twin siblings by a significant amount.
5. The authors carried out a detailed genetic analysis of the people in the study (twins versus non-twin siblings) to try and find which chromosomes were carrying genes related to happiness differences. The authors identified two such spots, but there were no genes at those two locations that were obviously related to brain chemistry meaning these results were inconclusive.
6. The class had many questions about how accurate these numbers might actually be.



## Happiness & Health: The Biological Factors- Systematic Review Article

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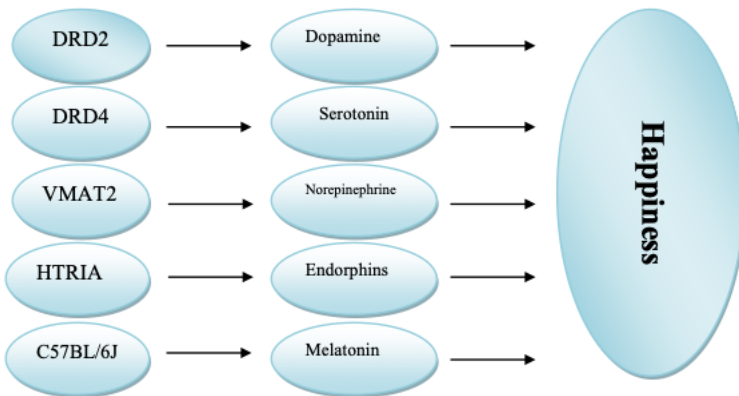


Fig. 1: Effects of genes on happiness neurotransmitters

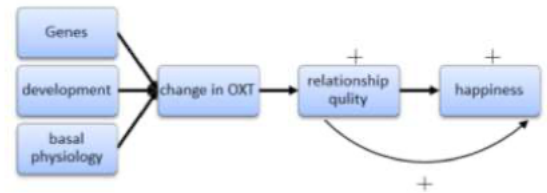


Fig.2: Effects of OXT on happiness

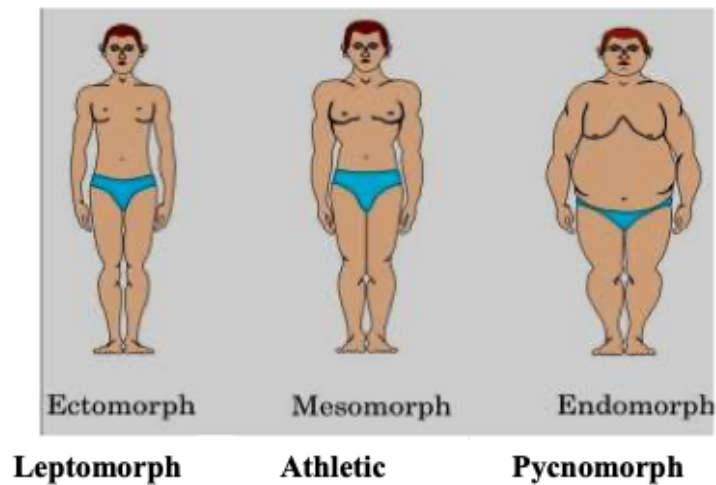


Fig. 3: Anthropometric typology

Table 1: Genes related to mood and emotional characteristics (8)

Genes	Associations
DRD2	Alcoholism, Substance abuse, craving behavior, cocaine dependence, smoking, ADHD, parenting, Obesity, video gaming, sexual activity, posttraumatic stress disorder schizophrenia, Parkinson's, brain metabolism, BMI, executive functioning, love styles (EROS) pathological gambling. Pathological aggression, schizoid/avoidant behavior, criminal activity, politics party attachment. Energy, hypertension. Hyperphagia, growth, sexual maturation, brain development, depression, anorexia, bulimia, fibromyalgia, pain sensitivity, hunger, novelty seeking, extraversion, early onset sexual intercourse, defense style (lying), oppositional defiant disorder, panic disorder, developmental personality, Tourette Syndrome, Parkinson's, executive dysfunctioning, pleasure "buzz"
ANKKI	Smoking dependence, parental rule-setting, Schizophrenia, cognition deficit, alcohol and opiate dependence, pleasurable "buzz",
5HT2A	Eating disorders, obesity, Insulin resistance, love styles (romantic), suicide, ADHD, Panic disorders, impulsive aggression, cognitive impulsivity, anger, sweet tooth, antidepressant treatment outcomes, fibromyalgia, obsessive-compulsive disorder, borderline personality, smoking behavior, cocaine dependence, BMI.
OPRK1 (kappa-opioid receptor)	Alcohol and heroin dependence. Pain mechanisms and tolerance.
OPRM1 (mu-opioid receptor)	Pleasure "buzz", smoking addiction, heroin addiction, alcoholism, pain sensitivity, BMI, type 2 diabetes mellitus.
COMT	Psychiatric and affective disorders, alcoholism, substance use disorder, smoking, post-surgical pain, fibromyalgia, Parkinson's disease, ADHD.
SLC6A3	Post-surgical pain, cocaine abuse, alcohol dependence, smoking behavior, juvenile delinquency, pathological aggression, bipolar disorder, schizophrenia, ADHD, impulsive aggression, cognitive impulsivity.
HTR3B	Heroin addiction, migraine, impulsive behavioral aggression, cognitive -impulsivity, ADHD alcoholism.
NOS3	Pain mechanism, healing mechanisms, circulation, hypertension, cardiovascular.
PPARG	Type 2 diabetes, Obesity, Insulin sensitivity, Body composition, eating disorders, BMI, physical exercise, common metabolic disorders, body mass, waist circumference, inflammatory response, immune system.
CHREBP	Plasma triglycerides, triglyceridemia, obesity „improves plasma glucose,
FTO	Severe obesity, food intake, adiposity, body mass, energy intake, BMI, fat mass, pleasurable "buzz".
TNF alpha	Inflammation, mortality, schizophrenia, bipolar disorder, BMI, Immune response.
PEMT	Proinflammatory, immunoregulation, apoptosis, substance use disorder.
MANEA	Substance dependence
LEPTIN-OB	BMI, Schizophrenia, stress, obesity risk, food intake, craving behavior, diabetes, insulin sensitivity, adiposity, body composition, linear growth, metabolic factors, hyperphagia, cocaine dependence, lipogenesis, modulation of sweet substances, anorexia, bulimia, cardiovascular effects, fertility, sexual maturation, brain development, depression, fatty acid metabolism, hunger,
MAO-A	Pain sensitivity, bipolar affective disorder, ADHD, alcoholism, Substance Use Disorder, violent behavior, juvenile delinquency, smoking, child abuse, suicide, criminal activity, posttraumatic stress disorder, antidepressant treatment response, alcoholism, panic disorder, schizophrenia, pathological gambling.
ADIPOQ	Metabolic syndrome, adiposity, fat mass, energy intake, obesity, lipogenesis, type 2 diabetes, BMI.
STS	ADHD
VDR	Obesity, BMI, overeating, metabolic syndrome, anthropometric measures, schizophrenia, temporal lobe epilepsy, immune system, type 2 diabetes, physical activity, BoneDensity (Osteoporosis).
DBI	Anxiety Disorders
GABRA6	Autism, alcoholism, stress response.
GABRB3	Autism, alcoholism, stress.
MTHFR	Cardiovascular disease, Homocysteine levels, obesity, fat mass, Schizophrenia.
MLXIPL (CARBOHYDRATE BINDING ELEMENT)	Plasma triglycerides, glucose craving behavior, obesity.
VEGF	Angiogenesis factor, cognition, tissue healing, pain sensitivity, oxidative stress.
DRD4	Financial risk taking, nicotine withdrawal, ADHD, novelty seeking, Alcoholism, aggression, impulsivity, delinquency, memory deficits, anger, temperament, schizophrenia, sexual intercourse, drug abuse, extraversion, obesity, stress, emotional reactivity, infant attachment, oppositional defiant disorder, fibromyalgia, hyperphagia, alcohol craving, pathological gambling, panic disorder, developmental personality, Tourette Syndrome, Parkinson's.
VMAT2	Antidepressant treatment outcome, Parkinson's, ADHD, cocaine and methamphetamine dependence, spirituality "GOD Gene".
CLOCK	Circadian system, mood, bipolar, endocrine and metabolic rhythms, stress, reproduction, morphine dependence
MELATONIN	Sleep anxiety, alcoholism
OREXIN	Hyperphagis and energy regulation

# Heritability and Genome-Wide Linkage Scan of Subjective Happiness

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**Table 1**

Distribution of the Sample Over Zygosity and Age

	Total sample	Younger sample	Older sample
MZM pairs	844 <sup>1</sup> (627) <sup>2</sup>	433 (386)	411 (241)
DZM pairs	645 (420)	370 (299)	275 (121)
MZF pairs	1586 (1181)	616 (545)	970 (636)
DZF pairs	1027 (690)	448 (381)	579 (317)
DOS mf pairs	788 (493)	426 (335)	362 (158)
DOS fm pairs	731 (458)	386 (306)	345 (152)
Brothers	890	511	379
Sisters	1129	601	528

Note: <sup>1</sup> = number of families; <sup>2</sup> = total number of complete pairs.

**Table 3**

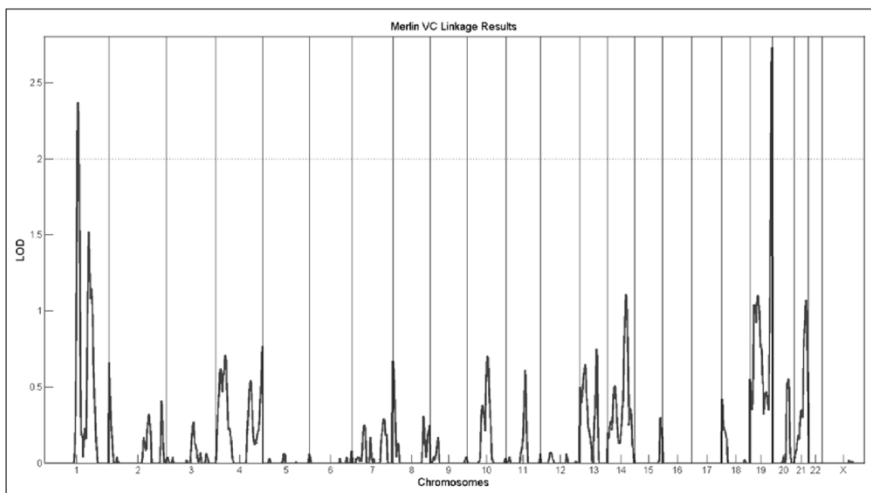
Twin-Sibling Correlations (95% CI) for Happiness

	Young (95% CI)	Old (95% CI)
MZF	.42 (.35–.48)	.43 (.37–.48)
DZF/ F-F	.17 (.10–.23)	.17 (.10–.24)
MZM	.19 (.10–.28)	.29 (.17–.39)
DZM/ M-M	.08 (.01–.15)	.10 (.00–.21)
DOS/M-F	.18 (.13–.23)	.13 (.06–.19)

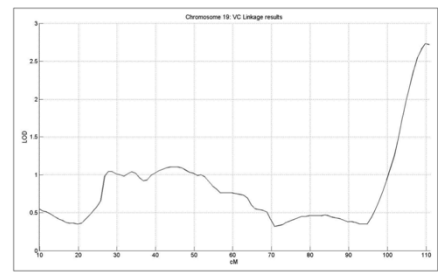
**Table 2**

Subjective Happiness Observed Means Levels and Distribution of Sex and Age in the Total, Non-Linkage, and Linkage Sample

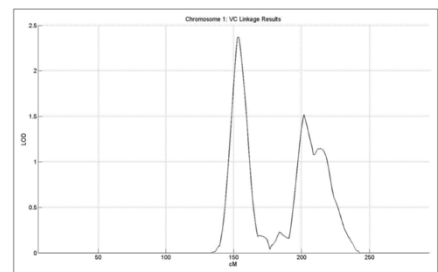
	Total sample			Non-linkage sample			Linkage sample		
	N	age	HAP	N	Age	HAP	N	age	HAP
Total	12279	24.69 (11.66)	22.71 (4.36)	11122	23.75 (11.14)	22.71 (4.38)	1157	33.75 (12.58)	22.76 (4.23)
Males	4805	23.52 (11.47)	23.02 (4.18)	4367	22.5 (10.77)	23.02 (4.19)	438	33.72 (13.19)	23.08 (4.15)
young	2734	16.4 (2)	23.25 (4.26)						
old	1967	32.96 (12.06)	22.78 (4.04)						
Females	7474	25.44 (11.71)	22.51 (4.46)	6755	24.55 (11.3)	22.52 (4.49)	719	33.78 (12.21)	22.55 (4.27)
young	3433	16.56 (2.07)	22.84 (4.43)						
old	3811	33.11 (11.28)	22.23 (4.48)						



**Figure 1a**  
Merlin VC linkage results across the whole genome.



**Figure 1b**  
Merlin VC linkage results for Chromosome 19.



**Figure 1c**  
Merlin VC linkage results for Chromosome 1.