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Dermatoglyphics And The Human Psyche: A Research Study Among Undergraduate Medical Students On Fingerprints As Indicators Of Personality

[1]Latha. N, [2]Dr. Karen Harshitha, Dr. Jagadeesh.N
[1]MBBS Student Phase 3 Part 2, [2]Associate Professor,
[3]Vice Principal, Professor and HOD,
[2,3]Department of Forensic Medicine and Toxicology
Vydehi Institute of Medical Sciences and Research Centre, Bangalore

***Corresponding Author:**
Dr. Karen Harshitha
Associate Professor, Department of Forensic Medicine and Toxicology,
Vydehi Institute of Medical Sciences and Research Centre, Bangalore

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Abstract

Background: The study of fingerprints also called Dactylography is a part of the field of Dermatoglyphics. Fingerprints are one of most unique biological identifiers for an individual. It imprints on a person from the prenatal period and lasts till death unless traumatically altered. Another unique aspect of a person is their personality. The personality traits are influenced by life experiences and also inherited factors. The Biological link between the fingerprints and personality traits is a research hypothesis based on the common origin of skin and nervous system from embryonic ectoderm. This study explores the potential correlation between fingerprints and the "Big Five" personality traits and the utilisation of such information for aptitude recognition and career counselling.

Methods: A cross-sectional descriptive study was conducted among 150 undergraduate MBBS students at the Vydehi Institute of Medical Sciences and Research centre in Bangalore. Fingerprint patterns (loops, whorls, arches, composites) were recorded, and personality traits were assessed using the validated Big Five Personality Inventory. Statistical analysis was performed to understand the correlation between dermatoglyphic patterns and trait scores.

Results: Analysis revealed that Loop patterns demonstrated a significant positive correlation with Conscientiousness ($p = 0$) while Whorl patterns were significantly associated with Agreeableness ($p = 0.000497$). Chi square analysis revealed no statistically significant association between fingerprint patterns and preference for medical speciality though the trend suggested that those with loop fingerprint patterns leaned towards surgical fields as choice of speciality.

Conclusion: The findings suggest a biological link between dermatoglyphic phenotypes in the form of fingerprints and specific personality dimensions in this case the Big 5 personality traits. This novel approach of individual assessment can assist in early behavioural profiling and career counselling in medical education. Further studies into the topic with a large study sample and better analytical techniques of fingerprints will yield more information into the intellectual theory of link between dermatoglyphia and cognitive and behavioural traits.

Keywords: Fingerprints; Big Five Personality Traits; Five-Factor Model (FFM), Biological Basis of Personality; Psychometrics

Introduction

Fingerprints are a unique characteristic feature and permanent biological markers of any individual unless altered traumatically or by disease. They are the commonest biometric parameter used for identification of an individual. Fingerprints remain unchanged throughout an individual's lifespan unless altered by other factors. No two individuals can have identical fingerprints, not even identical twins.[1] Fingerprints are patterns formed by the papillary or epidermal ridges of the fingertips. The ridge pattern of fingertips appears between 12 to 16 weeks of intrauterine life, and the formation is competed by 24 weeks. The development of brain begins by 3rd week. By 5th week the primordial brain vesicles develop rapidly into major structures resembling an adult brain. The inheritance of dermal traits is considered to follow a classical polygenic model. [4] Both the dermal ridges and the central nervous system are ectodermal in origin; this developmental concurrence suggests that dermatoglyphic patterns may serve as an external proxy of early neural development providing a rare insight into a person's cognitive aspect at their fingertips.

Dermatoglyphics is based on the principle that the skin of the balls of the fingers and thumbs is covered with ridges and grooves, the pattern of which varies between individuals and makes absolute identification possible. The history of recognition of fingerprints go back to the prehistoric carvings and drawings of fingerprint ridge like patterns on hand. Their use as means of identification was first recognised by Sir William James Herschel who would make locals attest their signatures with palmprints. Sir Francis Galton first published his book "Fingerprints" in 1892 pioneering the importance of fingerprints for their individuality and permanence. He was also interested in the use of fingerprints for his research into Eugenics. Qazi Azizul Haque and Hem Chandra Bose in 1897 under the supervision of Edward Richard Henry were trailblazers into the modern system of fingerprint classification which is being used for manual filling of non- digitised fingerprints even today. The digital revolution in India has ensured that the UIDAI Aadhar fingerprint database as the world's largest biometric system, storing fingerprints and iris scans of over 1.3 billion Indian residents within the secured Central Identities Data Repository (CIDR). The recognised patterns are loop, whorl, and arch and composite. The use of fingerprints as biomarkers of identification has transitioned from criminal identification and forensic evidence to every day usage in offices, biometric verification for government and private utilities and personal use as safety options on smartphones!

An individual's personality can be just as unique as their fingerprints. Human behaviour and personality are shaped by a complex interaction of genetic, biological, and environmental factors. Personality traits influence an individual's emotional responses, interpersonal relationships, academic performance, professional orientation, and overall life outcomes. A child even with minimal life experiences already exhibits characteristics of a specific personality from traits inherited from genetic factors. It is widely accepted that the personality of an individual is developed because of those inherited traits combined with a set of life experiences.[2]. **In modern trait theory,** the Big Five Personality Model—comprising openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism—is **considered the 'Gold Standard'** for assessing personality traits due to its empirical validity and cross-cultural applicability.[3] Understanding personality traits has long been a subject of interest across multiple disciplines, including psychology, medicine, forensic science, and education, both for theoretical investigation and practical application. Research on personality traits is core to many major disciplines, such as medicine, psychology and corporate human resource allocation.

Previous studies have suggested potential associations between fingerprint patterns and psychological attributes[4]; however, findings remain inconsistent due to variations in methodology, sample size, and assessment tools**.** Furthermore, while dermatoglyphics has been studied in clinical psychiatry and neuropsychological disorders (e.g., schizophrenia, depression, autism, mental retardation)[5,6,7], its application as a psychometric marker in healthy, high-functioning populations like medical students remains underexplored.

Medical students represent a unique population due to the high academic demands, emotional stress, and early career decision making involved in medical education. Understanding personality traits in this group may help inform career counselling, academic guidance, and mental health interventions. If stable

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biological markers such as fingerprints are shown to correlate with personality traits, they may serve as accessible accessory tools in psychological assessment and their implications. It is especially useful to evaluate the orientation of students towards a particular profession thus establishing their aptitude towards an expertise and to assess oneself for their future prospects. A medical student with a chosen speciality tailored to their personality trait and innate aptitude will be less likely to drop out or suffer burnout as is the case with attrition rates among medical students lately.

The present study was undertaken to examine the relationship between fingerprint patterns and personality traits based on the Big Five model among undergraduate MBBS students. Additionally, the study aimed to explore whether fingerprint patterns or personality traits influence students' orientation toward surgical or non-surgical medical specialties. This research study seeks to bridge the external ridge patterns of fingertips with the internal intricate patterns of a person's psyche while contributing empirical data to an emerging area of research.

Methodology

Study Design And Setting: -

A cross-sectional, descriptive study was conducted among undergraduate MBBS students (Phase I to Phase III Part 2) at Vydehi Institute of Medical Sciences and Research Centre, Bengaluru. The study was carried out over a six-month period in 2024 to explore the associations between dermatoglyphic patterns, Big Five personality traits, and future medical specialty preferences.

Ethical Considerations: -

The study was initiated following approval from the Institutional Ethics Committee (IEC). Participation was entirely voluntary, and written informed consent was obtained from all subjects. To ensure privacy, all data collection was anonymized, and confidentiality was strictly maintained throughout the research process. The data collected in the form of fingerprints was destroyed promptly following the analysis to protect the participants.

Participants And Sampling: -A total of 150 students out of 1000 MBBS students were recruited using purposive sampling.

Inclusion Criteria: Currently enrolled MBBS students who consented to both dermatoglyphic recording and psychometric testing.

Exclusion Criteria: Students with permanent physical deformities, active skin infections, or significant scarring of the fingertips that would preclude clear ridge analysis and those not willing to consent for the process.

Data Collection Procedures: -

Dermatoglyphic Analysis: Fingerprints were collected using the traditional ink-and-paper rolling method. Impressions of all ten digits were obtained from each participant. Patterns were classified into four primary categories based on the Galton-Henry system: Loop, Whorl, Arch, and Composite.

Personality Assessment: Participants completed the pre-validated Big Five Personality Inventory. This self-administered questionnaire evaluated five core dimensions: Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. 50 questions were in the forms that were physically answered by the participants and the scores calculated to ascertain their dominant personality trait.

Career Orientation: Students indicated their preferred future medical specialization, which was categorized into Surgical (e.g., Surgery, OBG, Orthopedics), Non-Surgical (e.g., Medicine, Pediatrics), or Undecided.

Statistical Analysis: -

Data were analyzed using SPSS Statistics version 25.0. Descriptive statistics summarized the frequency of fingerprint patterns and personality traits. One-Way Analysis of Variance (ANOVA) was employed to investigate the biological-behavioural link. The statistical power was maximised, and the systemic nature of ectodermal development was reflected by utilising, the individual digital pattern (N = 1500digits) as the unit of analysis. This allowed for a robust comparison of mean personality scores across fingerprint groups. Tukey's HSD post-hoc test was used to identify specific pairwise differences. Additionally, Chi-square tests evaluated categorical associations between personality and specialty preference. A p -value < 0.05 was considered statistically significant.

Results: -

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Participant Characteristics And Distribution

A total of 150 undergraduate medical students participated in the study. The distribution of fingerprint patterns was as follows: Loops were the most prevalent pattern (74.7%), followed by Whorls (22.7%), Arches (2.0%), and Composites (0.7%).

Table 1: Distribution of Fingerprint Patterns (n = 150)

Fingerprint Pattern	Frequency	Percentage (%)
Loop	112	74.7
Whorl	34	22.7
Arch	3	2.0
Composite	1	0.7
Total	**150**	**100**

Regarding personality profiles, Agreeableness and Conscientiousness were the most frequent dominant traits, each identified in 29.3% of the cohort.

Table 2: Distribution of Dominant Personality Traits

Personality Trait	Frequency	Percentage (%)
Agreeableness	44	29.3
Conscientiousness	44	29.3
Openness to Experience	36	24.0
Neuroticism	21	14.0
Extraversion	5	3.3

Personality Traits, fingerprint patterns and Medical Specialty Orientation: -

Out of 150 students, 83 opted for the surgical fields and 63 opted for non-surgical fields as their choice of medical speciality. Of the 83 students who chose surgical fields, majority(63) had loop pattern of fingerprints. The association between personality traits and the choice of a surgical versus non-surgical medical specialty was examined. While students opting for surgical fields showed higher frequencies of Conscientiousness (16.0%) compared to those in non-surgical fields (13.3%), the association did not reach statistical significance (chi2 = 13.053, p = 0.062).

Table 3: -Fingerprint patterns and Medical Specialty Orientation: -

Speciality	Loop	Whorl	Arch	Composite	Total
Surgical field	63	17	2	1	83
Non-Surgical field	45	17	1	0	63
Not Decided	4	0	0	0	4

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Total	112	34	3	1	150

Table 4: -Medical Speciality and Personality traits: -

Speciality			PERSONALITY TEST					Total	Test statistics value	P value
			Agreeableness	Conscientiousness	Extraverted	Neuroticism	Open to experience			
	Non-Surgical Field	Count	21	20	0	7	15	63		
		% of Total	14.0%	13.3%	0.0%	4.7%	10.0%	42.0 %		
	Not Decided	Count	0	0	1	0	3	4	13.053	0.062
		% of Total	0. 0%	0.0%	0.7%	0.0%	2.0%	2.7%		
	Surgical Field	Count	23	24	4	14	18	83		
		% of Total	15.3%	16.0%	2.7%	9.3%	12.0%	55.3 %		
Total		Count	44	44	5	21	36	150		
		% of Total	29.3%	29.3%	3.3%	14.0%	24.0%	100.0 %		

Table 5: -Expected Frequencies: -

Speciality	Loop	Whorl	Arch	Composite
Surgical field	**61.973**	**18.813**	**1.66**	**0.553**
Non-Surgical field	**47.04**	**14.28**	**1.26**	**0.42**
Not Decided	**2.987**	**0.907**	**0.08**	**0.027**

Table 6: -Chi Square Points: -

Speciality	Loop	Whorl	Arch	Composite
Surgical field	0.017	0.175	0.07	0.361
Non-Surgical field Not Decided	0.088	0.518	0.054	0.42

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Not Decided	0.344	0.907	0.08	0.08

One-Way ANOVA:

Fingerprint Patterns and Personality Traits: -

The evaluation of the relationship between biological markers and psychological makeup of the participants was done by a One-Way ANOVA, comparing personality trait scores within each fingerprint group.

Loop Patterns: A highly significant difference in personality trait means was observed within the Loop group [$F(4, 555) = 23.62$, $p < 0.001$]. The effect size was large ($f = 0.41$), with fingerprint grouping explaining 15% of the variance in scores ($eta2 = 0.15$). Post-hoc Tukey HSD analysis revealed significant differences between Extraversion and all other traits, as well as between Conscientiousness and Neuroticism.

Whorl Patterns: Significant differences in trait means were also found for the Whorl group [$F(4, 165) = 5.28$, $p < 0.001$]. The association demonstrated a large effect size ($f = 0.36$), explaining 11.4% of the variance.

Arch Patterns: The Arch pattern demonstrated a high eta-squared (0.30). However, this finding is statistically of a lesser significance due to the low representation of the Arch patterns among the sample population. (n=3) [$F(4, 10) = 1.07$, $p = 0.419$].

Table 7: -Summary of One-Way ANOVA Results across Fingerprint Patterns

Fingerprint Pattern	F-Statistic	p-value	Effect Size (f)	Variance (η2)	Interpretation
Loop	23.62	< 0.001*	0.41 (Large)	15.0%	Highly Significant
Whorl	5.28	< 0.001*	0.36 (Large)	11.4%	Significant
Arch	1.07	0.419	0.66 (Large)	30.0%	Not Significant

Post-hoc Tukey HSD analysis was conducted to identify specific pairwise differences between personality traits within the significant groups.

In the Loop group, Extraversion scores were significantly lower than Agreeableness, Conscientiousness, and Openness to Experience (all $p < 0.001$). Furthermore, Conscientiousness and Agreeableness scores were both significantly higher than Neuroticism scores ($p < 0.001$). This suggests that students with loop fingerprints have a distinctive profile where they are more agreeable and conscientious than extraverted or neurotic.

In the Whorl group, a similar pattern was observed where Agreeableness was significantly higher than both Extraversion ($p = 0.002$) and Neuroticism ($p = 0.008$). Additionally, Openness to Experience was significantly higher than Neuroticism ($p = 0.015$). The takeaway from this is that the group with whorl patterns are characterized by agreeableness and openness to experience relative to their other traits.

Table 8: Post-hoc Tukey HSD Comparisons of Personality Traits within Fingerprint Groups

Fingerprint Group	**Pairwise Trait Comparison (I vs J)**	**Mean Difference (I-J)**	**Std. Error**	**p-value**	**Interpretation**
LOOP	Extraversion vs. Agreeableness	-26.0*	1.23	< **0.001**	Highly Significant
	Extraversion vs. Conscientiousness	-26.0*	1.23	< **0.001**	Highly Significant

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	Extraversion vs. Openness	-18.0*	1.23	< **0.001**	Significant
	Conscientiousness vs. Neuroticism	+8.0*	1.23	< **0.001**	Significant
	Agreeableness vs. Neuroticism	+8.0*	1.23	< **0.001**	Significant
WHORL	Extraversion vs. Agreeableness	-13.0*	1.58	**0.002**	Significant
	Agreeableness vs. Neuroticism	+7.0*	1.58	**0.008**	Significant
	Neuroticism vs. Openness	-11.0*	1.58	**0.015**	Significant
ARCH	All Pairwise Comparisons	---	---	---	---

Discussion: -

The study of epidermal ridge pattern on fingers, palm, and soles is known as "Dermatoglyphics". Harold Cummins first coined the word in 1926. Since then, the growth of the field has innovated into surprising avenues. The ridge patterns on the fingerprints are the most unique identifiers of an individual. The original ridge characteristics are not disturbed unless the skin is damaged to a depth of about 1 mm[8]. There are certain conditions where the individual can be born with smooth fingertips with associated chromosomal and congenital disorders which exhibit alterations in ridge patterns.[9,10]

Identification is the process of determining a person's individuality from certain physical traits that are specific to them.[11] The study of epidermal ridges on the fingers is called Galton- Henry Classification system and uses fingerprints as a means of identification. It is also called Dactylography or Dactyloscopy.

Fingerprints are fascinating representations of an individual, beautiful and mysterious and unparalleled as an identifier. The idea of them being a tattoo-like representation of one's psyche is a distinctive theory that has been researched in the past. The common ectodermal origin both the nervous system and the integumentary system have is either a coincidence or a chance to delve into a deeper, more profound theory that needs to be appraised.

Mandeep Singh & Oindri Majumdar (2015) in their paper titled 'Dermatoglyphics: Blueprint of Human Cognition on Fingerprints' discussed about the connection of the brain with the fingerprints.[12] Several psychological and intelligence theory studies have been conducted in the past that attempted to draw a parallel between the fingerprint patterns of an individual and their neuro-cognitive development. There have been several research studies that link the development of brain of an individual to the epidermal ridge patterns evaluated in dermatoglyphics. [13]

Research exploring the link between physical characteristics and cognitive processes has examined how external bodily markers may reflect underlying neurological traits. Desai (2016) contributed to this discussion in her thesis by investigating the relationship between fingerprint patterns, their representation in specific brain lobes and the personality that is attributed to that specific pattern. Her findings suggest that observable physical features may offer insights into individual behavioural differences, which gave a previously unexplored perspective to behavioural and cognitive research.[14]

The present study explored the correlation between dermatoglyphic patterns in fingerprints and personality traits among Indian medical students using the Big Five Personality framework. The predominance of loop fingerprint patterns observed in this study aligns with existing dermatoglyphic literature, which consistently reports loops as the most

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common fingerprint pattern in human populations. The finding is similar to that seen in the study conducted in 2017 by Siddapur R K among medical students.[15]

The behavioural or personality traits of an individual attributed to each pattern of a fingerprint when collectively analysed, serves as a tool to explore the personality of an individual. This can be utilised as an ability and aptitude measuring-aid in categorizing individuals as per their inherent potential and aligning their strengths with suitable professional and life choices.[16]

The interlink between human brain function and fingerprint patterns tend to reveal deep-seated connections. The neural correlation between various intelligence types and personality traits is intricately linked to specific brain areas, with the neocortex acting as a bridge between distinct functional divisions. [17] The observed correlation reflecting the shared ectodermal origin of the cerebral cortex and the integumentary system that give rise to the epidermal ridges can be explored in more detail and conclusive manner with a larger sample size and a prospective study into the participant's choices and experiences. The prenatal factors that affect neuronal migration during the second trimester may also alter the formation of the epidermal ridges thus linking the physical phenotypes to behavioural predispositions.

However, it is difficult to prove this hypothesis without delving deeply into the chromosomal and genetic origins of these systems and performing prenatal tests to determine a definite biological link between the two.

A key finding of this study, supported by One-Way ANOVA ($p < 0.001$) and a large effect size (f=0.41), is the highly significant variance in personality scores within the loop fingerprint group. This suggests that the loop phenotype is not merely a physical trait but a biological correlate of specific psychological configurations, most notably Conscientiousness. Conscientiousness is characterized by discipline, organization, reliability, and goal-oriented behaviour—traits that are particularly relevant in medical education and professional

practice. The strong association suggests a possible biological predisposition influencing personality development, although environmental factors undoubtedly play a complementary role. It is interesting to note that loop fingerprint patterns have been associated with attributes of excellent communication skills, compassionate nature and exceptional attitude and imagination.

Whorl fingerprint patterns demonstrated a significant association with agreeableness. Agreeable individuals are typically cooperative, empathetic, and socially harmonious qualities that are beneficial in patient centered medical care. The significant association between Whorls and Agreeableness ($p < 0.001$, eta^2 = 11.4%) aligns with the hypothesis that prenatal ectodermal development influences the neural circuits involved in social cognition and empathy. Whorl patterns are indicative of above average understanding, artistic inclinations and effective communication skills.

The specific correlation between Loop patterns and Conscientiousness and whorl patterns and agreeableness in a high-functioning Indian Medical cohort represents a novel finding that warrants further validation through a multi-disciplinary, multi-centric, long term prospective research study project.

Arch and composite patterns could not be meaningfully analysed due to their extremely low representation in the sample. Although the arch pattern showed a large effect size, the lack of statistical significance highlights the impact of insufficient sample size and reduced statistical power. This limitation underscores the need for larger, more evenly distributed samples in future research.

Notably, across both major fingerprint groups, Extraversion scores were significantly lower than the dominant traits of Conscientiousness and Agreeableness. In a high-pressure academic environment of MBBS, this "Extraversion Gap" may reflect a self-selection bias among the participants where the rigorous demand of medical education is touted to favour students with more disciplined, introverted, and agreeable profiles.

The study found statistically insignificant association between fingerprint patterns or personality traits and students' medical specialty preferences. This suggests that career decisions in medicine are likely influenced more strongly by academic exposure, mentorship, lifestyle considerations, and socio-economic factors rather than stable biological or personality markers alone.

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While the association between fingerprints and specialty preference did not reach the threshold for statistical significance (p = 0.062), the observed trend suggests that students with high Conscientiousness scores—often linked to Loop patterns—tended toward surgical orientations. This 'borderline' significance suggests that with a larger sample size, a distinct biological preference for certain medical disciplines might emerge.

An intriguing thought at this juncture would be, why not determine the aptitude by directly administering the personality test to the medical students? Human beings usually aspire to satisfy the influences and expectations built up subconsciously in their minds and might answer the tests accordingly with bias and prejudice, confounding the results. It is however impossible to change one's fingerprints and the clue they might reveal of the innate personality and the behavioural tendencies that will aid as a metric for their career counselling.

Based on the fingerprint patterns and personality traits, the students can be guided by the teaching faculty into fields better suited for their attributes to tap into their innate potential and elicit the best possible performance in the suitable professions. It is conclusive that fingerprints should not be used deterministically, but from an applied perspective, their potential role as adjunctive indicators in psychological assessment and career counselling should not be ignored. The integration of biometric stability with validated psychological instruments may enhance individualized guidance, particularly in high stress educational environments especially medical education.

Conclusion

The integration of dermatoglyphic analysis with psychometric profiling represents a novel frontier in socio-psychological medical research. While historical literature has explored the link between epidermal ridges and psychiatric conditions, this study demonstrates that these biological markers also correlate with personality traits among high-functioning young adult populations.

Our findings reveal a statistically significant association between specific fingerprint patterns and the Big Five Personality traits. Specifically, Loop patterns were significantly associated with Conscientiousness, while Whorl patterns correlated with Agreeableness. Although no significant association was found regarding medical specialty preference (p = 0.062), the robust association explained by fingerprint groups (up to 15%) suggests that these markers are not random but are external reflections of underlying neuro-developmental configurations.

The implications of this research extend beyond academic curiosity. By understanding the biological correlates of personality, educators may eventually utilize dermatoglyphics as an adjunctive tool to assist students in identifying innate strengths that may be masked by environmental or socioeconomic factors. Such an inventive and creative approach to student guidance could optimize vocational alignment and improve long-term professional satisfaction within the medical field.

The primary limitation of this study remains the uneven distribution of certain patterns, particularly Arches, which reduced statistical power for that subgroup. Additionally, the utility of this method is restricted in cases of Adermatoglyphia or manual ridge trauma. Future research should involve larger, multicentre cohorts and explore other stable biometric identifiers, such as palatal rugae or cheiloscopy (lip prints), to validate these findings across diverse populations.

Ultimately, this study contributes baseline data for the Indian population and advocates for a multidisciplinary approach that bridges forensics, embryology, and psychology. Decoding the biological markers of human aptitude has the potential to revolutionize how we understand neuro-developmental streams and harness human potential for the betterment of global healthcare.

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