



CENTRO DE PESQUISA E ANÁLISES HERÁCLITO

# GENETIC ANALYSIS



Genetic testing, by revealing individual predispositions and the body's potential response to different interventions, represents a powerful tool that can significantly complement conventional medical treatment. When this genetic information is correctly interpreted by the attending physician and integrated with lifestyle medicine, there is enormous potential to refine and personalize treatment, optimizing its effectiveness and, when possible, minimizing adverse effects.

Minimizing adverse effects is crucial because individual genetic variability, such as polymorphisms in genes encoding drug-metabolizing enzymes (e.g., cytochrome P450 like CYP2D6 or CYP2C19), can influence the pharmacokinetics and pharmacodynamics of medications, altering the ideal dose or predicting adverse reactions.

This approach requires robust and well-aligned multidisciplinary collaboration, involving various medical areas such as Internal Medicine, Endocrinology, Metabolism, Cardiology, Sports Medicine, Neuroscience, Psychology, and other relevant specialties. Synergy among these professionals is crucial to creating a health plan truly tailored to the biological, environmental, and behavioral needs of each individual, ensuring a holistic and integrated view of the patient.

Precision medicine in lifestyle medicine represents a promising, yet complex, frontier in healthcare, aiming to adapt medical interventions to individual genetic, environmental, and lifestyle factors. Genetics can significantly contribute to lifestyle interventions by enabling:

## 1. Enhanced Risk Stratification: more targeted preventive interventions.

Identifying individuals with a higher genetic predisposition to certain health conditions, even before the onset of clinical symptoms.

For example, the presence of variants in the APOE gene (especially APOE4) may indicate an increased risk for Alzheimer's disease, while polymorphisms in the FTO gene are strongly associated with obesity.

The use of Polygenic Risk Scores (PRS) can consolidate genetic risk more comprehensively for complex diseases such as type 2 diabetes or cardiovascular diseases, allowing for more targeted preventive interventions.

## 2. Strategy Customization:

The adaptation of dietary recommendations, exercise plans, and other lifestyle interventions based on an individual's genetic makeup, aiming for maximum effectiveness.

a. Nutrigenomics: Genetic variants can influence the response to specific nutrients. For example, individuals with certain variants in the CYP1A2 gene may metabolize caffeine more slowly, which can increase cardiovascular risk with high consumption. Similarly, polymorphisms in the LCT (lactase) gene can predict lactose intolerance, and variants in genes such as APOA5 or FTO can influence the response to fat or carbohydrate consumption.

b. Physical Exercise: Genetics can inform about predisposition to muscle fiber types (e.g., ACTN3 associated with strength and speed), blood pressure response to aerobic exercise, or even chronotype (PER3 and circadian rhythms), optimizing training times and modalities.

### 3. Identifying Responders and Non-Responders:

The ability to predict which individuals will have a more favorable response to certain lifestyle interventions or specific treatments, optimizing the therapeutic course.

For example, if an individual has a genetic predisposition for a suboptimal response to a low-carbohydrate diet, genetic information can guide the physician to explore other nutritional strategies that are more effective for that genetic profile.

However, always respecting that the individual's clinical manifestation is paramount.

Several studies demonstrate that genetic variants associated with conditions such as obesity, metabolic syndrome, fatty liver disease, type 2 diabetes, and cardiovascular risk interact with environmental factors, such as diet and physical activity. This gene-environment interaction modulates both the baseline risk for developing these conditions and the individual response to interventions (Nakamura et al., 2023; Rosenzweig et al., 2019).

This interaction is fundamental to epigenetics, where lifestyle can influence gene expression without altering the DNA sequence, impacting long-term health.

The incorporation of genomic data, sophisticated analyses (including bioinformatics and machine learning to interpret large volumes of genetic data), and personalized health education tailored to each individual's reality are essential elements of this approach.

It is crucial that the interpretation of results be carried out by qualified professionals, often with the support of genetic counseling, to ensure that the information is understood and applied ethically and responsibly.

The ultimate goal is to improve patient outcomes by aligning lifestyle interventions with individual genetic predispositions and contextual environmental factors, always considering ethical implications, data privacy, and the prevention of genetic discrimination.

In short, genetic information, when correctly interpreted and used in conjunction with lifestyle medicine and the attending physician's specialized knowledge, offers a unique opportunity to refine conventional treatment, resulting in more precise, proactive, and truly individualized healthcare, paving the way for

more predictive, preventive, personalized, and participatory medicine. Understanding the role of genetics in our health is an incredible advancement, but it's natural for concerns or even anxiety to arise when receiving information about predispositions.

It is crucial to clarify that a genetic outcome is not a sentence or an immutable destiny. This is where the crucial concept of epigenetics comes in.

## The Influence of Epigenetics on the Manifestation of Diseases:

If your genetics (your DNA) is like the "hardware" of your body — the set of basic instructions to build and operate you — epigenetics is like the "software" that controls how and when those instructions are read and executed. It represents a layer of information that overlays the DNA, regulating gene expression without altering the underlying genetic sequence.



## What is Epigenetics?

Epigenetics studies alterations in gene expression that do not involve changes in the DNA sequence itself, but which can be inherited and are influenced by environmental and lifestyle factors. Think of your genes as lights. Your DNA determines whether you have a light (a gene) and where it is located. Epigenetics decides whether that light is on or off, and its intensity (gene expression), by modulating the accessibility of the DNA to be "read" by the cellular machinery.



## How does it work?

External and internal factors can "mark" your DNA and the proteins around it (histones), influencing whether a gene will be activated or silenced. These epigenetic "marks" are dynamic and can be:

- DNA Methylation: The addition of a methyl group (CH<sub>3</sub>) to specific cytosine bases in DNA, usually in C-G rich regions called CpG islands.

This modification is a primary mechanism for silencing genes, as it can prevent the binding of transcription factors or recruit proteins that compact DNA, making the gene inaccessible for transcription.

- Histone Modifications: Histones are proteins around which DNA wraps to form chromatin.

Chemical modifications to these histones (such as acetylation, methylation, phosphorylation, and ubiquitination) can alter the structure of chromatin, making it more "open" (euchromatin), facilitating gene expression, or more "closed" (heterochromatin), silencing expression.

For example, histone acetylation generally relaxes chromatin, promoting transcription. Non-coding RNAs (ncRNAs): RNA molecules that are not translated into proteins but play crucial regulatory roles. Examples include microRNAs (miRNAs), which can bind to specific mRNAs to block their translation or promote their degradation, and long non-coding RNAs (lncRNAs), which can interact with DNA, RNA, and proteins to modulate gene expression in various ways.

## Impact on Disease Risk:

Epigenetic marks are remarkably dynamic and can be significantly influenced by lifestyle and environment. This means that even if you have a genetic predisposition to a condition (i.e., a gene that, if "switched on," increases the risk), your daily habits can influence whether that gene will actually be activated or remain silenced.



## Examples:

- **Diet:** Nutrients such as folate, vitamin B12, and choline are essential methyl donors for DNA methylation. A diet high in processed foods and low in nutrients can lead to unfavorable methylation patterns, influencing genes related to metabolism, inflammation, and even tumor suppressors, increasing the risk of cardiovascular disease and certain types of cancer.
- **Chronic Stress:** Prolonged stress can lead to alterations in the methylation of the glucocorticoid receptor gene (NR3C1), affecting the regulation of the hypothalamic-pituitary-adrenal (HPA) axis and the stress response, which may increase vulnerability to mood disorders and inflammatory diseases.
- **Physical Exercise:** Regular physical activity can induce epigenetic changes in genes involved in mitochondrial biogenesis (such as PGC-1alpha), insulin sensitivity, and muscle function, improving glycemic control and metabolic health.
- **Sleep:** Sleep deprivation and disruption of the circadian rhythm can alter the methylation and expression of key genes related to metabolism, immune function, and brain health, contributing to the risk of obesity, type 2 diabetes, and neurodegenerative diseases.
- **Exposure to Toxins:** Environmental pollutants (such as BPA or phthalates) and toxic substances (such as smoke) can induce epigenetic changes in genes related to detoxification, DNA repair, and inflammation, increasing the risk of respiratory and cardiovascular diseases and cancer.

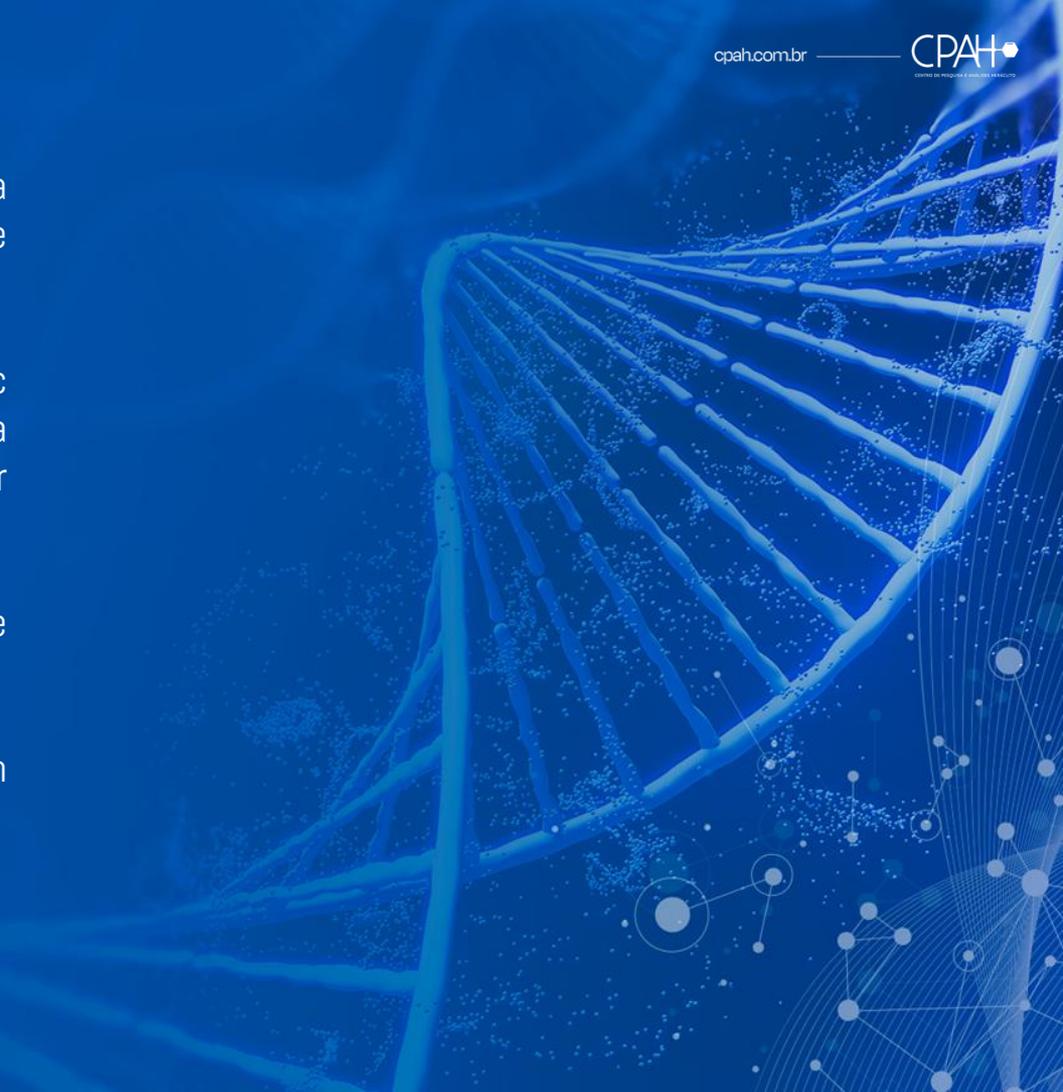
Therefore, epigenetics shows us that we have a significant degree of control over the manifestation of our genetic predispositions.

The result of a genetic test is not a fatalistic prediction, but rather a risk map that offers us a unique opportunity to be proactive in managing our health.

Not Generating Anxiety About the Result: The Power of Information and Action

It is perfectly normal to feel some apprehension when receiving genetic information.

However, it is crucial to change the perspective:



**1. It's Not Determinism, It's Predisposition:** Having a predisposition means you have a higher probability of developing a condition under certain circumstances. It doesn't mean it's inevitable. Epigenetics is living proof that the interaction between your genes and your environment is what truly defines your health status. You have the ability to influence the probability.

**2. Information is Power:** Knowing your genetic predispositions gives you the power to make more informed and targeted lifestyle decisions. Instead of worrying about an abstract risk, you can act concretely to mitigate it, transforming knowledge into personalized health strategies.

**3. Focus on Prevention and Personalized Intervention:** With this information in hand, your doctor can guide you in more specific and effective lifestyle interventions, a concept known as Precision Health or Precision Medicine. For example, if you have a predisposition to a dysfunction in insulin secretion (as suggested by certain genetic variants), your diet and exercise plan can be adjusted to optimize beta cell function and insulin sensitivity. Another example would be a predisposition to a deficiency in the methylation pathway (as in variants of the MTHFR gene), where supplementation with active forms of folate (L-methylfolate) may be more effective than regular folic acid.

**4. Your Lifestyle Has a Real Impact:** The choices you make every day – what you eat, how much you exercise, how you manage stress, the quality of your sleep, your exposure to toxins – are powerful tools for modulating your gene expression through epigenetics. They can "turn on" protective genes or "turn off" risk genes, directly influencing the trajectory of your health.

**5. Professional Guidance is Essential:** The interpretation of genetic results and the formulation of an action plan should always be done in conjunction with qualified healthcare professionals. They can provide the full context, explain the nuances of your genetic profile, and translate this information into practical and safe recommendations for your well-being, ensuring that interventions are evidence-based and appropriate to your individual case.

*Think of genetic testing as a compass. It doesn't determine where you'll go, but it points you in the directions you can consider and the potential challenges. It's your journey, and you have the tools to navigate it in a more conscious, proactive, and healthy way.*



# OUR SOLUTIONS



## Package 1: The Path to Essential Well-being and Optimized Metabolism.

This package is the foundation for those seeking to understand their genetics for a healthier life, focusing on the pillars of nutrition, metabolism, overall inflammation, and detoxification capacity.

Focus: Uncovering the genetic predispositions that affect daily nutrition, energy metabolism, and the body's ability to handle toxins and inflammation.



## Includes analyses of:

### Nutrients – Vitamins and Minerals:

MTHFR (C677T, A1298C), MTRR, FUT2, TCN1, TCN2, ALPL, NBP3, ALDH7A1, PDXK, PNPO, SLC23A2, SLC23A1, BTBD9, SLC30A2, SLC30A8, SLC39A2, SLC39A13, CA1, SLC19A2, SLC19A3, SLC22A1, TPK1, SLC25A19, PHDC, BCKDHB, PEMT, CHKA, BHMT, FMO3, BCO1, CYP2R1, CYP27B1, GC, VDR, DHFR, SEP15, GPX4, GPX1, MTR, MTRR, CYP4F2, VKORC1, GGCX, TRPM6, TRPM7, CNNM2, ATP2B1, SHROOM3, SLC41A1, GATM, CKM, PDSS1, CoQ9, COQ8A, COQ2, CoQ3, NQO1, CD36, CYP7A1, SLC30A1, SLC39A8, HFE, TM6RSB, LYRM4, FECH, FAM210B, SOD2, SLC11A2, SLC22A5, CPT1A, CPT1B, CPT2.

### Nutrients – Foods:

LCT, MCM6, CYP1A2, ADORA2A, FADS1, FADS2, AOC1, HMNT, HDC, HRH1, HRH2, HRH4, CASR, UMOD, DGKH, CLND14, AGXT, GRHR, GOX1, ACE, APOA2, TCF7L2, MAOA, FMO3, CYP2D6, ADH1B, ADH1C, ALDH2, AMY1, SLC22A4, CBS, HLA-DQB1, HLA-DRA, FLG, RFX5, HLA-DQA1, IL18, IL13, CCL26, CLTC1, AGTR1, CLDN1, NTN4, ALDOB, ATP7B, SOD2.

## Includes analyses of:

### General Inflammation:

TNF-alpha, IL-17, NLRP3, HMGB1, INFG, GSTM1, GSTO1, GSTA1, NFE2L2, AS3MT, NQO1, SOD1, SOD2, KIT, IL-13, IL4R, FCER1A, CMA1, PTPN22, IL33, ALDH2, PTGS2, AOC1, HNMT, CFB, EDN1, HSP70, CYP1A1, TYK2, RETN, WNT10A, LTA4H, MMP2, FOXC2, TLR4, VEGFR3, COL1A1, COL2A1, COL11A1, CASP9, PARK2, NFKB1, KCNE1, KCNE3, ADD1, MS4A2, HLAB, HLA-DR, HLAA, LGALS3, ADRA1A, GSDMB, CDHR3, ADRB2, ARG1, TRPM3, FGF10, CYCS, COX1, TSLP, TBX21, IFNG, IL1R1, DAO Enzima, HTR3A, ADRB2, TRPV3, PLPP6, SOX9, GJB2, PSTPIP1, NCSTN, MIR423, MIR22, OAS1, MUC2, MUC5AC, CLCA1, HSPA1L, HSPA5, TRAP1, AGER, GLO1.

### Metabolism and Weight:

MTNR1B, PNPLA3, TM6SF2, HSD17B13, MBOAT7, GCKR, IFNL3, NCAN, LHCRG, DENND1A, FSHB, FSHR, ADIPOQ, PLIN1, GLP1R, PCSK1, GCG, C12orf51, ACAD10, MYL2, GNB3, ACADM, ACADS, SCD, SIRT1, SIRT3, LEPR, MC4R, UCP1, TRIM4, SULT2A1, GHRL, GHSR, ABCG2, SLC2A9, SLC22A12, SLC28A2, CXADR, BDNF, FGF21, NPY, SH2B1, SLC6A14, AMY1, HBB, HK1, ANK1, MYO9B, FNK3, POMC, NROB2, RSP03, LHFPL6, TMEM192, SLC9B1P3, PPM1K, BCAT1, GPRC6A, PCK1, IGF1, NAT2.

## Benefits:

Provides a genetic map to optimize diets, supplementation, and habits, aiding in the prevention of metabolic and inflammatory diseases, and in weight management.





## Package 2: The Mind in Focus: Cognition, Mood, and Sleep

This package is designed for individuals seeking to maximize their brain function, stabilize their mood, and optimize their sleep patterns, based on their genetic predispositions.

Focus: Deep understanding of the genetic basis of mental health, cognitive function, and the sleep-wake cycle.



## Includes analyses of:

### Humor and Brain:

PER3, OPN4, CLOCK, HTR2A, OXTR, CRHR1, BDNF, HTR1A, MTR, MTRR, COMT, ACCN1, CACNG2, GADL1, GAD1, GABRA1, GABRG2, ALDH5A1, GABRA2, NR3C1, NR3C2, ADORA2A, GNB3, SLC6A4, ACCN2, IL6, IL1B, IDO1, KMO, OPRM1, SNCA, DRD2, DRD3, GCKR, KLB, ADH1B, ALDH2, ADH1C, CNR1, CNR2, FAAH, ABCB1, AKT1, VMAT2, KIAA0319, DCDC2, GRIA1, HIF1A, NPTN, ANK3, DRD1, ANKK1, DRD4, LINC00951, HTR2B, SNAP25, GSTA1, MTHFD1L, ATP6V1B2, TOMM40, TPH2, IDO2, FGA, SERPINF, GPX1, GSTM1, TLR4, HFE, TRPM8, MMP16, NNMT, C7orf10, KCNK18, MTDH, LRP1, NRP1, PHACTR1, TRPV1, HTR1B, PDE1C, LINC01104, ADAMS12, CHRM2, LRRN2, DTNBP1, REC114, HMGA2, VRK2, MAPT, MAOB, SLC6A3, GRIN2A, SLC1A2, SLC39A8, C4A, GCH1, IL-18, RELN, PTPRD, NSG2, GRID2, BTBD3, SLC1A1, GRIA3, GRIN2B, GRIK1, GRIK2, GRM5, GRM6, SLC3A2, DAB1, CTNNA3, FUS, SCN11A, LINGO1, HTRA2, LRRK2, PER1, SLC2A13, GBA, BChE.

### Sleep and Circadian Rhythm:

MEIS1, GABRA, BTBD9, MAP2K5, PTPRD, HLA-DRB, PER2, AANAT, GSK3B, CLOCK, GABRA6, CRY1, CRY2, NPAS2, NR1D1, OPN3.

## Benefits:

Allows for the personalization of therapeutic approaches for mood disorders, optimizes cognitive performance and sleep quality.





## Package 3: Heart, Vessels and Active Longevity

Designed for individuals focused on cardiovascular health, prevention of age-related chronic diseases, and extending life with quality.

Focus: Understanding genetic risks for heart and vascular diseases, blood pressure, and longevity potential, including the response to exercise.

## Includes analyses of:

### Heart Health:

F2, CYP11B2, AGTR1, FGA, FGB, FGG, ITGB3 PIA1 PIA2, F5, CDKN2B-AS1, ALOX5AP, ACE, LRP8, LOX1, NOS3, PCSK9, LPA, LDLR, LDLRAP1, ABCA1, MEF2A, APOB, FTL, SLC40A1, TF, TMPRSS6, SLC17A1, BTBD9, VWF, GUCY1A3, COMT, CETP, LIPC, CYP7A1, ABCG8, ABCG5, APOA5, LPL, APOC2, GPD1, MLXIPL, GPER1, HMGCR, PSRC1, PCSK7, CRP, ADRA1A, NRP1, NRP2, MYBPC3, MYH7, TNNT2, SERPINE1, PITX2, ZFXH3, CAV1, SCN5A, SCN10A, KCNN3, HCN4, PRRX1, ACMSD, SLC4A5, LSS, NPPA, ADD1, SGK1, LSD1, UMOD.

### Disease Prevention:

HFE (C282Y, H63D, S65C), BMP2, BTBD9, SLC40A1, TMPRSS6, HFE2, HIF1A, MC1R, ASIP, EXOC2, SLC45A2, PADI6, IRF4, TNFSF11, OPG, LRP5, SQRDL, VDR, ESR2, TGFB1, COL1A1, LGR6, ABCG8, ABCB4, MUC2, IL1B, PTPN22, MUC1, TRPM8, TACR1, BDNF, THBS1, FGF10, CFH, CFI, C3, ARMS2, LIPC, C2, G6PD, FMO3, SERPINA1, TREM2, APP, ZCWPW1, CLU, PICALM, APOE, CHI3L1, MSH3, SCN9A, SCN10A, SCN11A, TRPV1, PAH, PRNP, CTNNA3, FUS, LINGO1, HTRA2, CYP2C19, HOXB13, FGFR4, HNF1B, CASC17, DAB2IP, CASC8, ESR2, COX2, GSTM1, GSTP1, CYP3A4, GPX4, CYP1B1, CYP19A1, EHPB1, LRRK2, GBA, BChE, HLA-DRB1, HLA-B, FUT2, SLC01B1, PNPLA3, NR1I2, MMP3, MMEL1, CRHR1, IL17A, IL2, IL28, CCR5, CD55, FOXO3A, TAS2R38, TAS2R16, DEC2, FOXC2, UGT1A1, CREB1, ANKK1, IL1A, IL4, PRSS1, SPINK1, CTCR, CPA2, GCH1, SPR, DHFR, AGMO, TPH2, FN1, JAK2, CHEK2, TERT.

### Exercise and Activity:

ANKK1, CNR1, LEPR, GABRA3, BDNF, AGTR2, AGT, IL6, MSTN, NOS3, AMPD1, TTN, ACTN3, ACE, COL1A1, MIR608, BMP4, FCRL3, TNF, MMP13, MMP1, MMP3, GDF5, CHRNA5, CPT1B, FGF5, POU3F2, PPARGC1A, SMAD3, TBX3, TDRD9, IL15RA, CNTF, TRHR, MTOR, GLI3, IGF2, NR3C1.

## Benefits:

Assesses genetic risks for cardiovascular, neurological, and metabolic diseases associated with aging. Provides information for personalized prevention strategies, optimizing longevity and physical performance.

All packages include a follow-up consultation with our doctors. Before the assessment, we will send you a report with some questions about your medical history and lifestyle, which will be completely confidential.



### *Dr. Fabiano de Abreu Agrela Rodrigues*

MRSB/P0149176 holds a Post-PhD in Neuroscience, is an elected member of Sigma Xi - The Scientific Research Honor Society (more than 200 Sigma Xi members have received the Nobel Prize), and is also a member of the Society for Neuroscience in the United States, the Royal Society of Biology and The Royal Society of Medicine in the United Kingdom, The European Society of Human Genetics in Vienna, Austria, and the APA - American Philosophical Association in the United States. He holds a Master's degree in Psychology, a Bachelor's degree in History and Biology, and is also a Technologist in Anthropology and Philosophy, with various national and international training in Neuroscience and Neuropsychology. Dr. Fabiano is a member of prestigious high IQ societies, including Mensa International, Intertel, ISPE High IQ Society, Triple Nine Society, ISI-Society, and HELLIQ Society High IQ. He is the author of more than 330 scientific studies and 30 books. Currently, he is a visiting professor at PUCRS and Comportamento in Brazil, UNIFRANZ in Bolivia, and Santander in Mexico. In addition, he serves as Director of CPAH - Centro de Pesquisa e Análises Heráclito (Heraclitus Research and Analysis Center) and is the creator of the GIP project, which estimates IQ through the analysis of genetic intelligence.



### *Adriel Silva*

Adriel Silva is a psychoanalyst, writer, researcher, and lecturer, with a degree in Physics from Unisinos and MBAs in Project and People Management. He is currently studying Psychology at Uniftec and pursuing a Master's degree in Neuropsychology at the Universidad Europea del Atlántico. He is the Scientific Project Manager at CPAH - Centro de Pesquisa e Análises Heráclito, working on projects such as Gifted Debate, Neurogenomic, RG-TEA, among others. He is a member of Mensa Brazil, Mensa Internacional, IIS and CPAH, where he presents seminars and participates in research groups. He has dual exceptionality, being gifted and autistic, and is the author of books that explore neurodiversity and child development.



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