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REVIEW ARTICLE

# Contribution of Dr. Rita Levi Montalcini in Field of Paediatrics

**Kasumbiwal Ajay H.[1], Dake Mangesh[2], Tambe Pranita[3], Manisha Mohan Naidu[4]**

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## ABSTRACT

Rita Levi-Montalcini was a pioneering neuroscientist whose discovery of nerve growth factor (NGF) profoundly influenced modern neuroscience and pediatric medicine. Her work provided crucial insights into the mechanisms of neuronal growth, differentiation, and survival, which have significant implications for child health and neurodevelopmental disorders. This article highlights the life, scientific contributions, challenges, and lasting legacy of Dr. Rita Levi-Montalcini with a special focus on pediatrics.

NGF, discovered by Levi-Montalcini, plays a vital role in the development and maintenance of the nervous system during infancy and childhood. It has been shown to influence neuronal maturation, synaptic plasticity, and regeneration, making it particularly relevant in pediatric neurological conditions such as congenital neuropathies, cerebral palsy, neurodevelopmental delay, and perinatal brain injury.[1–3] Beyond the nervous system, NGF has also been implicated in immune regulation and tissue repair, opening new therapeutic possibilities in pediatric inflammatory and genetic disorders.[4,5]

Despite facing significant obstacles including gender discrimination and racial persecution during World War II, Levi-Montalcini continued her research under extremely challenging circumstances, demonstrating remarkable perseverance and dedication to science.[6] Her achievements were recognized with the Nobel Prize in Physiology or Medicine in 1986, inspiring generations of researchers and clinicians worldwide.[7]

In pediatrics, her work laid the foundation for translational research targeting neuroprotection, neuroregeneration, and early intervention strategies in childhood

**AUTHOR'S AFFILIATION:**

[1] Professor and HOD, Department of Pediatrics, VDGMC, Latur, Maharashtra, India.

[2] Assistant Professor, Department of Pediatrics, VDGMC, Latur, Maharashtra, India.

[3] Senior Resident, Department of Pediatrics, VDGMC, Latur, Maharashtra, India.

[4] Student, Department of Pediatrics, VDGMC, Latur, Maharashtra, India.

**CORRESPONDING AUTHOR:**

**Manisha Mohan Naidu,** Student, Department of Pediatrics, VDGMC, Latur, Maharashtra, India.
**E-mail:** kmanisha720580@gmail.com

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neurological disorders.[8-10] Dr. Rita Levi-Montalcini's scientific legacy continues to shape pediatric neuroscience, emphasizing the importance of fundamental research in improving child health outcomes

***Key Message:*** The discovery of NGF revolutionised concepts of neuronal growth and survival and opened new approaches to paediatric neurological disorders, showing how perseverance and innovative thinking can advance science and clinical practice.

**KEYWORDS**

• Rita Levi-Montalcini • Nerve Growth Factor • NGF • Paediatric neuroscience • Neuron development • Neurotrophins • Women in science • Neurodevelopmental disorders • Neurodegeneration

## INTRODUCTION

Rita Levi-Montalcini was born on 22 April 1909 in Turin, Italy, into a cultured Jewish family. Her father, an engineer, expected daughters to focus on domestic roles, yet her mother encouraged education. From an early age, Levi-Montalcini demonstrated a keen interest in medicine and science. Despite her father's initial resistance, she pursued medical studies and entered the University of Turin Medical School. Under the mentorship of histologist Giuseppe Levi, she mastered precise microscopic techniques, experimental rigor, and critical observation. She graduated with highest honours in 1936, combining clinical neurology and psychiatry with research on the developing nervous system in chick embryos.

The introduction of anti-Jewish racial laws in Italy in 1938 abruptly interrupted her academic career, as she was dismissed from university positions and barred from public institutions. This political exclusion forced her to design alternative paths to continue her scientific interests, demonstrating early resilience and determination that would characterize her career.

During this period, Levi-Montalcini developed a deep interest in neurodevelopment, influenced by her exposure to clinical cases of children with neurological disorders. She was motivated to understand how neurons grow and connect, seeking explanations that bridged basic science and clinical medicine. These formative experiences helped her develop a strong sense of curiosity, scientific rigor, and the importance of translating laboratory findings to improve human health.

Her early mentors, including Giuseppe Levi and later Viktor Hamburger in the United States, emphasized meticulous observation and hypothesis-driven experimentation. This foundation, combined with her innate perseverance, enabled Levi-Montalcini to continue groundbreaking research under extremely challenging conditions, including wartime Italy. Her story exemplifies how mentorship, opportunity, and personal determination can shape scientific discovery, providing a valuable lesson for today's medical students and young researchers.

### Early Life

Rita Levi-Montalcini was born on April 22, 1909, in Turin, Italy, into an educated Jewish family that valued intellectual and cultural pursuits. Her father, Adamo Levi, was an engineer and mathematician, while her mother, Adele Montalcini, was a painter. Although she grew up in an environment that appreciated learning, societal norms initially discouraged women from pursuing higher education. Inspired by the death of a close family friend from cancer, she developed a strong interest in medicine and the biological sciences.

In 1930, Levi-Montalcini enrolled in the University of Turin Medical School, where she trained under the guidance of the renowned neuroanatomist Giuseppe Levi. This mentorship introduced her to experimental research and neuroembryology, shaping her lifelong interest in nervous system development. She graduated with a medical degree in 1936 and later specialized in neurology and psychiatry. Her early research focused on the growth and differentiation of nerve cells during embryonic development.

## Scientific Contribution

Dr. Rita Levi-Montalcini's most significant scientific contribution was the discovery of Nerve Growth Factor (NGF), a protein that plays a critical role in the growth, differentiation, and survival of neurons. Through her experimental studies on chick embryos, she demonstrated that specific target tissues release substances essential for nerve cell development. This finding challenged the prevailing belief that neuronal growth was predetermined and introduced the concept of chemically mediated neuronal survival.

The identification of NGF marked the beginning of the neurotrophin field and significantly advanced the understanding of nervous system development. NGF was shown to be essential during embryonic and early postnatal life, influencing the maturation of sensory and sympathetic neurons. These insights provided a biological basis for understanding neurodevelopmental processes and disorders, particularly relevant in pediatrics, where early neural growth determines long-term neurological outcomes.

Beyond neurodevelopment, Levi-Montalcini's research expanded the role of NGF to include immune regulation, inflammation, and tissue repair. This broadened the clinical relevance of her work, linking neuroscience with immunology and regenerative medicine. Her discoveries paved the way for translational research exploring NGF-based therapies for neurodegenerative diseases, nerve injury, and pediatric neurological conditions.

Dr. Levi-Montalcini's contributions extended beyond a single discovery. She played a key role in establishing neurobiology as an independent scientific discipline and inspired decades of research into growth factors and cellular signaling. Her work fundamentally changed modern neuroscience and continues to influence pediatric research, clinical practice, and therapeutic innovation.

## Challenges and Discrimination

Dr. Rita Levi-Montalcini faced significant challenges and discrimination throughout her scientific career. As a Jewish woman in early twentieth-century Europe, she encountered both gender-based and racial discrimination that restricted her academic opportunities. Despite her exceptional academic performance, she was initially discouraged from pursuing higher education due to prevailing societal expectations that women should prioritize domestic roles over professional careers.

Her professional life was severely disrupted in 1938 when Fascist Italy enacted anti-Semitic racial laws, which barred Jewish scientists from holding university positions and conducting research in academic institutions. As a result, Levi-Montalcini was forced to leave her laboratory and academic post. Rather than abandoning her scientific work, she demonstrated remarkable resilience by establishing a makeshift laboratory in her home, where she continued her experiments on nerve cell development using limited resources.

In addition to racial discrimination, she faced gender bias in a male-dominated scientific community, which often limited recognition and advancement for women scientists. Despite these obstacles, Levi-Montalcini persisted with independent research and international collaboration, eventually gaining global recognition for her discoveries.

Her ability to overcome systemic discrimination and professional exclusion stands as a powerful example of perseverance and intellectual courage. These challenges not only shaped her scientific character but also reinforced her commitment to equality, mentorship, and the advancement of women in science .

## Breakthroughs and Impacts

The discovery of Nerve Growth Factor (NGF) by Dr. Rita Levi-Montalcini represents a landmark breakthrough in neuroscience. NGF was the first identified neurotrophin, demonstrating that neuronal growth, survival, and differentiation are regulated by specific biochemical signals rather than solely by genetic programming. This finding fundamentally transformed the understanding of nervous system development and laid the foundation for modern neurobiology.

The impact of this breakthrough extends deeply into pediatric medicine. NGF plays a critical role during embryonic and early postnatal development, influencing the maturation of sensory and sympathetic neurons. Understanding its function has improved insights into neurodevelopmental disorders, congenital neuropathies, cerebral palsy, and perinatal brain injury, providing

opportunities for early diagnosis and intervention.

Beyond neurodevelopment, Levi-Montalcini's work revealed broader physiological roles of NGF, including immune regulation, tissue repair, and neuroprotection. These insights have informed translational research and therapeutic strategies in pediatric neurology, regenerative medicine, and neurodegenerative disease management.

Her discovery also inspired the identification of other neurotrophins and growth factors, significantly expanding biomedical research. Overall, Levi-Montalcini's breakthroughs have had enduring scientific, clinical, and societal impacts, demonstrating the transformative potential of fundamental research in improving child health and advancing medicine.

### Reflections and Learning

Dr. Rita Levi-Montalcini's life and work offer valuable lessons in perseverance, curiosity, and scientific integrity. Despite facing gender discrimination and political adversity, she pursued research with unwavering determination, demonstrating that resilience is essential for scientific progress. Her discovery of nerve growth factor highlights the importance of basic research, showing that fundamental scientific inquiry can lead to groundbreaking clinical applications.

Her career also emphasizes the value of interdisciplinary thinking. By connecting neurobiology, immunology, and developmental biology, she expanded the understanding of human physiology beyond traditional boundaries. Additionally, her advocacy for education, mentorship, and equal opportunities for women in science continues to inspire generations. For medical students and researchers, Levi-Montalcini's life reinforces the principles of dedication, ethical responsibility, and lifelong learning.

## CONCLUSION

Dr. Rita Levi-Montalcini's discovery of NGF shifted neuroscience from descriptive to molecular understanding of neuronal survival and connectivity. Her work provided a foundation for understanding paediatric and adult neurological disorders.

Her personal and professional life exemplifies resilience, integrity, and advocacy. She encouraged young scientists to pursue rigorous inquiry with compassion and social responsibility.

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Ethics approval not required as this is a narrative review based on published literature.

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