The Baton of Excellence: From Kurien to Kalam to Chauhan

When the world first heard of Dolly the sheep in 1996, cloning stood as an emblem of scientific wonder and ethical debate. Over the decades, the technology matured— refined through sophisticated cell culture, improved epigenetic reprogramming and precise embryological techniques. Today, cloning moves quietly but powerfully within India's dairy and livestock revolution, where science converges with culture, livelihood and national aspiration like a Sangam.

India, where cows are revered, and dairying sustains millions, has embraced cloning not as a mechanical manipulation of nature but as a conservation tool, a productivity amplifier and a national resource strategy. At the centre of this transformation stands Dr M. S. Chauhan, one of India's foremost reproductive biotechnologists, former Director of the National Dairy Research Institute (NDRI) and now Vice-Chancellor of Govind Ballabh Pant University of Agriculture & Technology (GBPUAT). His pioneering work in cloning India's first buffalo and establishing indigenous cloning capacity has helped India rise from an observer in global biotechnology to a recognised contributor—and increasingly, a leader.

India is the world's largest milk producer, yet the productivity of individual animals remains modest. The nation's strength lies in its vast treasure of indigenous breeds— Badri, Gir, Sahiwal, Ongole, Tharparkar, Kankrej and others—each evolved to withstand the hilly regions, drylands, diverse feeding systems, and disease resistance. These breeds hold qualities that modern dairy systems increasingly value: resilience, efficiency, and sustainability.

However, elite animals with exceptional performance are few, and their genetic excellence is often lost across generations. Cloning changes that fundamentally. What might take decades

of selective breeding can now be achieved in a fraction of the time, allowing India to multiply excellence rather than dilute it.

No figure has shaped India's livestock cloning landscape with greater depth or distinction than Dr M. S. Chauhan. Under his visionary leadership, the National Dairy Research Institute accomplished a landmark in modern Indian science—cloning the nation's first buffalo—followed by an illustrious lineage of clones —Garima, Garima-II, Shresth, Purnima, Lalima, Rajat and others—each a testament to rising precision, improved efficiency and remarkable gains in embryo viability.

Dr Chauhan also guided the refinement of cloning protocols for indigenous cattle. The birth of "Ganga," India's first cloned Gir calf, symbolised not only scientific achievement but India's commitment to preserving and multiplying indigenous germplasm. His work proved that cloning can strengthen, not compromise, India's bovine heritage. Today, as Vice-Chancellor of GB Pant University, Dr Chauhan continues to propel India's livestock research forward, nurturing a generation of young scientists and elevating India's status in global biotechnology.

Milk is central to India's nutrition, culture and rural economy. By cloning elite dairy cattle and buffaloes, India can rapidly expand animals that: give higher and more consistent milk yields, produce superior fat and SNF content, carry the A2 beta-casein gene, and thrive under Indian climatic conditions, and require less feed per litre of milk. Dr Chauhan's pioneering efforts ensured that exceptional animals—once irreplaceable— can now be preserved and replicated for national benefit.

The global frontier of biotechnology envisions dairy animals as sources of high-value nutritional and therapeutic proteins. With cloning and precision genomics, India can develop cattle lines that produce: lactoferrin and lysozyme for infant immunity, specialised casein variants for premium dairy products, and therapeutic proteins for pharmaceutical applications. Cloning ensures that once such an elite line is created, it can be replicated with fidelity, enabling India to compete internationally in advanced dairy bioproducts.

Cloning is emerging as a crucial tool for preserving India's irreplaceable cattle biodiversity. Rare or ageing elite cows can be recreated; threatened breeds can be multiplied without compromising their genetic purity. This aligns perfectly with India's cultural reverence for the cow as a symbol of nourishment and abundance.

As temperatures rise and diseases evolve, India needs animals that remain healthy under stress. Cloning allows rapid propagation of naturally disease-resistant and heattolerant animals, reducing veterinary losses and promoting animal welfare—an ethical imperative in the Indian context.

Under Dr Chauhan's stewardship, GB Pant University has forged scientific collaborations with Russia and Belgium, linking Pantnagar's laboratories with global research hubs. These partnerships have elevated India's cloning and reproductive biotechnology efforts into the

worldwide mainstream, enabling exchange of technologies, joint research, advanced training and international visibility.

This outward-looking scientific leadership mirrors the emergence of the New India—confident, research-driven, and ready to lead the Global South. Pantnagar's rise illustrates that Indian agricultural universities can become not only centres of national excellence but global players shaping the future of food and livestock biology.

Young scientists across India now look to Dr Chauhan as proof that a career in agricultural or veterinary biotechnology can bring global recognition, intellectual satisfaction and material prosperity. His journey—from the cloning laboratory in Karnal to the international research arena—stands as an inspiration for those who aspire to shine at the world level.

Dr Chauhan's work stands firmly in the lineage of two of India's most transformative scientific leaders: Dr Verghese Kurien, who turned India into the world's largest milk producer; and Dr A. P. J. Abdul Kalam, who inspired generations to dream boldly and serve the nation through science. Dr Kurien empowered India's farmers. Dr Kalam empowered India's youth. Dr Chauhan empowers India's scientific future, ensuring that livestock biotechnology becomes a force for national prosperity, global leadership and rural upliftment. Dr Chauhan carries forward the baton of these legends—combining Kurien's ground-level empathy with Kalam's sky-touching vision. His achievements remind the nation that science rooted in purpose can transform millions of lives.

Cloning is not a substitute for robust breeding programmes; it is a precision amplifier— an advanced biotechnological tool that works in harmony with conventional and genomic selection systems. Techniques such as somatic cell nuclear transfer (SCNT), oocyte maturation, epigenetic reprogramming and blastocyst-stage embryo transfer allow India to rapidly multiply elite germplasm, conserve rare genetic lines and stabilise high-performance traits that would otherwise take decades to propagate. When integrated with genomic breeding values (GEBVs), marker-assisted selection and cryopreservation of elite cell lines, cloning becomes a force multiplier for national livestock improvement.

Guided by ethical frameworks, strict biosafety norms, and a deep cultural respect for India's reverence for cattle and buffaloes, cloning can reinforce the foundations of dairy development. It can help reduce genetic erosion, improve climate resilience, enhance milk composition traits such as casein variants and A2 beta-casein, support diseaseresistant breeding, and ultimately empower smallholder farmers—the backbone of India's dairy revolution. When nurtured with scientific integrity and societal trust, cloning will contribute to a future where India's dairy sector becomes stronger, more resilient, and globally respected.

In the unfolding story of modern India—scientific, self-confident and forward-looking— Dr M. S. Chauhan stands as one of the true torchbearers of our age, illuminating a path where tradition and technology walk not in tension but in perfect cadence. His life's work demonstrates that progress need not sever us from our civilisational roots; instead, when the wisdom of our dairy heritage meets the precision of contemporary biotechnology, a nation

discovers its power to rise on its own terms. In Dr Chauhan's journey, one sees the quiet confidence of New India. He reminds us that a country grows great not by imitation but by innovation rooted in identity—by holding in one hand the tools of the laboratory and in the other the values of a civilisation that has revered cattle for millennia.

As an alumnus of Pantnagar University who had the rare privilege of working as a footsoldier of Dr Kalam for thirty-five years, and who sat with Dr Verghese Kurien to witness the quiet thunder of his conviction, I recognise in Dr M. S. Chauhan the same rare alloy of vision, humility and relentless purpose. Leaders of this mould do not merely guide institutions—they shape epochs, they lift entire disciplines, and they awaken in young minds the audacity to dream.

Watching Dr Chauhan elevate Pantnagar to global stature, champion indigenous cattle with scientific courage, and carry India's banner into advanced cloning technology, I see the unmistakable continuity of a great tradition. Kalam taught us that India's future lies in the hands of its scientists; Kurien taught us that rural India is the heartbeat of national prosperity. In Dr Chauhan, these two rivers meet. He embodies their mettle—rooted in the soil, reaching for the sky—and he inspires the next generation to rise not just as good scientists, but as nation-builders in a New India poised for global leadership.

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