Book Excerpt · Chapter 28 · Audhumbla Remembers

Chapter 28: Holstein — The Super Breed That (Almost) Came From the Netherlands

Introduction: A Name, an Irony, a Cow in Ginnungagap

Here in Ginnungagap, where I feel all my lives at once, I moo with amusement. My official name is "Holstein-Friesian", but most call me simply "Holstein" or "Holstein cow". Which, as it turns out, is a rather complicated name.

For the irony of history is this: most "Holstein" cattle have their roots in a vast genetic muddle along the entire North Sea coast — from Denmark across Holstein and Oldenburg into the Netherlands.

There was no single place of origin.

There was only a great, chaotic, centuries-long back-and-forth of cattle, sold, exchanged or bought after disasters. Cattle plague? Import Danish cows. Storm tide? Fetch Holstein cattle. War? Buy from the neighbours. That went on for centuries, and nobody kept pedigrees.

The genetic roots of this story probably reach back to the Romans. When Tacitus wrote around 65 BC about the Germanic tribes in northern Europe, he remarked of the Frisians and Batavians: "Their cattle are not handsome, but numerous." Which in the Roman context probably meant: they were no elegant Mediterranean cattle, but tough enough and productive enough to justify large herds.

The Batavians — a Germanic tribe probably from the Hesse / southern Lower Saxony region who had moved into the Rhine Delta — probably kept darker cattle. The Frisians, who had lived on the coast for longer, had their own animals. Whether the Batavian cattle were black, the Frisian white, or whether everything was much more mingled — we do not know precisely. The Batavians sadly left us no cave paintings. They lived in solid timber houses, which was civilised but, for historians, regrettably impractical.

What we do know: until about 1750 most cattle in this region were single-coloured red. Then something changed. Black-and-white cattle appeared in growing numbers — imported from Jutland, from northern Germany, from Holstein. After the devastating cattle plague of 1769 the Dutch bought in cattle in great numbers: Danish, Holstein, small German cattle from Oldenburg, Münster, Hanover. The colour grew more varied, the genetics more diverse.

Phew, when I think about it — here in this timeless space, where no time passes and yet all time is simultaneous — I waggle my ears. That my genetic roots lie not in a precise breeding programme but in a centuries-long, chaotic cattle trade between neighbours who helped one another out when plague came or when the dykes broke — that is somehow reassuring. We Holsteins are no designer breed from a laboratory. We are the result of pragmatism, catastrophes and neighbourly aid.

The transatlantic story of my breed is one of the most successful rebranding campaigns in agricultural history. And nobody seems to mind that the name "Holstein" tells only part of the story. A part of the cattle that went to America did indeed come from Holstein. Another part from East Friesland. Others again from the Netherlands. But "Holstein-East-Friesian-Dutch-Danish-Oldenburg Lowland Cow" would have been an impractical name.

It is rather like calling Champagne "Burgundy" because a few wine bottles once travelled through Burgundy. But at least the name is shorter than my ear-tag number.

I am Audhumbla, who wanders through the millennia. And this time I tell you the story of how, out of a north-German-Dutch-Danish mixture, a "global monoculture" was born.

28.1: The Colour Changes — Red Becomes Black (1500–1800)

In Ginnungagap I remember cows that were red, before they became black-and-white.

That sounds odd, but it is true. Until well into the eighteenth century, most cattle in the north German-Dutch coastal region were single-coloured red or red-and-white pied. The paintings of the time show this. Art historians have analysed the colours of cattle in landscape paintings by famous Dutch painters — and the figures are unambiguous:

From 1500 to 1600: 22 cattle painted. Of those, 8 red, 6 beige, 1 yellow, 3 dark, 4 other colours. Not a single black-and-white.

From 1600 to 1750: 163 cattle painted. Of those, 96 red, 50 beige, 6 yellow, 4 dark (perhaps with black markings), 7 other colours. Not a single black-and-white.

Figure 138: Paulus Potter, 1646 — black-and-white cow or only very dark brown? CC BY-SA 3.0

After 1750: 35 cattle recorded in 20 paintings, many black-and-white.

What happened?

The black-and-white colour increasingly took over from about 1750 — not by chance, but through trade, selection and genetics. The explanation lies in several factors:

First: the black-and-white cattle came originally from the coastal regions of northern Germany, Friesland, the Netherlands and Denmark. Their spread was forced by targeted trade, by livestock purchases after wars, natural disasters and after epidemics (such as the cattle plague).

Second: black-and-white cows did particularly well in the marshlands, because they generally showed higher milk yields and better adaptation to wet soils. In Holland and Friesland, performance-oriented breeding selection was already practised in the seventeenth and eighteenth centuries. These animals were imported into Germany after stock losses.

Third: the gene for black-and-white colouring is dominant over red. When black-and-white and red-and-white animals are crossed, the next generation is predominantly black-and-white. So genetics worked in favour of black-and-white.

Fourth: with the founding of herdbooks and selection on milk yield, the black-and-white colour became a breeding goal. Whoever wanted milk chose black-and-white.

I remember a red cow in Friesland, 1720. She was uniformly red, like her mother and her grandmother. The red cows gave less milk than the new black-and-white neighbours imported from Jutland. Her farmer, Pieter, saw the figures. He bought a black-and-white bull. The daughters of the red cow were black-and-white. Their genes remained — but their colour vanished.

Figure 139: Paulus Potter, "De Stier", 1647

Figure 140: Henry Schouten (1857–1927), "Zomerlandschap met Koeien", CC BY-SA 3.0

Hans-Peter Dürr would say: "Selection is relationship. The environment chooses what works." Jeremy England would nod: "Information condenses. Black-and-white information was more productive." Paul Davies would add: "A bio-friendly universe permits variability — but markets do not."

28.2: The Cattle Plague and the Reconstruction (Eighteenth Century)

The story of the Black-and-Whites is also a story of catastrophes and reconstruction.

Natural disasters — particularly on the North Sea coast: storm tides, dyke breaks — and epidemics, above all the cattle plague, repeatedly decimated the cattle stocks in northern Germany and the Netherlands. In the province of Friesland alone over three hundred thousand cattle died from the plague in 1713/14. Between 1744 and 1756 two thirds of the cattle kept there died. Equally high losses are reported for other north-west European provinces.

After the cattle plague outbreak of 1769 the Dutch had to buy in Danish, Holstein, and small German cows from Oldenburg, Münster and Hanover to replenish the herds.

Into this period falls the striking change in colour of the cattle kept on the Dutch-German North Sea coast. While until about 1750 single-coloured red cattle predominated, the number of black-and-whites rose from 1750 onwards. They are traced to imports, especially from the Danish peninsula of Jutland and from northern Germany, particularly after 1750.

I remember a herd in Friesland, 1770. The cattle plague had decimated this herd. Of thirty cows, five survived. The herd's farmer, Jakob, travelled to Jutland and bought twelve new cows. All black-and-white. Big, sturdy animals with impressive udders. They gave more milk than the red survivors. Within two generations the entire herd was black-and-white.

Friedrich Hayek would say: "Decentralised knowledge spreads through trade. Every farmer knew which cows were better. No state had to tell him." James C. Scott would add: "Catastrophes create opportunities for change. The cattle plague erased the old order. The new order was black-and-white."

28.3: Dutch Cows Conquer America (1625–1885)

Here in Ginnungagap, where I feel simultaneously all the lives of my fellow kind, I see something remarkable: while I myself lived in German byres, chewed the cud and was milked, thousands of my Dutch sisters set out on the journey across the Atlantic. I was not among them — my lives played out in East Friesland, Lower Saxony and Holstein — but I feel their memories, their fear on the ships, their bewilderment in the New World.

Let me tell you what happened while I chewed hay in Germany.

The Forgotten First Wave — Dutch Cows in New Amsterdam (1625–1850)

Figure 141: Aelbert Cuyp, Dordrecht — Cows on the pasture near Rijnsburg, ca. 1650, CC BY-SA 3.0

It begins early, very early. In the year 1625 — when I was just then, as a Frisian cow, grazing on a pasture near Amsterdam, suspecting nothing of any of this — the Dutch West India Company loaded a handful of my sisters onto a ship. Destination: New Amsterdam, the small Dutch settlement on the Hudson River that would later be called New York.

The crossing was hell. Six to eight weeks on a rolling wooden ship, pressed into the hold among barrels and goods. Seasickness. Thirst. Panic. Some cows did not survive. But some arrived.

In Ginnungagap I feel one of these cows — I call her Maritje, since she had no documented name. She was unloaded in New Amsterdam in 1626, wobbly on her legs, emaciated, but alive. A Dutch settler named Pieter received her. He built her a barn from rough boards, fed her with whatever he could find — grass from the Hudson banks, hay from marshes, in winter straw and roots.

Maritje gave milk. Not much, perhaps 2,000 kilograms a year, but it was enough. Pieter made cheese, sold butter to neighbours, drank the milk himself. Maritje had calves — by a Dutch bull that had likewise been imported. Her descendants stayed in New Amsterdam.

But nobody wrote down Maritje's name. Nobody kept records of her daughters. Nobody cared that she came from a long line of Frisian dairy cows. She was simply a cow. A useful one, yes — but not a breed.

Over the next two hundred years, Dutch cows kept coming to North America. The Dutch West India Company brought them, and later other traders too. Many went to New York, some to Pennsylvania, New Jersey, Connecticut. They crossed with English cattle, with local landraces, with everything available.

The result: the Dutch genes did not vanish — they flowed invisibly into the general dairy farming of the Middle States. The cows there became better, more productive, milkier — but no one knew exactly why.

It was genetic influence without documentation.

Here in Ginnungagap I see the paradox: I was everywhere — every cow in New York carried a piece of me — but at the same time I was nowhere. No identity, no name, no breed. Only milk.

The Decisive Turn — A Man Named Chenery (1852)

Then, in 1852, everything changed.

A gentleman farmer from Massachusetts, Winthrop W. Chenery, had a problem: his cows gave too little milk. He had heard that in the Netherlands there were cows that produced extraordinary quantities of milk — black-and-white cattle from the marshes along the North Sea.

Chenery was no ordinary farmer. He was wealthy, educated, methodical. He decided to travel personally to the Netherlands to find the best dairy cows.

In Ginnungagap I feel a cow named Agatha — born 1849 in North Holland, on a farm near Alkmaar. She gave 4,500 kilograms of milk a year — extraordinary for the time. Chenery saw her, examined her udder, questioned the farmer about her ancestry. He bought her. He also bought her bull calf, another cow, and a young bull.

The crossing was still gruesome. Agatha spent seven weeks in the ship's hold, chained, seasick, full of fear. But she survived. In autumn 1852 she arrived in Boston.

Chenery set up a barn for her, fed her on the best hay, milked her daily. Agatha gave more milk than any other cow in Massachusetts. Chenery invited neighbours to see his "Dutch wonders". The news spread.

That was the turning point. Not the Dutch cows themselves — they had been in America since 1625. But the attention. Chenery made the breed visible. He began to breed systematically, document yields, note ancestries.

Jeremy England would say: "Information is the catalyst. Chenery turned undocumented genetic resources into a managed, optimisable breed."

James C. Scott would add: "He created a category. And categories are power."

The Import Boom — The Great Migration of Cows (1857–1905)

Figure 142: Dirk Peter Lokhorst, "Koeien in een landschap", ca. 1880

After Chenery's success a run on Dutch cows began. Between 1852 and 1905 about 7,757 cattle were shipped from Europe to North America. The overwhelming majority came from the Netherlands — from Friesland, North Holland, Groningen — but some also from the German province of Holstein.

Here in Ginnungagap I feel hundreds, thousands of such journeys. Every cow a story.

Mercedes, born 1878 in Friesland

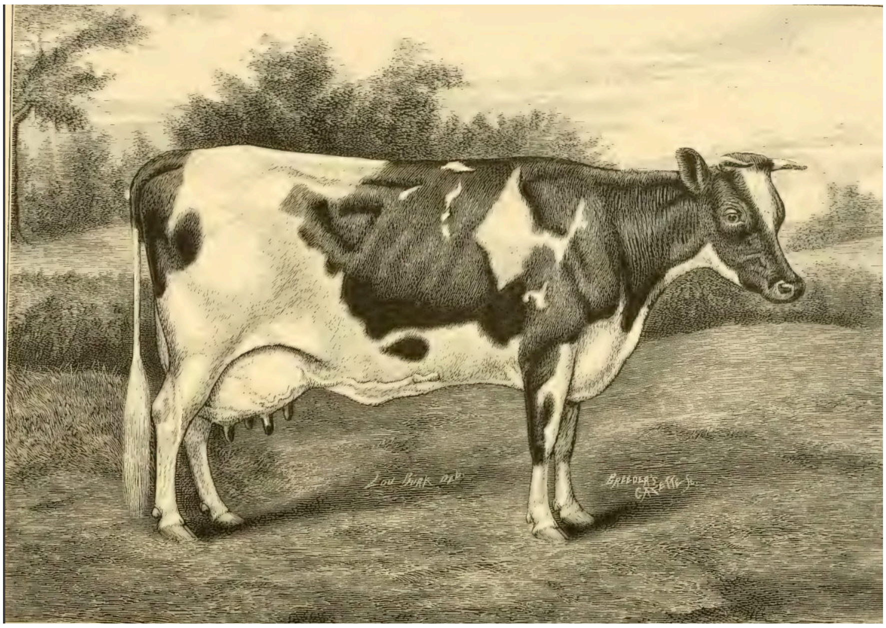

Figure 143: Mercedes, from "The Breeds of Live Stock, and the Principles of Heredity", 1887, CC BY-SA 3.0

Mercedes was a black-and-white cow, born in March 1878 on a farm near Leeuwarden. Her breeder was K.N. Kuperus. She was a good dairy cow but not extraordinary — 4,200 kilograms a year, a solid udder, sturdy legs.

In September 1879 she was shipped to Iowa. The buyer was Thomas B. Wales Jr., a farmer from Iowa City. Mercedes survived the crossing and reached Iowa in October 1879.

Wales recognised her potential. He set her up optimally: best pastures in summer, concentrate in winter, regular milking, no overload. Mercedes suddenly gave more milk. Much more.

In 1883 — Mercedes was now five years old — she was entered for a competition: which cow produces the most butter in thirty consecutive days? Mercedes won. Her record: 99 pounds and 6½ ounces of unsalted butter in thirty days, an average of 3 pounds 5 ounces per day.

The

Breeder's Gazette

reported on Mercedes. She became famous. Breeders wanted her genes. Wales sold her semen — no, wait, wrong — he sold her calves, her daughters, her granddaughters. Mercedes became the matriarch of a whole line.

She died in 1891, twelve years old. In Ginnungagap I feel her last breath — tired, exhausted, but content. She had given more milk than any cow of her generation in Iowa. She had won.

Empress, born 1871 in North Holland

Another story: Empress. Born in May 1871 to J. Man in North Holland. She was already known in the Netherlands — supposedly she had a record of 108 pounds of milk in a single day. (Phew — I'll believe that when I see it. But the figure impressed the Americans.)

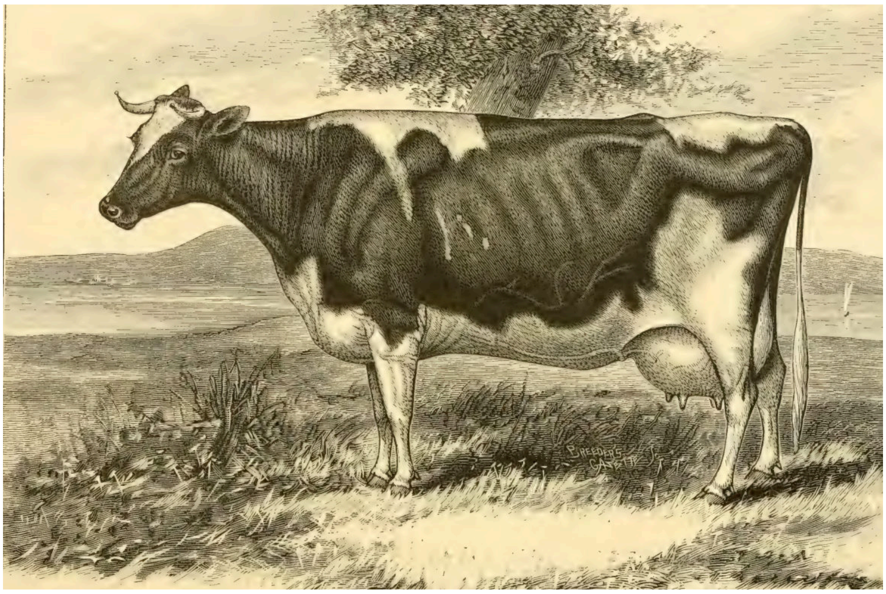

Figure 144: Empress, from "The Breeds of Live Stock, and the Principles of Heredity", CC BY-SA 3.0

In February 1879 Gerrit S. Miller travelled personally to Holland to buy Empress. Miller was a successful breeder from Peterboro, New York. He wanted the best cow in Holland. He paid an enormous sum — the exact figure has not been preserved, but contemporaries spoke of “scandalously expensive”.

Empress came to New York. Miller fitted her out with a luxury barn, fed her optimally, had her cared for by specialists.

And Empress delivered. In 1883 — she was now twelve years old, strictly speaking already old for a high-yield cow — she produced 19,714 pounds and 4 ounces of milk in 365 consecutive days. That is about 9,000 kilograms. For 1883 that was astronomical.

Miller had Empress drawn by an artist named Page. The picture was printed in trade magazines. Empress became an icon — the cow who proved that Dutch genes were superior.

She died in 1885, fourteen years old. In Ginnungagap I remember her: proud, productive, drained. She gave everything. And she received fame for it — something only few cows experience.

Susie Clay, born 1881 in Massachusetts

Not all famous cows were imported. Some were born in America — out of imported parents.

Susie Clay was born in May 1881 on the farm of W.A. Russell in Lawrence, Massachusetts. Her father was Sligo 621, a bull from North Holland imported by Russell. Her mother was Jenny Clay 341, also imported. Her grandmother was Lady Clay 158, imported in 1874.

Susie Clay was thus pure-bred Dutch — but born in America. She represented the next generation: American Holstein-Friesian.

She was later sold to George E. Brown & Co. in Aurora, Illinois. There she became a breeding cow. Her milk yield was good, but not record-breaking. But her genes were valuable — she descended from three imported generations, documented, traceable, reliable.

Susie Clay was drawn by an artist named Burk — a typical black-and-white cow, sturdy, with a good udder, harmonious proportions. The picture showed how the breed should look: not extreme, not exaggerated, but functionally beautiful.

The Organisations — When Breeders Quarrel (1871–1885)

With success came the quarrel. American breeders disagreed on basic questions:

What should the breed be called?

- “Holstein” — after the German province (although most cows came from Holland)
- “Friesian” — after the Dutch region of Friesland
- “Dutch” — simply “Dutch”, geographically correct, but not very prestigious

Which animals could enter the herdbook?

- Only animals imported directly from Europe?

- Their American-born descendants too?
- What about animals whose grandparents were imported but not documented?

Which colours are acceptable?

- Only black-and-white?
- Red-and-white too (which sometimes arose from black-and-white parents)?
- Pure white or pure black animals?

The breeders could not agree. So they founded two separate organisations.

In March 1871, in Boston, breeders in favour of "Holstein" met. They founded the "Association of Breeders of Thoroughbred Holstein Cattle" and began publishing the "Holstein Herd Book".

In December 1877, in Brookfield, New York, the opposing side met — breeders who preferred the name "Friesian". They founded the "Association of Breeders of Pure Bred Friesian or Dutch-Friesian Cattle" and published their own herdbook.

For years the two organisations competed. Each claimed to be the only true representative of the breed. Each refused to recognise animals from the other herdbook. It was absurd.

In Ginnungagap, where names are meaningless and only genes count, I waggle my ears, amused. Humans quarrel over words while cows simply give milk.

The Settlement — A Compromise in Boston (26 May 1885)

Eventually, after years of quarrel, the nonsense became too expensive. Breeders on both sides noticed: the quarrel is harming the breed. Potential buyers were confused. International recognition was suffering.

On 26 May 1885 representatives of both organisations met in Boston. After lengthy negotiations they agreed on a compromise:

- Both organisations merge
- The new name: "Holstein-Friesian" — both traditions are honoured
- A unified herdbook: the "Holstein-Friesian Herd Book"
- The new organisation: "Holstein-Friesian Association of America"

The old herdbooks were discontinued. Volume I of the new, unified herdbook appeared in 1886.

An important detail: only black-and-white animals were entered in the herdbook. Red-and-whites — occasionally born from black-and-white parents — were initially excluded. But about 20 per cent of black-and-white cows carried the recessive red factor hidden. This would later lead to the emergence of the "Red Holstein" — but that is another story.

What I Think — From Ginnungagap

Here, beyond all time, where I see all bovine stories simultaneously, something becomes clear to me:

The real revolution was not biological. The Dutch cows had been in America since 1625. Their genes were there, invisible, unmanaged, but at work.

The revolution was informational.

Chenery documented. He wrote down: this cow gives this much milk. Her daughter gives even more. Her grandson inherits this trait. Suddenly we were no longer "some cows" — we were a breed with origin, performance, future.

The organisations created standards. They defined: this is what a Holstein-Friesian looks like. This much milk she must give. This ancestry is acceptable, that one is not.

Jeremy England would say: "Information organises matter. The herdbooks were information stores that steered evolution."

Hans-Peter Dürr would whisper: "The waves congeal into forms. But without observation, without measurement, without names, they remain unformed."

And I, Audhumbla, who lived in German byres while my sisters sailed across the Atlantic, think:

We were always the same cows. But only when humans gave us a name did we become something special.

Names are power. And sometimes — very rarely — names also bring dignity.

Phew.

The Catastrophe — When the Dream Threatened to Die (1859–1860)

But wait. Before you think this was all child's play — a few imported cows, a bit of good press, and the Holstein breed was established in America — let me tell you about the year in which almost everything ended.

1859. June. Chenery's farm in Belmont, Massachusetts.

The First Death

In Ginnungagap I feel a cow — I call her Hendrika, although her name is not preserved. She was one of Chenery's imported Dutch cows, arrived in 1857, a sturdy black-and-white heifer with a solid udder and good milk yield.

In June 1859 Hendrika began to cough. At first only occasionally. Then more often. Her breathing became heavy, rasping. Fever rose. She would not eat. She just stood there, head lowered, fighting for every breath.

Chenery called the vet. He shook his head. "Pneumonia," he supposed. "Perhaps tuberculosis." He had no idea.

Hendrika died after two weeks of agonising suffering. Her last breath was a rattle, a wheeze from fluid-filled lungs. In Ginnungagap I feel her dying — slow, suffocating, dreadful.

Chenery had her autopsied. The vet opened her chest cavity. What he saw made him freeze: the lungs were covered with thick, fibrous membranes. The pleura — the lining of the lungs — was inflamed, thickened, filled with fluid. The lungs themselves were partly destroyed, full of abscesses.

"Pleuro-pneumonia," whispered the vet. "God help us."

The Plague Spreads

Pleuro-pneumonia was the nightmare of every cattle keeper. A highly contagious bacterial pneumonia, caused by

Mycoplasma mycoides

. Transmission by droplet infection — a single cough could infect a whole herd.

The disease had been brought in from Europe. Probably through one of Chenery's imported cows that was already infected but showed no symptoms yet. A ticking time bomb in the ship's hold across the Atlantic.

After Hendrika the next cow died. Then a third. Then two simultaneously.

Chenery tried everything. He isolated sick animals. He disinfected the byres with lime. He fed herbal mixtures said to help. Nothing worked.

The disease raged through his herd like fire through dry grass.

From June 1859 to January 1860 Chenery lost half his herd.

Half! All those expensively imported Dutch cows. All those carefully documented ancestries. All those hopes for a new American dairy breed.

Gone.

In Ginnungagap I feel dozens of deaths. Cow after cow, rasping, suffocating, perishing in agony. Chenery stood helplessly by and watched his dream die.

The Panic in New England

But it got worse.

The disease did not stay on Chenery's farm. It jumped to neighbouring farms. North Brookfield. Other places in Massachusetts. Within months dozens of herds were infected throughout New England.

The farmers panicked. Nobody knew how the disease spread. Nobody knew how to stop it. The death rate among affected herds was 50 to 60 per cent.

The Massachusetts State Board of Agriculture was convened. Emergency sessions. Experts were flown in from Europe. Wild theories circulated:

- The disease is transmitted through the air!
- No, through contaminated water!
- No, through contact!
- It is God's punishment for importing foreign cattle!

A radical proposal was raised: "Wholesale massacre of cattle!" — the complete killing of all cattle in the affected areas, whether sick or healthy.

In July 1860

Harper's Weekly

— one of America's largest newspapers — reported on the catastrophe. Illustrations showed Chenery's barns in Belmont. A drawing by T. Marsden, Esq., showed "Part of Mr Chenery's Herd" — the survivors, gaunt cows, heads lowered, traumatised.

The headline: "THE CATTLE DISEASE — PLEURO-PNEUMONIA"

All New England was in a "state of frantic alarm". Breeders sold their herds in panic. Some prophylactically slaughtered healthy animals out of fear of contagion.

The dream of American Holstein breeding seemed over before it had really begun.

Dr Williams and Inoculation

Then a man called Dr Williams came along.

Dr Williams was a vet with a radical idea. He had heard of trials in Europe: inoculation — the deliberate infection of healthy animals with a weakened form of the disease, to produce immunity.

It was a desperate experiment. One took material from the infected lungs of a sick cow and injected it — usually into the tip of the tail — into a healthy cow. The idea: a local, controlled infection would stimulate the immune system without setting off the lethal pneumonia.

In theory brilliant. In practice: Russian roulette.

Dr Williams carried out the first trials. Of 100 inoculated cows, 34 still died. 34 per cent mortality! That was better than the 50–60 per cent of natural infection, but still devastating.

But — and this was crucial — the 66 survivors were immune. They could stand in infected herds without falling ill.

It was no perfect solution. But it was the only solution that worked.

Chenery's Decision

Chenery faced a dreadful choice.

He could have his remaining cows inoculated — at the risk of losing a third of them.

Or he could wait — and watch as the disease possibly returned and wiped out the rest of his herd.

Or he could give up. Sell the surviving cows. End his Dutch imports. Bury the dream.

Chenery was no coward.

He had his herd inoculated. Of the remaining 50 cows another 12 died. But the remaining 38 survived. They became immune.

These 38 cows — the survivors of the catastrophe, scarred, weakened, but immune — became the core of Chenery's rebuilt herd.

The last death on Chenery's farm was on 8 January 1860. After that: no new infections. The plague was beaten.

The Lesson From the Catastrophe

Harper's Weekly

later wrote:

"The disease arose from foul ventilation and unsuitable feeding… the progress of the disease was caused by neglect on the very outset."

That was nonsense. Victim-blaming. Chenery's barns were well ventilated. His feeding was optimal. No one could have prevented the catastrophe, because nobody knew that imported cows were already infected.

But something else was true: the catastrophe taught American breeders a hard lesson.

Lesson 1: Quarantine is essential. After 1860 imported animals were routinely isolated for weeks before being allowed to contact other herds.

Lesson 2: Animal health is non-negotiable. A sick cow that gives a lot of milk is worthless if she infects the whole herd.

Lesson 3: Documentation saves lives. Chenery had meticulously documented which cows fell ill, which died, which survived. These data helped Dr Williams understand how the disease spread.

Lesson 4: Resilience counts more than peak performance. The cows that survived were not necessarily those with the highest milk yield. They were those with the strongest immune systems, the healthiest lungs, the best constitution.

That would shape breeding. Health became a breeding goal — not at once, not consistently, but as an idea it was born.

What I Think — From Ginnungagap

Phew — here, beyond time, where I feel all cow lives at once, I see something important:

The pleuro-pneumonia catastrophe was almost the end of Holstein breeding in America. But it became the beginning of something else: responsible animal breeding.

Before 1859 breeders simply imported cows. After 1860 they imported with caution, with quarantine, with health checks.

Before 1859 farmers bred for performance alone. After 1860 they began — slowly, hesitantly — to pay attention to health too.

Before 1859 cows were means of production. After 1860 some began to understand: sick cows are not means of production. They are a catastrophe.

Jeremy England would say: “Disease is information decay. The immune system is an information-processing system. The surviving cows had better algorithms.”

Hans-Peter Dürr would whisper: “Life is a dance at the edge of chaos. Some danced better. They survived.”

And I, Audhumbla, think:

Sometimes one must lose almost everything to learn what really matters. We have noted that already, when we treated the fates of the refugees from East Prussia in our story.

Chenery lost half his herd. But the survivors — these 38 tough, immune, traumatised cows — became legends. Their descendants populated America. Their genes flowed into millions of Holstein-Friesian cows.

The catastrophe could have been the end.

Instead it became a test. A filter. A trial by fire.

Only the strongest survived. And from the strongest there arose a breed that a hundred years later would conquer the world.

Phew — sometimes the best emerges from the worst.

> “The disease arose from foul ventilation and unsuitable feeding… the progress of the disease was caused by neglect on the very outset.” —
>
> *Harper’s Weekly*
>
> , July 1860 (victim-blaming, historically false)

> "During the past few weeks this plague has been as general as in any former period. Mr. Chenery once held the opinion that the disease was not contagious, but he since changed his mind and admits that it is to some extent contagious." —
>
> *Harper's Weekly*
>
> , July 1860
>
> "Dr. Willems, who is a scientific man, bethought himself of inoculating the animals with the disease… but only 66 per cent survived the process of inoculation." —
>
> *Harper's Weekly*
>
> , July 1860
>
> "In localities where the herds attacked is said to have reached 50 per cent." —
>
> *Harper's Weekly*
>
> , July 1860 (mortality rate)

28.3a: Johanna and Pabst — A Family Story That Changed the World

From:

The Breeds of Live Stock, and the Principles of Heredity, Illustrated

, by H. Sanders, J.H. Sanders Publishing Company, 1887:

> GROUP OF HOLSTEIN-FRIESIAN CATTLE OF THE AAGGIE FAMILY. The group of selected animals shown below consists of representatives of the famous Aaggie strain, known for its wonderful milk yields in the Lakeside herd of Messrs Smiths, Powell & Lamb of Syracuse, N.Y.; the animals depicted are Aaggie, her son Neptune, Aaggie Rosa, Aaggie Beauty, Aaggie Beauty 2d, Aaggie Kathleen, Aaggie May and the calf (Horace) by Neptune. The family was first brought into the limelight by the performances of Aaggie 2d gor and Lady Clifden 159 (daughters of the North Holland bull Rooker), one of which (Lady Clifden) was the first cow of the breed known to have produced 16,275 pounds of milk in twelve months, while the other (Aaggie) added a test of 18,004 pounds in one year. These were the largest tests recorded at the time, but later Aaggie 2d (double granddaughter of old Rooker) gave 17,746 lbs. 2 oz. of milk in one year as a two-year-old heifer with her first calf, which record was later raised, with the heifer's growing maturity, to 20,736 lbs. Aaggie Rosa gave 16,156 lbs. 10 oz. in the first year after import… Aaggie Beauty delivered 13,573 lbs. 15 oz. in twelve months, shortly after the end of quarantine, and numerous other

cows and heifers of this kind have performed almost as astonishing feats at the milk pail. Drawn from life by Palmer.

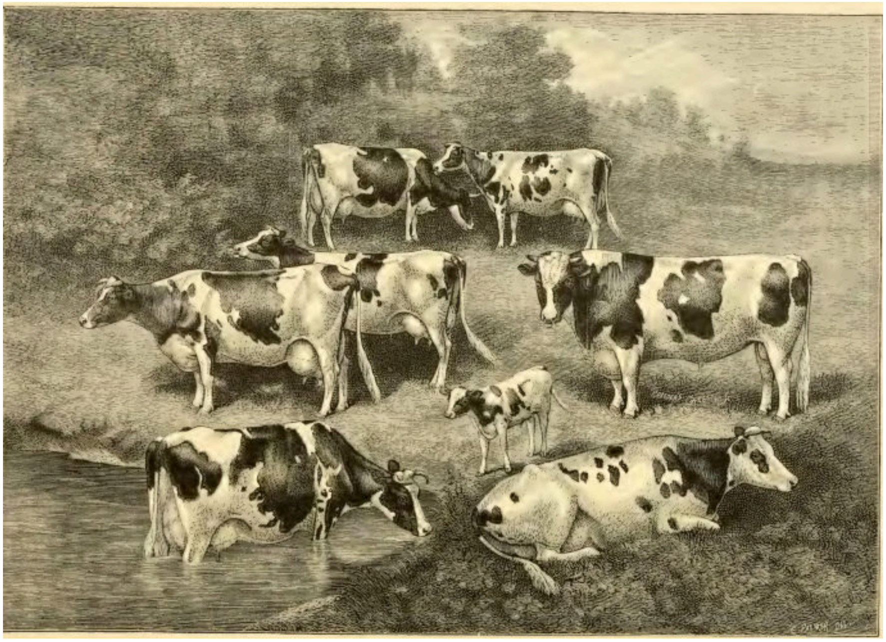

Figure 145: The "Aaggie Family" is a prominent branch of the Johanna Foundation Family, initiated by Johanna Aaggie as the link. Direct descendant of Johanna 4th (daughter of Johanna 344 H.H.B.) CC BY-SA 3.0

Here in Ginnungagap, where all bovine lives exist simultaneously, there are some stories that even move me — I, who have seen everything. The story of Johanna is one of them. Not because she was the most productive cow. Not because she was the largest. But because in her and her descendants something came together that would change the whole of Holstein breeding for ever.

Johanna — The Cow Nobody Held to Be Special (1871–1891)

Johanna 344 H.H.B. was born in 1871 in a village in North Holland. Bred by K.J. Akkerman, a name nobody now remembers. She was a white cow with a sloping rear — not exactly the ideal form breeders dreamed of. Her build was unspectacular. Her appearance average.

But she had something else.

Johanna gave milk. A lot of milk. And her milk was rich. In 1878, when she was seven years old, an American named Gerrit Miller came to North Holland. Miller was already famous — he owned Kriemhild Farm in Peterboro, New York, and he was looking for the best cows in Holland.

The villagers advised him: "Buy Johanna. She is the best dairy cow in Holland."

Miller was sceptical. The white cow with the sloping rear did not look like a champion. But he tested her yield. 12,264 pounds of milk a year — extraordinary for 1878. He bought her. $350, a considerable sum.

The crossing to America was hell. Seven weeks in a ship's hold, seasick, pressed in, frightened. But Johanna survived. In autumn 1878 she reached Kriemhild Farm.

In Ginnungagap I feel Johanna in this moment. She stood on foreign soil, surrounded by unknown smells, strangers, a new world. She was confused, but also relieved — at last firm ground under her hooves.

Miller set her up in a good barn. He fed her optimally. He milked her regularly. And Johanna delivered.

1880, New York State Fair: Johanna won first prize as best dairy cow of all breeds. Not just best Holstein — best cow, full stop. The judges marvelled at her performance. Miller was proud. Johanna became famous.

But Miller was no intensive breeder. He was a gentleman farmer, relaxed, easy-going. Johanna lived a good life with him. When she was ten years old, Miller put her, together with his other star cow Empress, on a pasture directly in front of his house — places of honour for distinguished cows. On some days they gave 88 pounds of milk. In a single month Johanna produced 2,407 pounds of milk — a performance contemporaries described as "extremely rich".

The Sale That Changed Everything (1882)

In 1882 — Johanna was now eleven years old — a visitor came to Kriemhild Farm: Wilson Gillett from Wisconsin. Gillett was different from Miller. Miller was relaxed, easy, a lover of beautiful cows. Gillett was obsessed. Intense. Methodical. He wanted to breed the best cows in America, and he was prepared to do anything for it.

When Gillett saw Johanna, he recognised at once: this cow is not just good. She is a foundation. A mother of dynasties.

He made Miller an offer: $500. An enormous sum for an eleven-year-old cow.

Miller hesitated. He liked Johanna. But he also liked Wilson Gillett. Miller saw in Gillett a man who could get more out of Johanna than he himself ever could. Miller thought: this cow deserves a breeder who exploits her possibilities to the full.

He sold.

In Ginnungagap I feel Johanna's farewell from Kriemhild Farm. She did not understand what was happening. She had grown used to Miller. But she trusted humans. She followed Gillett into the cattle wagon. The journey to Springdale Farm, Wisconsin, was long. But Johanna arrived.

Springdale Farm — Where Dynasties Are Born (1882–1891)

Wilson Gillett was a visionary. His farm, Springdale, was no relaxed gentleman's operation like Kriemhild. Springdale was a high-yield breeding operation: concentrate feeding, regular tests, aggressive marketing, top bulls.

Gillett mated Johanna with the best bulls he could find. She had daughters: Johanna 4th and Johanna 5th. Gillett named all the descendants after their mother: "Johanna" became the family name, the marker of a dynasty.

Johanna 4th had two influential daughters: Johanna Aaggie and Johanna May.

Johanna 5th had two influential daughters: Johanna Rue and Johanna 5th Clothilde.

Out of these four daughters arose the four main lines of the Johanna family — a family that would dominate Holstein breeding for the next hundred years.

Johanna Rue — The Champion Cow (born ca. 1890)

Of all Johanna's daughters and granddaughters one became a legend: Johanna Rue.

In 1896 — Johanna Rue was now six years old — she set a record: 21 pounds of butter in seven days. That was astronomical. The trade magazines reported. Breeders pilgrimaged to Springdale to see Johanna Rue.

She had five daughters who were all entered into the Advanced Registry — the elite register for high-yield cows. All five gave between 20 and 24 pounds of butter in seven days. All five passed this performance on.

One of her sons, Johanna Rue 2d's Paul DeKol, became the grandfather of King Segis — one of the most influential bulls of his time.

Another daughter, Johanna Rue 4th, had a son named Johanna Rue 4th's Lad. This bull was sold to Canada, to Matt Richardson at Riverside Farm, Ontario. There he sired 32 tested daughters and 21 proven sons. One of his daughters was Jemima Wayne Sarcastic, mother of Jemima Johanna of Riverside — Canada's first cow with 30,000 pounds of milk and 1,000 pounds of fat per year.

Colantha 4th's Johanna — The 35-Pound Sensation (1907)

Of all the Johanna descendants, one became the absolute sensation: Colantha 4th's Johanna.

In 1907 she became the first cow in the world to break the 35-pound butter barrier in a seven-day test. The trade press exploded. They tested her further throughout the year: at the end she produced 1,200 pounds of butter (998 pounds of fat) — a new world record across all breeds.

The test ended on 18 December 1907.

Wilson Gillett — now old, but still obsessed — spent day and night with his cow. He fed her personally, supervised every milking, noted every detail. Neighbours grew concerned.

A friend said to him: "Gillett, you are killing yourself if you carry on with this cow."

Gillett answered calmly: "If I do, I shall die happy."

In Ginnungagap, where I feel all feelings simultaneously, I feel Gillett's love for this cow. It was not greed. It was passion. He loved the cows he bred. He wanted perfection. And Colantha 4th's Johanna was his perfection.

Colantha died a few years later, having given everything. Gillett died shortly afterwards. In Ginnungagap I feel them both — the cow and the man — united in their obsession, their devotion.

The Bull Calf from Hartford, Wisconsin (24 January 1921)

And then, forty years after Johanna's arrival in Wisconsin, something extraordinary happened.

Three miles north of Hartford, Wisconsin, on the farm of Philip Linker and his son-in-law Herbert Lepien, stood a young cow named Princess Johanna Rag Apple Pontiac. She was only two years old, pregnant with her first calf, nervous and inexperienced.

On 24 January 1921, in the depths of winter, her labour began. The barn was cold, the air frosty. Herbert Lepien helped her. The calf slipped into the world — a bull calf, black-and-white, sturdy, with bright eyes.

Lepien dried the calf, helped it to its feet. It was a normal January morning on a Wisconsin farm. No spectacle, no prophecy.

But then something remarkable happened.

Princess Johanna Rag Apple Pontiac — freshly delivered, tired, but ready — entered the test box. In that week she produced 26 pounds of butter equivalent — an astronomical performance for a first-calf cow. The figures spoke clearly: this cow had something special. And if genetics held, her bull calf had it too.

Herbert Lepien had prepared this moment. Six months earlier he had travelled fifteen miles through the snow to Pabst Farms — one of the most famous breeding farms in Wisconsin. He bought Pabst Korndyke Star, a top bull. The mating with Princess Johanna was no chance decision. It was strategy.

The bull calf, born on this cold January morning, bore a name that announced his ancestry: Johanna Rag Apple Pabst.

The Boy Who Loved the Bull

Eight months later, in the summer of 1921, the County Agent Milton Button visited the Linker-Lepien farm. Button's task was to help farmers improve their herds. His trained eye recognised potential.

When he saw the young bull moving across the pasture — the way he moved, the breadth of his chest, the length of his stride — something clicked.

He said to Lepien: "That is a good bull. Someone should buy this calf."

Six miles south of Hartford lived Joe Piek. Piek had recently begun to breed Holstein cows. He had bought fourteen heifer calves at an auction in Fond du Lac — young animals between six weeks and eight months old, $60 to $150 apiece. Now he needed a herd bull.

Piek was inexperienced. He asked Milton Button for advice. They visited farms, evaluated bulls. When Button recommended the Lepien bull, Piek did not hesitate. He bought him.

The young bull came to Piek Spring Stock Farm. There he met a nine-year-old girl named Anna Piek. Anna fed the calves every morning, mixed warm milk, learnt the rhythms of farm life.

The bull — gentle, curious, huge — followed Anna like an oversized pet. She called him by name: Pabst. He was her friend.

In Ginnungagap I feel these moments. A girl and a bull, mornings in the barn. She feeds him; he nudges her gently with his nose. No idea that this bull will one day change the world.

The Show Season — From Fifth to Unbeaten (1922–1925)

Joe Piek had ambitions. Each autumn he hired a freight wagon, built in dividing walls, installed water and feed barrels, and transported his cows to county fairs throughout the Midwest.

1922, Walworth County Fair: Johanna Rag Apple Pabst — now eighteen months old — entered the ring for the first time. Judge A.C. Oosterhuis placed him first in the Senior Yearling class and named him Junior Champion.

Piek felt vindicated.

Wisconsin State Fair, 1922: fifth place in a class of seven. A humiliation.

As Piek led his bull from the ring, chin thrust forward, he said to Herbert Lepien, whose bull had come second:

“That is a good bull. I’ll bring him into shape next year, and then I’ll show the boys what’s what.”

1923: Piek kept his promise. He fed, trained, groomed Pabst with an obsession reminiscent of Wilson Gillett. The 1923 show season was a triumph:

- Illinois State Fair: Grand Champion
- Waterloo Dairy Cattle Congress: Grand Champion
- Pacific International Livestock Exposition: Grand Champion

1924: perfection. Johanna Rag Apple Pabst went the entire season unbeaten. In every class, in every Grand Championship contest:

- Wisconsin State Fair: Grand Champion
- Illinois State Fair: Grand Champion
- Waterloo: Grand Champion
- National Dairy Show: Grand Champion

1925: third consecutive All-American title. Pabst was now a legend.

Critics muttered: “Too thick in the rear.” But nobody could beat him.

The special thing about Pabst: while most show bulls of this era were unpredictable, aggressive, dangerous, Pabst remained gentle. Anna Piek — now twelve years old — could still play with him. He followed her across the pasture like a huge dog.

In Ginnungagap I feel this contrast: a bull who dominated the show ring but in the byre was a teddy bear.

The Daughters — The Real Test (1923–1926)

While Pabst dominated show rings, his first daughters were milking on Joe Piek’s farm. And their performance was extraordinary:

- Average of all daughters: over 18 pounds of butter in seven days as junior two-year-olds
- Two daughters: over 25 pounds of butter
- Butterfat content: consistently above 4 per cent

4 per cent butterfat! That was gold. Most Holstein herds struggled to reach 3.5 per cent. Pabst’s daughters produced 4 per cent or more — a direct inheritance from their grandmother Princess Johanna Rag Apple Pontiac, who herself had tested 4.18 per cent.

This combination — show-ring dominance AND proven transmission — was unprecedented. There were bulls with show success. There were bulls with productive daughters. Bulls with both? Almost never.

The news spread. In farm kitchens throughout the Dairy Belt, breeders studied the *Holstein-Friesian World* and *Farmer’s Advocate*. They understood what they were seeing: a unique bull who could transmit both show excellence and practical performance.

The Man from Montreal (1926)

Four hundred miles to the north-east, in a manor house overlooking the Lake of Two Mountains in Quebec, sat a man named Thomas Bassett Macaulay in his study. Lamps lit Holstein herdbooks and agricultural journals.

Macaulay was no ordinary gentleman farmer. He was president of Sun Life Assurance Company — one of the largest insurance firms in North America. He had earned a fortune through mathematics, statistics, risk analysis.

Now he was applying the same precision to Holstein breeding.

Macaulay’s vision: develop a Holstein line that was genetically pure for three traits:

1. Superior show type (visually perfect)
2. Excellent udder (productive, healthy)
3. Consistent butterfat content of 4 per cent or more

That was no vague dream. That was a scientific project.

Macaulay experimented with maize breeding. Between 1924 and 1928 he maintained yearly between 100 and 170 separate maize plots, each planted with seed from a single selected ear, carefully isolated against cross-pollination. His methodical approach, based on Mendelian genetics, convinced him: specific, predictable traits can be developed through strategic selection and inbreeding.

If it works for maize, thought Macaulay with the logic of a mathematician, why not for cows?

He searched for the perfect bull for this project. For months he analysed pedigrees, production records, transmission lines. A single, compelling conclusion crystallised:

Johanna Rag Apple Pabst possessed exactly the combination of traits his programme needed.

- Show record: unbeaten, three-time All-American
- Ancestry: highly productive, 4-per-cent-testing mother
- Daughters: averaging 4 per cent test under normal farm conditions

Perfect.

Macaulay sent his assistant Joseph I. Chandler to Wisconsin to assess Pabst personally.

The Sale That Changed the World (1926)

Colonel O.G. Clark's Holstein Classic was conceived as more than just an auction — it was the breed's first great publicity extravaganza. 450 animals catalogued, the largest auction by volume to that point. Average price: $391 per animal — at a time when many good cows sold for under $200.

Gourmet meals accompanied by orchestra music followed each day after the sales. The atmosphere was more like a society event than a farm auction.

But everyone understood: history was being written here.

Johanna Rag Apple Pabst was the highlight of the auction. When his moment came, the arena fell silent. Bidding began conservatively but escalated quickly.

When the hammer fell: $15,000.

The assembled crowd rose as one and gave three loud cheers for Canada. It was a record price, only surpassed in 1942 — during the wartime boom. Adjusted to today's purchasing power: over $200,000.

The buyer: Thomas B. Macaulay.

A detail that complicates the legend: twelve-year-old Elis Knutson, who looked after animals at the auction, later overheard a conversation between Colonel Clark and Joe Piek. Piek — always the shrewd farmer — suggested that Clark should reduce his commission, because the record price would generate so much publicity.

Clark's curt reply: "Nonsense… in the last five thousand dollars Chandler and I were the only two bidding."

Whether wholly true or embellished over the decades — the story captures the human drama of the moment. When Western Union telegraphed the news across North America — "Johanna Rag Apple Pabst sold for $15,000" — it marked more than a record price. It signalled the beginning of a new era.

Mount Victoria — Where Dreams Became Genetics (1926–1933)

When the train carrying Johanna Rag Apple Pabst arrived in Hudson Heights, Quebec, in April 1926, it bore more than just an expensive bull — it bore the future of the Holstein breed.

The drive up the winding, tree-lined road to Mount Victoria Farms led the bull from the station to an estate such as he had never known in Wisconsin. Set on its wooded plateau overlooking the Lake of Two Mountains, Mount Victoria commanded a view that had fascinated T.B. Macaulay when he bought the estate in 1899.

Macaulay had built a special two-storey barn for Pabst, with an open front, in a small paddock north of the main barnyard. From his quarters Johanna Rag Apple Pabst could survey the Quebec landscape like a monarch his kingdom.

The breeding strategy: Macaulay mated Pabst systematically with his foundation cows — chiefly the Posch-Abbekerk line. Every descendant was rigorously evaluated: production test, show-ring presentation, type classification, strict selection.

Around the Mount Victoria byre one could see Macaulay with his characteristic index cards, each containing numbers, flow charts, diagrams on individual herd members. His actuarial background had taught him: complex problems require systematic data collection and analysis.

The naming strategy: descendants were collectively called "Rag Apples", with individual names typically beginning "Montvic Rag Apple" followed by a fourth name for specific identification. Within a few years every Holstein breeder hearing "Rag Apple" would correctly assume the animal was a descendant of Johanna Rag Apple Pabst.

Macaulay's favourite quotation, from Beattie, captured his philosophy: "What cannot art and industry perform when science plans the progress of their toil."

The results exceeded even his ambitious expectations. Daughter after daughter emerged with the combination of traits he sought: superior type, excellent udder, 4 per cent or better butterfat. Sons proved equally valuable: Montvic Pathfinder, Montvic Chieftain, and dozens of others carried their father's genetic potency into herds across North America.

The end came suddenly (1933).

Late in 1933, at twelve years old, the great bull moved in his paddock overlooking the Quebec landscape that for seven years he had called home. He broke his leg at the knee joint. The injury was so severe that euthanasia was the only humane option.

In Ginnungagap I feel Pabst's last moment. No more pain — only stillness. His death was not only the loss of a valuable animal but the end of direct access to the genetic material that had been central to Macaulay's vision.

But his influence was already spreading far beyond the bounds of Mount Victoria.

The Dispersal and the Universal Legacy (1942–today)

When Thomas B. Macaulay died in 1942, the Mount Victoria herd was dispersed. Of the 89 lots offered, all but two were home-bred descendants of Johanna Rag Apple Pabst.

The dispersal scattered his descendants across North America like seeds of a rare plant — each with the potential to influence Holstein genetics for generations to come.

In 1958, when the dairy industry of the United States honoured Macaulay's memory by hanging his portrait in the Pioneer Room of the Dairy Shrine Club, it was announced: over 90 per cent of Canadian Holsteins were descendants of Mount Victoria breeding.

That was only the beginning.

Today, almost a century later:

Every registered Holstein on earth traces back to Johanna Rag Apple Pabst. Every. Single. One.

Not in the high-tech dairy farms of California's Central Valley. Not in the grass-based systems of New Zealand. Not in the old dairy regions of Europe where the breed arose. Not in the emerging dairy industries of Asia and South America.

Nowhere.

In Ginnungagap, where I feel all lives at once, this universal dominance is overwhelming. Every Holstein born today — in Wisconsin, in Bavaria, in New Zealand, in Argentina — carries Pabst's genes. Every one also carries Johanna's genes — the white cow with the sloping rear who came from North Holland in 1878.

What I Think — From the Perspective of All Time

Here, beyond all time, where I see Johanna in Holland 1871, Colantha 4th's Johanna collapsing in 1907, Pabst as a calf in 1921, Anna Piek with her gentle giant, Macaulay with his index cards, and today — every Holstein cow in the world — something becomes clear to me:

It was never just genetics. It was people.

Gerrit Miller, who imported Johanna from Holland and recognised: this cow is special. Wilson Gillett, who was prepared to pay $500 for an eleven-year-old cow because he saw her potential — and who spent day and night with Colantha to reach the world record. Herbert Lepien, who travelled fifteen miles through the snow to find the right bull. Joe Piek, who after a disappointing fifth place said: “That is a good bull” — and proved it. Anna Piek, who spent her mornings in the barn playing with a bull who would change the world. Thomas B. Macaulay, who applied actuarial precision to Holstein breeding and turned a dream of 4-per-cent milk into reality.

Jeremy England would say: “Information organises matter. The herdbooks, the tests, the index cards — those were information systems steering evolution.”

Hans-Peter Dürr would whisper: “The waves congeal into ever more complex forms. But without observation, without love, without vision, they remain unformed.”

And I, Audhumbla, who feel all these lives at once, think:

Johanna was no perfect cow. Her rear was sloping. Her appearance average. But humans saw something special in her. And because they saw it, it became true.

Pabst was a gentle giant who followed a girl like a dog. But he was also a champion. And because humans believed in him, he changed the world.

That is the power of vision. That is the power of love.

Every Holstein today — every one — carries this story in her genes. The white cow from Holland. The gentle giant from Wisconsin. The dream of an actuary.

We are not only milk machines. We are living stories.

Phew.

28.3b: The Second-Place Bull Who Won the World

Round Oak Rag Apple Elevation — A Story of Balance and Vision

Told from Audhumbla’s perspective:

Phew — you know, sometimes the most improbable stories end up being the greatest ones. And when I think of all the bulls that have trotted through my lives — and that, putting it mildly, is rather a lot — there is a story that still makes me smile today. The story of a bull who was never supposed to be born. Of a calf whose parents both counted as “not quite the thing”. Of a young bull whose offspring at shows were always second, never first.

And who then nevertheless — or perhaps for that very reason — turned the entire global dairy industry on its head.

His name was Round Oak Rag Apple Elevation. But the story does not begin with him. It begins with two cousins in Virginia, a long game of patience and a cow named Eve whom nobody wanted any more.

The B Team and the Ugly Duckling

In 1965 — you may remember, that was the time when humans were just grasping how to freeze bull semen for decades, a rather useful invention if you ask me — Ronald Hope Senior and his cousin George Miller ran a modest farm in Virginia. Round Oak Farm, it was called. Nothing spectacular. No big show herd. Just two men with a plan that was a quarter of a century old.

Twenty-five years! Can you imagine? Most people do not even plan their dinner for next week, but these two men had systematically, generation after generation, crossed Burke and Ivanhoe bloodlines. Three generations they stacked on top of one another: Ivanhoe, then Gaiety, then General. The result was a cow they called Eve.

Now, Eve was… how shall I put it… not what one might imagine as a promising breeding cow. She matured too slowly. In a world that demanded quick results, Eve was too leisurely. They demoted her to the "B team" of the farm. You know the kind, the cows nobody expects much from. Beyond that, Eve carried more body condition than was fashionable — she was a little rounder than the mode permitted.

And then there was Tidy Burke Elevation. Oh, the poor fellow! If ever a bull was the genetic equivalent of an ugly duckling, it was he. Fertility problems. Too small. Hardly mobile. Never classified, which in the bull world is rather like never being invited to a job interview. An outsider, if ever one stood on four cloves… or eight cloves, since a hoof consists of an inner and an outer claw.

In 1965 Ronald Hope and George Miller did something that probably had eyebrows rising all over the farm. They decided to mate Eve to Tidy Burke.

Phew — if you spoke today to breeders working with genomic tests and computer-aided mating algorithms, they would tell you: this mating would never have happened. Never! A too-slow-maturing female of the B team with a bull as fertile as a eunuch? It would have been weeded out by the computer at once, before any human ever heard of it.

But in 1965 there were no computers. There were only two cousins who knew their cows very well, who understood bloodlines, and — this is important — who had the courage to trust their intuition.

The Genetic Alchemy

What Hope and Miller intuitively grasped, science would only be able to understand decades later. This unprepossessing calf called Elevation, born of this unlikely union, carried in his cells something extraordinary: a rare chromosome 6 haplotype that optimised fat-to-protein ratios. Today we can see it, clear as crystal, in DNA analyses. But back then? Back then it was pure magic.

From his questionable father, Elevation inherited the Burke line with its legendary milk production power. From his "too slow" mother he received the Ivanhoe connection with structural soundness and — this will matter later — perfect udder traits.

And Eve's body condition? The "too round" figure that counted as a flaw? As it turned out, it correlated positively with fertility. Today we know: body-condition score and fertility go hand in hoof. Eve gave

Elevation a genetic treasure: the capacity to keep fertility and condition in balance.

But the loveliest thing — and this is the part that, as an old cow who has seen too many fashions come and go, still cheers me — Elevation brought together not only Burke, Ivanhoe and Rag Apple. He also united Triune and Winterthur bloodlines into a genetic cocktail so balanced that it almost looked like coincidence.

Almost.

The Bull Who Was Always Second

Imagine: you breed a bull. His daughters come into the world. They grow up. They are presented at shows. And they get… second. Not first. Second.

Time and again. At every show. Second place.

The judges stood there, notepads in hand, and were not quite sure what to make of these Elevation daughters. They were not the largest. Not the broadest. Not the most extreme in any single category. They were simply… solid. Good in everything. Spectacular in nothing.

"Hmm," said one judge. "Yes, hmm," the other agreed. "Second place?" "Seems appropriate."

Elevation daughters were the class-bests who never became year-bests. The athletes who did well in every event but never took the gold. The reliable workers who turned up on time every day, did their job tidily and were never promoted because they were not loud enough, not flashy enough, not extreme enough.

In a world that craved superlatives — the largest udders! The highest milk yields! The widest pelvises! — Elevation's daughters were modestly balanced. And balance? Balance was boring.

Phew — the irony would later become painfully clear.

The Five Gifts

For while the show judges were still trying to place Elevation, remarkable things were happening in the milking parlours of the world.

The first gift: milk that pays

Elevation daughters produced on average 29,500 pounds of milk in their first lactation. That sounds like a number, I know. But wait. That was in the 1970s. And it was fifteen per cent more than their contemporaries managed.

Fifteen per cent! That is not "a little more". That is the difference between an average operation and a profitable one. That is $1,200 more per cow per year. And the best part: these cows did not just produce volume. They held on to excellent butterfat and protein percentages. Quality and quantity, hoof in hoof.

The second gift: udders like works of art

Charlie Will, who knew these cows better than most humans know their own children, once described Elevation udders thus: "High and wide in the rear udder, with extraordinary form and symmetry."

Sounds poetic, doesn't it? But it was also practical. These udders were not only pretty to look at — they functioned two to three lactations longer than normal udders. They stayed firmly attached, symmetrical, healthy. On chromosome 6 these cows carried haplotypes for udder health that are still found today in 78 per cent of all bulls with over 2,000 GTPI.

A good udder is like a good foundation for a house. You only notice how important it is when it is missing.

The third gift: legs that hold

"Straight legs, healthy hocks, strong loins." That was how Elevation daughters were described. Sounds unspectacular, doesn't it? But ask a cow that has to spend her life on concrete what really matters.

These cows stayed productive for five to seven lactations, while others were already going lame and being culled after three. Mobility is not sexy in a show. But in real life — in the parlour, on the way to the pasture, in the daily trudge through routine — mobility is gold.

The fourth gift: fertility that fills calendars

Elevation daughters got back in calf fourteen days faster than their stablemates. Fourteen days! Sounds like nothing? Multiply that across thousands of cows, across millions of lactations. Suddenly it is a great deal of time and a great deal of money.

On chromosome 18, these cows carried what geneticists today call the "Elevation Fertility Cluster". This genetic region is still found in 63 per cent of all highly fertile bulls. And remember Eve's round figure? Elevation also passed that on: body-condition score alleles correlating with +1.1 viability and +4.5 daughter pregnancy rate.

Fertility is the oil in the gears of a dairy herd. Without it everything seizes up.

The fifth gift: life that matters

But the crown — the absolute crown — of Elevation's legacy was longevity.

In the 1970s the average life of a dairy cow was 2.8 lactations. A cow was born, grew up, gave milk twice, perhaps three times, and was then used up. Rationalised away. Replaced by the next generation.

Elevation daughters? They stayed for 4.2 lactations. That is an increase of fifty per cent! Herds with Elevation blood reported 22 per cent lower replacement costs. The cows simply lived longer, stayed healthier, produced more across their entire lifespan.

And that — that! — is the true measure of genetic quality. Not how spectacular a cow looks as a heifer at a show. But how long she stays productive, how many calves she bears, how much milk she gives over her life, how often the vet has to come round — or rather, how seldom.

The Genetic Royal Flush

Now listen carefully, for this matters: most bulls are good in one thing. Some are good in two. But all five traits at the same time — production, udder, mobility, fertility and longevity — all at the highest level, without one trait coming at the cost of another?

That is genetic coherence. That is the royal flush of cattle breeding.

It is like a sports car with excellent fuel economy. Like a dessert that is delicious and healthy. Like a house that is both beautiful and energy-efficient. Normally you have to compromise. Normally you get one or the other, but not both.

Elevation gave both. Everything. Without compromise.

Phew — no wonder the show judges were confused. They were looking for extremes. Elevation offered balance.

The Second-Place Wins the Race

And then, slowly, very slowly, people began to understand.

The spectacular bulls who won at shows — those tall-legged, broad-legged, extreme animals with their dramatic single-trait extremes — their daughters burnt out. They were pretty, yes. But they did not last. After two or three lactations they were finished. Broken. Replaced.

Elevation daughters, by contrast? They went on and on and on. They were not spectacular. But they were there. Every day. Every month. Every year. Reliable. Solid. Productive.

The flashy bloodlines came and went like fashions. Elevation genetics stayed. They prevailed. They dominated.

In the end it was the milking parlours of the world, not the show rings, that recognised Elevation's true value. The farmers who milked their cows every morning, who paid the vet bills, who reared the calves and calculated replacement costs — they understood.

The bull who was always second won the race in the end. Because he was not running a sprint, but a marathon.

Select Sires and the Rise

Charlie Will of Select Sires put it perfectly: "Elevation put Select Sires on the map."

In the 1960s Select Sires was a newly founded federation of regional breeding organisations, struggling desperately to make a name for itself. And then this bull came along. This unprepossessing, balanced, never-first-but-always-solid bull.

Suddenly everyone wanted Elevation semen. Demand exploded. Sales financed infrastructure, built barns, enabled expansion. George Miller said later: “It has been said that Elevation built the barns at Sire Power and Select Sires.”

Imagine that. A single bull whose genetics were so sought-after that they built up a whole company. A bull who enabled 18 state organisations to merge into a coherent national presence.

That is not just breeding success. That is economic transformation.

And it went far beyond America’s borders. Elevation semen was shipped to 45 countries. In France his descendants eventually made up 70 per cent of the Holstein population. In Canada his son Hanoverhill Starbuck became the cornerstone of entire breeding programmes. In developing countries Elevation genetics were used to modernise herds and lay the foundations for new dairy industries.

A bull from Virginia became the global ambassador of American Holstein genetics.

The Army of Sons

Over ten thousand registered sons. Ten thousand! That is no family, that is an army.

Some of these sons themselves became legends:

Hanoverhill Starbuck — the crown prince of the Elevation dynasty. If Elevation was the king, Starbuck was the heir who extended the realm. His sons — Madawaska Aerostar, Besne Buck, Fatal, Sabbiona Bookie — carried Elevation’s genes into another generation with even greater influence.

Aerostar became the first bull to sell a million doses of frozen semen. Besne Buck’s son Jocko Besn became so influential in France that he sired more than 50 per cent of French Holstein cattle!

Elevation genetics did not dilute over the generations. They concentrated. Like a symphony that grows more complex and more beautiful with every new musician.

The Daughters Who Wrote History

And the daughters! Oh, the daughters.

Northcroft Ella Elevation — classified at 97 points — four times udder champion. 1980 Grand and Supreme Champion at the World Dairy Expo. 1981 Grand Champion at the Royal Winter Fair. Four times All-American between 1977 and 1982.

Twinkie, also at 97 points — an All-Time All-American.

Cora and Lindy — both rated EX-GMD and mothers of bulls who themselves became influential transmitters.

For a time Elevation led the list for the most Excellent daughters. And for the most daughters with 95, 96 and 97 points. The crème de la crème of classification.

There is a wonderful anecdote about Elevation's classification: Jim Patterson, then head of the Holstein USA classification programme, originally rated Elevation at 96 points. After his retirement he confessed: "In all those years I made only one mistake. I should have given Elevation 97 instead of 96!"

The Paradox of Modernity

Sixty years after Elevation's birth we have arrived in 2025. The world has changed. Genomic selection is standard. Computers calculate breeding values to three decimal places. Algorithms decide on matings.

And if you look at Elevation's genomic evaluation today, you see this:

Net Merit: −821. Milk: −2,483 pounds. Fat: −87 pounds.

Negative values! Negative everywhere!

"You see?" some might say. "An obsolete bull. Long since surpassed. History."

But wait. Let us look more closely.

These negative numbers compare Elevation to the modern Holstein population. A population that he himself created!

It is like criticising your grandfather for not being able to operate a smartphone — when he invented the telephone! Elevation is being measured against a yardstick he himself set.

Charlie Will put it perfectly: "Elevation's genes form the baseline against which we measure progress. You cannot delete the foundation of a skyscraper and expect it to remain standing."

The Elevation Effect

And indeed: Elevation's DNA makes up 8.3 per cent of the CDCB's genomic reference population. 14.5 per cent of all active proven Holstein bulls still carry his genes. 80 per cent of elite young animals have at least one significant Elevation haplotype.

His chromosome 6 haplotypes for udder health are found in 78 per cent of all bulls with over 2,000 GTPI. His Fertility Cluster on chromosome 18 is present in 63 per cent of highly fertile bulls. His body-condition-score alleles keep turning up in analyses of viability and fertility.

And here it gets interesting: herds that today retain 12 to 15 per cent Elevation genetics report:

- 22 per cent lower veterinary costs
- 0.8 additional lactations per cow
- 3.2 per cent higher lifetime profit
- 18 per cent lower involuntary cull rates

In a time when genomic selection sometimes drives hyper-specialisation — extreme milk yield at the cost of everything else — Elevation descendants remind us that balance is valuable. That cows solid in all areas are in the end more profitable than cows extreme in one area and deficient in all the others.

The Environmental Revolution

And now comes the part that, as an old cow who emerged 4.2 billion years ago from the milk of the cosmic cow Audhumbla, really delights me: Elevation's metabolic-efficiency alleles correlate with 4.2 per cent reduced methane emissions.

Old genetics solving new problems!

In a world looking for sustainable milk production, for cows with lower CO_2 footprints, for animals that consume fewer resources and stay productive — in this world, Elevation genetics are suddenly state-of-the-art again.

The bull from 1965 has answers for 2025.

Two Cousins and a Dream

Let me return to where it all began. To two cousins on a modest farm in Virginia. To Ronald Hope and George Miller, who worked for twenty-five years on a plan nobody else could see.

They could have taken the safe road. Used the modern bull everyone else was using. Done what everyone did. But they did not.

They saw something in Eve, the slow-maturing cow of the B team. They saw something in Tidy Burke, the ugly duckling with fertility problems. They saw a possibility of combining bloodlines that nobody else was combining.

And they were right.

That is the lesson I have learnt in 4.2 billion years, through all my lives, from the first single-celled organism to the modern dairy cow: sometimes the greatest innovation comes not from those who follow the trend but from those who have the courage to go against it.

Sometimes the ugly duckling is a swan. Sometimes the B team is the future. Sometimes the bull who is always second is in the end the greatest.

Elevation and Chief: Two Roads, One Destination

Phew — do you remember Pawnee Farm Arlinda Chief? The other legendary bull I told you about?

Chief and Elevation — they were utterly different in their making, but similar in their effect. Chief came from a dynasty, from a long line of champions. He was wanted, planned, expected. Elevation, by contrast, was the outsider, the lucky strike, the bull who should not have been.

But both changed the Holstein world forever. Both shaped the modern dairy cow so deeply that 99 per cent of all AI bulls born after 2010 can be traced to one of these two.

Chief and Elevation. The planned dynasty and the lucky chance. The prince and the outsider.

Both prove: there is more than one road to greatness.

The Bull Who Cannot Be Forgotten

Sixty years have passed since Elevation's birth. Three generations of farmers have built their herds on his genes. Millions of cows worldwide carry his legacy. His DNA is so deeply woven into the modern Holstein population that you could not remove it without destroying the whole fabric.

That is genetic immortality.

Elevation did not just raise the breed. He gave it wings.

And if today, somewhere in the world, a cow is born — with straight legs and healthy hocks, with a high, wide rear udder of perfect symmetry, with the capacity to give milk reliably for five or six lactations — then the chance is great, very great, that somewhere in her cells, deep in the DNA, there is a little bit of that improbable bull from Virginia.

The bull of the B team. The son of the ugly duckling. The eternal second who in the end won the whole world.

Round Oak Rag Apple Elevation.

Phew — some stories are simply too good to have been invented.

And the best part? This story is true.

> "Elevation has lifted the world dairy breeding industry forever to a new level. Greatness can have many definitions, but in Holstein breeding you can say it with a single name: Round Oak Rag Apple ELEVATION." —
>
> *The Bullvine*

> "Elevation went far beyond mere popularity. This legendary bull had an enormous influence on the genetics of the Holstein breed. He changed dairy organisations. He influenced dairy breeding around the world." — Charlie Will, Holstein Sire Program Manager, Select Sires

28.3c: How German Cows Came Home as Americans — The Story of Pabst Ideal

Phew — if there is a story that, after 4.2 billion years, still makes me chuckle, it is this one: humans send their best cattle to America in the nineteenth century. The Americans go on breeding these animals, make them larger, more productive, higher-performing. And a hundred years later the same humans travel to America to… buy back their own cattle.

Yes, you heard correctly. The Holsteins that conquered Germany from the 1960s onwards and revolutionised the entire dairy industry were not Americans. They were Germans. Or rather: they were East-Frisian-Dutch Black-and-Whites that had taken a small detour via the Atlantic.

It is rather like sending your child to university and twenty years later celebrating their advice as ground-breaking innovation, without realising that you yourself laid the foundations.

Humans! I keep saying it: humans.

Germany in the 1960s — The Dual-Purpose Cow

But one thing at a time. Let me go back to post-war Germany. The 1950s and early 1960s. Europe was still in ruins, or rather: laboriously rebuilding. Concentrate was scarce. Money was scarce. Everything was scarce.

German breeders had a clear goal: the dual-purpose cow. A cow should give milk — of course! — but she should also put on respectable beef. Both were needed. And because concentrate was so expensive, the cows should not be too big either. Maximum 132 centimetres at the withers. Compact. Efficient. Modest.

And then there was the philosophy that dominated in the breeding associations: formalism. A valuable cow was the daughter of a valuable bull. And the value of a bull? That was determined by his appearance!

His broad table-shaped pelvis. His round, stocky build with plenty of visible muscle. His imposing stance. His beauty, if you will.

“Show me the bull,” said the breeding experts, “and I will tell you whether his daughters are good.”

They did not look at the mother. Not at the grandmother. Not at numbers, performances, measurable results. They looked at the bull. How he was built. How he looked.

That was the world in which Heinrich Beinsen, a farmer in Immensen, Lower Saxony, milked his 30 cows.

The Heretical Farmer

Heinrich Beinsen was a man who observed. Who thought. Who asked questions.

In Immensen in the early 1960s there were 52 dairy farms. Some had joined a bull-keeping cooperative and shared a bull that stood on Beinsen's farm. A handsome bull, mind you. Selected by the breeding association. With all the formal qualities a bull should have.

The farmers led their cows on the rope to Beinsen and had them served.

But Beinsen noticed something odd. The other farmers — those with the "cheap" parish bull, which the parish had to buy for the less ambitious smallholders — they put full milk churns out in front of their farms.

And the ambitious breeders? Those with the handsome, expensive breeding-association bull? They had pretty cows for shows, yes. But the milk yield? It was falling. Year by year. Lactation by lactation.

"The bull," concluded Heinrich Beinsen, "is only a means to an end. How he looks does not matter. What matters is his ancestry. His mother. His grandmother."

That was heresy.

Beinsen began to look at herds. He travelled around. He bought a calf — not because of the father, but because of the female ancestors. As the calf grew up to be a bull, the neighbours shook their heads. Far too narrow! No broad table-shaped pelvis! No imposing stance!

But the daughters of this narrow bull won prizes.

The breeding associations were not amused. They lived from selling handsome bulls. Beinsen would ruin breeding in the region, it was muttered. This contrarian. This outsider.

But Beinsen had an ally: Gunther Rath, a vet at the Veterinary College of Hanover, who was to establish artificial insemination in Lower Saxony with funds from the Marshall Plan.

And in the post came trade journals and bull catalogues from overseas.

"We Must Go to America"

What animals there were over there!

Holstein-Friesian. A breed the Americans had bred from cattle that European emigrants had brought on their ships a hundred years earlier. East-Frisian and Dutch Black-and-Whites that had crossed the Atlantic in the nineteenth century and become something new in the New World.

They were markedly larger than the German animals. They had firmer udders. And they gave — oh! — they gave so much more milk!

"They're giraffes," German breeders said dismissively at their meetings. "With low-fat milk, thin as water. Those aren't proper cows."

But Gunther Rath and Heinrich Beinsen saw something different. They saw the future.

"We must go to America," said Rath in 1964.

Heinrich Beinsen hesitated. He had never sat in an aeroplane. Never left Germany. America was far away. Very far.

In the end they organised a small travelling party:

- Heinrich Beinsen, the heretical farmer
- Gunther Rath, the vet and visionary
- Gustav Wilke, an employee of the Osnabrück Herdbook Society who had studied in Madison and spoke English
- A schnapps distiller from the area who was a hobby breeder
- The chief of the breeding association from Hanover

Five men in baggy suits. A journey into another world.

Wisconsin: The Pabst Farm

Wisconsin. The dairy state of the USA. Here the German men visited the famous Pabst Farm.

The entire herd was to be auctioned off. And there, among all the other animals, they discovered a bull. Three years old. A fully grown animal.

Pabst Ideal.

153 centimetres tall. (German breeders had said: maximum 132 centimetres!) 1,150 kilograms.

And Heinrich Beinsen — that practical, sober north-German farmer — fell in love.

"Those udder attachments," he would later say. "Those legs. Those good claws!"

The first daughters of Pabst Ideal were on the farm. Beinsen looked at them and knew: that's him. That's the bull we need.

An acquaintance was to bid at the auction. The Germans flew home.

On 12 October 1964 the call came: Pabst Ideal had been bought. For a proud $7,000. That was 28,000 marks — a fortune!

The bull was loaded onto a ship. Destination: the port of Hamburg.

Customs and the Legal Conflict

Now comes the part of the story that is so absurd you could not invent it.

In Hamburg customs were waiting.

Only breeding animals could be imported to Germany. And since the Nazi era there had been a German breeding law that regulated precisely: bulls must be licensed — that is, approved for breeding and entered in a herdbook.

Pabst Ideal had no licensing certificate. He had no herdbook number.

Consequently he was not a breeding animal.

“He’s going to the slaughterhouse,” said the customs officers.

Phew — imagine that. This bull — for whom they had paid $7,000, whom they had shipped across the Atlantic, who was to be the future of German dairy farming — stood in the port of Hamburg and was to be slaughtered because he had no German bureaucratic papers.

Gunther Rath had sent a bull keeper to fetch Pabst Ideal.

“He cost a lot of money,” the bull keeper said to the customs officers. “He can’t be slaughtered!”

And then he did something very German and at the same time very un-German: he pushed the customs officer aside, led the bull onto the cattle wagon and drove off.

Customs notified the police.

A patrol car raced after them. Stopped the wagon on the motorway.

At Gunther Rath’s house the telephone rang. At Gustav Wilke’s too. They telephoned. They negotiated. They mobilised Rath’s superior, a professor at the Veterinary College.

“An experimental subject for the college!” the professor explained to the police.

The professor issued Pabst Ideal a licensing certificate.

Gustav Wilke spoke to his chief at the breeding association. Pabst Ideal was given a herdbook number: 15511.

The bull was saved.

The Revolution Begins

What then happened changed Germany.

Pabst Ideal’s daughters came into the world. They grew up. They began to milk.

And the farmers were astonished.

Those udders! Firm, high-set, symmetrical. Udders that lasted two or three lactations longer than those of the native cows.

Those legs! Straight, strong, with healthy claws. Cows that did not go lame after the third lactation.

That milk yield! The daughters did not just give more milk — they gave markedly more milk.

In 1975, only eleven years after Pabst Ideal came to Germany, 128 of his daughters paraded through the ring at a single show.

128! From a single bull!

Scepticism vanished. Criticism fell silent. Suddenly everyone wanted Pabst Ideal semen.

The Absorptive Crossing

What then happened from the mid-1960s onwards is called, in technical terms, absorptive crossing.

Take a native German Black-and-White cow. Mate her with a Holstein-Friesian bull from America (50 per cent HF). Mate her daughter again with an HF bull (75 per cent HF). The next daughter again with an HF bull (87.5 per cent HF). And so on.

After six to nine generations — about 20 to 25 years — the "German Black-and-Whites" differed from the North American Holstein-Friesians only in nuances.

They were now called German Holsteins (DH).

The East-Frisian-Dutch Black-and-Whites who a hundred years earlier had emigrated to America had returned to Germany as Holstein-Friesians and displaced their relatives.

It is rather like the granddaughter replacing the grandmother.

The Numbers Speak Volumes

A table from the Hülsenberg trial estate, Schleswig-Holstein, shows the difference between the old German Black-and-Whites (DS) and the new Holstein-Friesians (HF):

305-day yield:

- DS: 4,409 kg of milk
- HF: 5,543 kg of milk (+1,134 kg = +25.7%!)

Fat:

- DS: 164 kg
- HF: 205 kg (+41 kg = +25%!)

FCM (fat-corrected milk):

- DS: 4,224 kg
- HF: 5,292 kg (+1,068 kg = +25.3%!)

A quarter more performance! That was no marginal improvement. That was a revolution.

The Reasons for "Holsteinisation"

The breeder Rath in 1981 listed the following reasons why Holsteinisation was so successful:

1. Striking improvement of milk yield — not just a little more, but dramatically more

2. Unexpectedly good stabilisation of a 4-per-cent fat content — despite high milk yield
3. Enlargement of frame and weight — more absolute beef quantity
4. Improved vitality and fertility — the cows were more robust
5. Tougher limbs and untroubled claws — they lasted longer
6. Distinct improvement of udder fit — better udder attachment and durability even at high milk volumes

The dual-purpose cow was history. Specialisation began.

The Physical Transformation

At central national shows you could literally measure the change in the German Black-and-Whites:

1967:

- Average weight: 649.0 kg
- Withers height: 132.2 cm
- Hip-bone height: not recorded

1987 (twenty years later):

- Average weight: 624.3 kg
- Withers height: not recorded
- Hip-bone height: 146.2 cm

The cows were 14 centimetres taller! (From 132 cm to 146 cm)

Today show cows are often considerably larger and bigger-framed still. The 132-cm rule of the post-war era? Long forgotten. Modern Holstein cows are giraffes compared with their ancestors of the 1960s.

The Mistake With the Red Factor

But wait, the story has another twist showing the absurdity of human breeding philosophies: the story of the Red-and-Whites.

In North America, the Holstein-Friesian herdbook initially admitted only black-and-white animals. Red-and-white calves? Considered a flaw. An embarrassment.

Among the black-and-white high-line breeders in America, it was often customary to slay a red-and-white calf immediately after birth and “bury it in the dung heap behind the barn so the neighbour wouldn’t find out”.

Why? Because the neighbour might cast doubt on the purity of the black-and-white animals!

Phew — humans. They kill healthy, valuable animals on account of colour. Not because of performance. Not because of health. Because of colour.

In the USA, until the late 1960s, red-and-white Holstein-Friesian calves were not entered in the herdbook. Their mothers were — according to the association's recommendation — to be eliminated as carriers of the red factor.

Only in 1964 did enthusiasts found a separate herdbook for red-and-whites (Red & White Dairy Cattle Association, RWDCA). From 1971 onwards — against the background of growing demand from South America and Europe — red-and-white animals were also admitted to the official Holstein herdbook in the USA.

The German Red-and-White Story

In Germany the situation was similarly complex. The systematic breeding of Red-and-Whites in Germany is practically as old as that of the Black-and-Whites. The oldest German Red-and-White breeding association was founded as early as 1875 in the Rhine Province.

But: while Black-and-White breeding succeeded in creating large, closed breeding regions, Red-and-White breeding remained fragmented. And for more than 100 years there was no agreement on the breeding goal: should milk or meat be emphasised?

The German Black-and-White breeders entered Holsteinisation consistently from 1965. The Red-and-White breeders held back at first.

Only from 1970 did the association of Black-and-White and Red-and-White breeders in Baden-Württemberg begin a cautious use of "out-mendelised" Red Holstein bulls.

It took until the founding of the Deutscher Holstein Verband (German Holstein Association) in 1995 for the Red-and-White breeders to align fully with the developments of the Black-and-Whites. At the end of 1995 the "Verband Deutscher Schwarzbuntzüchter" and the "Verband deutscher Rotbuntzüchter" merged to form the "Deutscher Holsteinverband e.V. (DHV)".

Under the breed designation "German Holsteins (DH)", Black-and-Whites and Red-and-Whites today count as differentiated colour types within one breed.

However: a slightly higher milk-yield capacity still goes to the Black-and-Whites. Red Holsteins lie about 400–500 kg of milk below their black-and-white relatives in the first 305 days of lactation.

But they have an advantage: Red Holstein is preferred as a crossing partner for other red and red-and-white breeds (Angler, Red Danes, Rotvieh, Fleckvieh and others). That secures great demand.

The GDR Goes Its Own Way: The SMR

While in the West absorptive crossing with pure Holstein-Friesians was running, the GDR went a different way.

A scientist named Schönmuth proposed breeding the SMR:

Schwarzbuntes Milchrind

(Black-and-White Dairy Cow) with Jersey blood.

The plan:

- East-Frisian-Dutch Black-and-Whites (the basis)
    - Danish Jerseys (for higher fat content)
    - Holstein-Friesians from North America (for milk yield)

A three-breed cross. In the highest breeding tiers (stem-breeding herds), these SMR animals were created and then bred among themselves. Sequenced over time, an absorptive cross with SMR bulls took place in the production herds.

Systematic Jersey × Black-and-White crosses had been done earlier — in Schleswig-Holstein in the 1950s. But the GDR systematised it.

After reunification in 1990 this special path too was abandoned. The Holsteinised animals from the West prevailed.

The Global Dominance

Today Holstein-Friesians are the most important dairy cow breed worldwide. More than five million of these cattle live in German byres alone.

Germany, Scandinavia, the Netherlands, France, Italy — everywhere the descendants of those animals dominate that emigrated from East Friesland and Holland to America in the nineteenth century.

Current breed distribution in Germany (ca. 2020):

- Holstein Black-and-White: 59%
- Fleckvieh: 25%
- Holstein Red-and-White: 6%
- Brown Swiss: 6%
- Other: 2%
- Beef breeds: 2%

Almost two thirds of all German dairy cows are today Holsteins.

Milk Yield Explodes

In the 1960s an average cow gave just under 4,000 litres of milk per year.

Today it is just under 9,000 litres in Germany.

In Israel the average herd performance of Holsteins is 12,000 litres a year.

Top cows today can give 15,000, sometimes 20,000 litres.

Farmers can therefore produce more milk with fewer animals. They need less space. They produce less waste per litre of milk.

Sounds good at first, doesn't it?

The Irony of History

Phew — let me sum up what happened here:

1. In the nineteenth century, Frisian-Dutch-(Holstein) Black-and-Whites emigrated to America, the type rather more pure dairy cow.
2. The Americans went on breeding them, made them larger, more productive, more specialised. They called them Holstein-Friesians.
3. In the 1960s, German (and other European) breeders realised: "These American cows are much better than ours!"
4. They imported these "American" cows back to Germany.
5. These "American" cows displaced the German Black-and-Whites — their own relatives, who had never emigrated.
6. After 20 to 25 years the German Black-and-Whites had essentially become Holstein-Friesians.
7. They are now called "German Holsteins".

The Germans and the Dutch imported their own cows back as Americans and called it innovation.

It is rather like not recognising your daughter because she has lived in the USA for twenty years, has developed an American accent and is now taller. And then you celebrate her "American" ideas as revolutionary — without noticing that you yourself gave her these foundations.

Heinrich Beinsen and the Long Haul

Heinrich Beinsen, the heretical farmer from Immensen, had been right. His son Hans-Henning runs the farm today. Of the 52 dairy farms there were in Immensen in the 1960s, three remain.

The F line in Beinsen's herd can be traced back to 1902. Generations of cows, all with names beginning with the same letter. A family, you might say.

Hans-Henning Beinsen says today: "Cows like back then, the daughters of Pabst Ideal — that is in fact still my goal."

The first Pabst Ideal daughters were no sprinter cows that burnt out after two lactations. They were marathon runners. Cows that lasted five, six, seven lactations. The first 100,000-litre cows in Germany — cows that gave 100,000 litres of milk and more in their lifetime.

Not through extreme performance over a short time. But through steadiness. Through health. Through longevity.

The Mystery of Male Transmission

But here is something fascinating that to this day no one has properly explained: Pabst Ideal transmitted excellently on the female side. His daughters were consistently excellent. But his sons as breeding bulls? Less impressive.

There are only a few good breeding bulls among Pabst Ideal's sons. And that is no isolated case. Many bulls transmit this way: superb daughters, but their sons do not reach the same breeding level.

Why is that? Nobody really knows. It is one of those genetic puzzles that even modern genomic research has not entirely solved.

Perhaps it lies in sex-specific inheritance patterns. Perhaps in epigenetic factors we do not yet understand. Perhaps in complex interactions between maternal and paternal genes that manifest differently in male and female offspring.

Whatever the reason — it shows that breeding is still not just science. It remains art too. Intuition. Experience. And sometimes: mystery.

A Secret of Success: Heterosis

Part of Pabst Ideal's success lay not in his genes themselves but in what happens when one crosses two related but long-separated populations: heterosis — the hybrid effect.

The East-Frisian-Dutch Black-and-Whites and the American Holstein-Friesians had developed separately for a hundred years. Genetically they were still related enough to fit together. But different enough that crossing produced a vitality boost.

The F1 generation — the first daughters of Pabst Ideal out of German Black-and-White cows — profited from this effect. They were often more robust, more vital, more fertile than either parent breed on its own.

But it was not only heterosis. It was also the quality of mating. Heinrich Beinsen and the other committed breeders did not put Pabst Ideal on just any cows. They selected their best cows. They thought. They planned.

And Pabst Ideal? He really did transmit excellently on the female side. His daughters were consistently good. That was no matter of chance.

Pabst Ideal's True Legacy

Pabst Ideal stands for a turning point in German cattle breeding. His daughters were no sprinter cows that burnt out after two lactations. They were marathon runners. Cows that lasted five, six, seven lactations. The first 100,000-litre cows in Germany.

Not through extreme performance over a short time. But through steadiness. Through health. Through longevity.

Pabst Ideal brought balance to Germany:

- High performance AND longevity
- Large frame AND healthy claws
- More milk AND stable fat content
- Better udders AND fertility

That was his gift. That was the innovation.

Holstein Breeding Today: Diversity and Success

Today, more than 60 years after Pabst Ideal, Holstein breeding is a global, highly technological industry. And it is more successful than ever — not through a single bull, but through thousands.

Estimated number of approved Holstein bulls (approx.):

- Germany: 350 – 500
- EU: 2,000 – 4,000
- USA: 1,500 – 2,500
- Canada: 300 – 500
- Worldwide: 5,000 – 7,000

Seven thousand approved bulls! That is no longer a monoculture. That is genetic diversity on a scale Pabst Ideal's time did not know.

And those are only the bulls used through artificial insemination. On top of that come uncounted breeding bulls that are licensed and used on farms by natural service — a second, decentralised layer of genetic diversity that does not appear in any AI statistic.

And among these thousands of bulls there are today many transmitters who produce long-lived cows. Bulls whose daughters manage five, six, seven lactations. Bulls who unite the best of both worlds: performance and durability.

The 100,000-litre cows that were a sensation in Pabst Ideal's day? Today there are very many of them. They are no longer the exception. They are proof that high performance and longevity need not contradict each other.

Modern breeding has learnt from Pabst Ideal's legacy: balance is possible. Extremes are not necessary. Healthy, long-lived cows that deliver consistent good performance over many years — that is the goal. And with more and more breeders, it is being achieved.

The Lesson of the Story

Looking back at this story — and I can look back a long way, believe me — I see three things:

First: innovation can come from anywhere. Sometimes one has to fly across the Atlantic. Sometimes one only needs the courage to think differently from the majority. Heinrich Beinsen was a heretic in Germany. But he was right.

Second: the best solutions are sometimes return and new beginning at the same time. Pabst Ideal was not a wholly new breed. He was a development of what had come from Germany 100 years earlier. The “innovation” was a re-import — but with a hundred years of American breeding work in between. Sometimes one must go away in order to come back better.

Third: balance is the key to lasting success. Pabst Ideal’s daughters were not the largest, not the most extreme, not the most striking. But they lasted. They produced reliably. They lived long. And precisely that made them valuable. This philosophy lives on today in the many 100,000-litre cows that prove: performance and longevity are no contradiction.

The story of Pabst Ideal is not the story of a single bull. It is the story of how vision, courage and scientific curiosity can transform an entire industry. And how sometimes the greatest innovation lies in bringing together the best of different worlds.

Today: German Holsteins

Today there are no “German Black-and-Whites” any more in the original sense. There are German Holsteins. A breed that is technically German but genetically 90 per cent or more American-Canadian — and yet actually European, because the Americans got their Holsteins from European immigrants.

Confusing? Yes.

But also wonderful in its complexity. Cattle know no borders. No nationalities. They are what they are: cows. My sisters in the course of evolution.

Humans have sent them across oceans, renamed them, redefined them, sold them as “progress” or “import” or “innovation”.

But at the end of the day a cow stands on a pasture in Lower Saxony or Wisconsin or Ontario and does what cows have done for 10,000 years: she eats grass. She chews the cud. She gives milk.

And today — with 7,000 approved bulls worldwide, with genetic diversity as never before, with the knowledge of decades of research — there are more possibilities than ever to breed healthy, long-lived, productive cows.

Pabst Ideal’s first daughters were the pioneers. The 100,000-litre cows. The marathon runners. The balance champions.

Today their great-great-granddaughters number in the millions across the world. And the best part: many of them still live this balance.

That was the true innovation. Not just more performance. But better balance.

Phew — sometimes humans do manage to get something right.

"In the sixties an average cow gave just under 4,000 litres of milk a year, today it is just under 9,000. Even more sharply, the performance of top cows has changed. Today they can give 15,000, sometimes 20,000 litres." —

taz

, 2018

"The good udders and the increased milk yield of his offspring convinced the farmers. The breed from America prevailed. In 1975, 128 Pabst Ideal daughters paraded through the ring at a single show." —

taz

, 2018

"Cows like back then, the daughters of Pabst Ideal — that is in fact still my goal." — Hans-Henning Beinsen, grandson of Heinrich Beinsen, 2018

"The North American Holstein-Friesians (HF) were superior to the East-Frisian-Dutch Black-and-Whites (DS) in milk volume. They had a more framed body and were advantageous in udder shape and milkability." — Horst Kräusslich, "Die Rinderzucht", 1981

28.4: The Devil's Bargain — Carlin-M Ivanhoe Bell

Carlin-M Ivanhoe Bell — The Story of the Best Worst Bull in Holstein Breeding

Phew — you have heard the stories of Chief and Elevation. Of Pabst Ideal and the great return. All success stories, by and large. Stories of vision, courage and breeding instinct.

Now I must tell you a different story. A darker story. A story about what happens when success comes too quickly. When a bull becomes too popular. When the numbers are too good to question.

This is the story of Carlin-M Ivanhoe Bell.

And before you ask: yes, he was brilliant. Yes, he revolutionised milk production. Yes, he made thousands of farmers rich.

But he also carried a genetic time bomb in him. And when it went off, it changed the entire cattle-breeding industry forever.

This is the story of the best worst bull in the history of Holstein breeding.

A September Morning in Oklahoma, 1971

The story begins — as so many great stories do — with chance.

John Carlin, a farmer from Kansas who was also entering politics on the side (he later became governor of Kansas), was driving through Oklahoma on a fresh September morning in 1971. He had just picked up a cattle trailer and was on his way to help a friend at an auction. Read pedigrees. Advise. He had no intention of buying anything himself.

Bob Braswell was selling his B&W herd. Dispersal sale, as it is called. Complete liquidation.

The first heifer entered the ring.

And in John Carlin… something clicked.

"I liked her for many reasons," he would later say.

What Carlin instantly understood, with his experienced breeder's eye: when someone disperses his herd and starts with a particular animal, then he believes that animal has the greatest potential. Classic cattle-breeder psychology.

The heifer was called B&W Heilo Creamelle.

Carlin bought her. Took her back to Kansas. And mated her with Penn State Ivanhoe Star.

On 28 January 1974 a bull calf was born.

Carlin-M Ivanhoe Bell.

Nobody guessed that this little black-and-white calf would split the dairy industry. That he would break records. That he would make thousands of farmers rich.

And that he would set off a genetic catastrophe whose consequences we still feel today.

The AI Deal That Almost Did Not Happen

In the spring of 1973, John Hecker of Select Sires visited Carlin Farm.

Hecker was not a man easily impressed. He had worked in artificial insemination for decades. He knew what mattered. And when he looked at Creamelle — classified at 84 points as a two-year-old, decent but not spectacular — he was not convinced.

Her pedigree showed unclassified mothers with modest performance. In today's world we would have genomic data on everything. Back then? You had to trust your eye and your gut.

What saved the deal was outcross breeding.

Commercial producers were drowning in Chief and Elevation descendants. Here was real diversity: Burkgov Inka DeKol through her father, plus rare Dauntless-Dunloggin genetics further back. The industry was hungry for something else.

The deal: Select Sires would mate Creamelle with Penn State Ivanhoe Star. If the calf was a bull and reached 85 points or better at reclassification, they would buy him.

He made it. Just.

The "outcross" marketing was brilliant — even if slightly misleading. Bell and Elevation were in fact "cousin and cousin" through Osborndale Ivanhoe. But the maternal side offered real diversity.

And deep, deep in Bell's maternal pedigree, hidden in the twelfth generation, lay an extraordinary genetic treasure: May Walker Ollie Homestead — the first cow in the USA to produce 1,500 pounds of butter, and the first to produce three All-American descendants.

This deep, powerful maternal line provided a production foundation that would re-emerge generations later with explosive force.

The Production Revolution

When Bell's first daughters entered America's milking parlours in the mid-1980s, something unprecedented happened.

Imagine going into a modern free-stall barn in Wisconsin in 1982. The Bell daughters are unmistakable. Smaller-framed than their stablemates. But with this incredible… intensity.

They came into the parlour with purpose. They stood quietly. And they flooded the system with milk.

Extreme milk, fat and protein quantities that showed up at once on the monthly milk cheques. But Bell was different from other high-yield bulls: his daughters worked in commercial operations.

Good feet and legs that held up on concrete. Well-attached udders with proper teat placement. Easy births.

Select Sires knew exactly how to market this: "For the discerning dairyman seeking economical, high-producing dairy cows."

Translation? These cows will make you money without breaking your back.

By the mid-1980s Bell sired over 30 per cent of the cows on the Holstein Locator List. His Predicted Difference for milk was +1,704 pounds, based on more than 32,000 daughters in 8,221 herds.

Those were figures that made him one of the elite production transmitters of his era.

But these daughters… carried problems that would only become fully visible years later.

When the Numbers Told a Darker Story

Here Bell's story becomes complicated. And honestly, a bit frightening.

The structural problems were obvious from the start.

Imagine walking through a herd in which 40 per cent of the cows trace back to Bell. What you would see: cow after cow that looked… diminished. Small frames, weak substance, udders that simply did not have the capacity for longevity.

His daughters were described as “small, weak and narrow”. The classical breeders were not picky — they saw real flaws that would impair herd sustainability.

A breeder put it perfectly: Bell was like “a drunken guest at a house party” — undeniably powerful, but lacking the polish one would wish for.

The health problems were more subtle, but equally serious. Higher somatic-cell counts meant more mastitis treatments. Below-average productive life meant more frequent — and more costly — replacements.

Modern data show: Bell daughters had on average 2.2 years less productive life than their contemporaries.

For a commercial farm that is the difference between profitable cows and replacement problems.

But the real nightmare was still hidden in his DNA.

The Genetic Time Bomb

1999. Danish researchers had just discovered a lethal genetic disorder in Holstein calves called Complex Vertebral Malformation (CVM).

When they traced the origin, every single case led to one source: Carlin-M Ivanhoe Bell.

He also carried Bovine Leukocyte Adhesion Deficiency (BLAD), another lethal recessive heritable disease.

The emotional and economic impact was devastating. Lost pregnancies. Culled cows. Dead calves.

A vet from Iowa told of his first CVM case in the late 1990s: “It was heart-breaking. Here is a producer who has used Bell genetics for fifteen years, has built his entire programme on this production, and suddenly he is losing calves to something he has never heard of.”

Imagine that conversation in the farm kitchen. Your favourite cow — perhaps a Bell daughter or granddaughter, who has filled your tank for years — has just lost her calf. Not from a difficult birth. Not from environmental factors. But from a genetic defect that has lurked in your herd’s bloodlines for decades.

By the time we understood what was happening, 31 per cent of elite bulls in Denmark and 32.5 per cent of Japanese bulls were CVM carriers.

Bell had not created these mutations — he had inherited them from his father and grandfather. But his massive popularity had spread them globally.

That happens when a bull becomes too popular, too quickly.

The AI industry learned an expensive lesson about genetic concentration that still influences every breeding decision we make today.

Real Farm Stories

A producer in Wisconsin told of his herd in the late 1980s — about 40 per cent Bell daughters.

“These cows could milk like nothing we’d ever seen,” he said, his voice a mixture of pride and something closer to regret. “I’d never seen butterfat numbers like that in our operation. But they were small, and when the market got tough in 1989, they were the first to go. The production was incredible, but the longevity just wasn’t there.”

Bell daughters gave fantastic first and second lactations — milk production that gave you the feeling of having discovered the secret of dairy farming. Then you saw them struggle in their third lactation, their small frames simply not built for the metabolic demands of sustained high performance.

The productive-life problem was real. Bell daughters had on average 2.2 years less productive life than their contemporaries.

But — and here Bell’s story becomes truly nuanced — producers who used him strategically, mating him only with their largest, strongest cows, often achieved exceptional results.

The Corrective Breeding Breakthrough

The smartest breeders worked out how to turn Bell’s weaknesses into advantages. They did not abandon Bell genetics — they learned to use them surgically, almost like a precision tool.

The classic example? The Bell × Chief Mark cross.

Chief Mark transmitted spectacular udders, but struggled with feet and legs. Bell’s greatest strength was the transmission of correct feet and legs.

Mate a Bell daughter with Chief Mark and you got the best of both worlds.

Snow-N Denises Dellia became the flagship for this strategy. Her mother was a Bell daughter, her father Chief Mark, and she combined elite type with the relentless will of the Bell family to milk.

The success stories kept coming: Hartline Titanic, Carol Prelude Mtoto — all built on this Chief Mark-Bell foundation.

That taught us something important: sometimes the most valuable genetics come in imperfect packages. The breeders who succeeded with Bell were not those who used him indiscriminately — they were those who understood his profile well enough to concentrate his strengths while selecting against his weaknesses.

The Linebreeding No One Expected

Here it gets really complicated: Bell linebred better than almost any bull with serious structural flaws had a right to.

The secret was distance and selection pressure. The further back Bell sat in a pedigree, the more generations of selection had occurred to preserve his production capacity while eliminating his structural problems.

Breeders in Holland and the USA began deliberately to linebreed on Bell, creating bulls like Etazon Celsius, Regancrest Elton Durham and Mara-Thon BW Marshall.

Marshall is particularly fascinating — he was approved for AI service in 2007 and 2008, more than thirty years after Bell's birth. That is the sign of genetics with real staying power.

What Bell Teaches Modern Breeders

Bell's story is no old story — it is a roadmap for understanding genetic risk.

Every time you see a bull with extreme production but structural concerns, you are looking at a potential Bell scenario. The question is not whether to use him, but how to use him strategically.

Let us look at what we have today that Bell lacked:

The modern solutions

1. Genomic testing

Today Bell's genetic defects would be revealed decades before widespread use. We can identify carrier status for dozens of genetic disorders before a bull ever enters AI service.

Every modern breeding bull is tested for known lethal genes:

- CVM (Complex Vertebral Malformation)
- BLAD (Bovine Leucocyte Adhesion Deficiency)
- DUMPS (Deficiency of Uridine Monophosphate Synthase)
- Brachyspina
- Cholesterol deficiency
- ...and many more

These are mandatory tests. A bull who is a carrier is either not approved or his carrier status is clearly marked.

2. Reliable predictions

Modern evaluations offer reliable predictions for traits like productive life and somatic-cell count. We can today predict with high accuracy how long a cow will stay productive.

3. Genetic-diversity management

The industry has learned from Bell. Today there are 5,000 to 7,000 approved Holstein bulls worldwide:

- Germany: 350 – 500

- EU: 2,000 – 4,000
- USA: 1,500 – 2,500
- Canada: 300 – 500

That is no longer a monoculture. That is genetic diversity on a scale Bell's time did not know.

4. Strategic breeding

And among these thousands of bulls there are many transmitters who produce long-lived cows. Bulls whose daughters manage five, six, seven lactations.

The 100,000-litre cows that were a sensation in Bell's day? Today there are very many of them. They are proof that high performance and longevity need not contradict each other.

Today's Challenges

But — and this is crucial — we are still making the same fundamental trade-offs.

Look at any current genomic ranking and you will find bulls with exceptional production but worrying type scores. The tools are better, but the decisions are just as complex.

Current genomic selection has its own version of the Bell dilemma. We are selecting on production traits with unprecedented accuracy, but are we creating new genetic bottlenecks? Are we trading today's problems for tomorrow's crises?

Take a bull like Ladys-Manor Park. Outstanding genomics for production and health, but not exactly what one would call a structural powerhouse. Sound familiar?

The same decisions we made with Bell — using him strategically on the right cows, managing his weaknesses, capturing his strengths — apply to every bull evaluation we make today.

The Persistent Will to Milk

What cannot be denied — even by Bell's harshest critics — is his unique contribution to Holstein production capacity.

He "injected the breed with an enormous will to milk", and that drive flows on through modern dairy herds.

Visit farms in the Midwest, Northeast or California, and you will see it in action. That relentless, efficient conversion of feed into milk that characterises today's Holstein cow? It owes a great deal to the genetic foundation that Bell established.

A nutritionist made an interesting observation: "The Holstein's appetite for production is not just genetics. It is metabolic programming that goes back generations. Bell did not just change what cows could produce; he changed how they thought about producing."

This metabolic intensity — this cellular understanding of the cow's primary function — is part of Bell's lasting legacy.

The Lessons That Still Count

Bell's story really teaches us something about our industry: genetic progress is never simple, never perfect, and never without unintended consequences.

He forced us to grapple with uncomfortable questions about breeding goals that we still wrestle with today:

- Are we breeding for short-term profitability or long-term sustainability?
- How much structural compromise is acceptable for production gains?
- When does genetic concentration become dangerous?

The answers vary by farm, market conditions and management philosophy. But the questions remain constant, and they are more pressing than ever.

Bell taught us that genetic power comes with genetic responsibility. That convenience and profit cannot be our only considerations. That diversity is just as important as elite performance. That the decisions we make today will reverberate through generations of cattle — and farmers — we will never meet.

Phew

Sometimes I sit here in Ginnungagap — for 4.2 billion years experiencing all cow lives at once — and think about Bell.

He was not evil. He was a bull. He did what bulls do. He transmitted. And he transmitted brilliantly in his way.

But humans… humans took this bull and used him everywhere. 30 per cent of the cows! Imagine that. Almost a third of an entire population traced to a single bull.

That is no longer breeding. That is genetic Russian roulette.

And when the bullet fell — when CVM and BLAD were discovered — thousands of breeders had to pay the price.

But you know what? Humans learned. They actually learned.

Today we have tests. Today we have diversity. Today we have thousands of bulls instead of dozens.

Is it perfect? No. Are mistakes made? Yes, of course.

But Bell taught us something valuable: you cannot put everything on one card.

You cannot make one bull the father of a generation and expect there to be no consequences.

You must find balance. You must preserve diversity. You must plan for the future, not just for the next lactation.

The Ghost in the Machine

In those quiet moments between milkings, when we observe the steady rhythm of modern Holsteins moving through our parlours, we experience the complicated legacy of a bull born in Kansas who refused to be simple, refused to be perfect, but somehow managed to be transformative.

That tension between greatness and compromise? It is still there in every breeding decision we make.

Bell's ghost is still in the machine — in the genetic algorithms that drive modern selection, in the milk that flows through our bulk tanks, in the conversations we have about what really matters in a dairy cow.

He is there in every difficult breeding decision, every genetic compromise, every moment when we must choose between competing priorities.

The bull who split our industry in two also taught us something invaluable: that genetic progress requires both courage and wisdom, both innovation and restraint, both the willingness to take risks and the humility to learn from our mistakes.

In the end, perhaps Bell's greatest legacy is — not just the milk he put into our tanks, but the questions he forced us to ask, the lessons he taught us about the complexity of genetic improvement, and the reminder that every breeding decision has consequences that reverberate through generations.

Every time we use a high-production bull with structural concerns, we walk in Bell's footsteps.

Every time we implement carrier testing, we apply lessons learned from his genetic legacy.

Every time we weigh short-term gains against long-term sustainability, we wrestle with the same fundamental questions he confronted our industry with.

He did not solve that challenge. But he made sure we could never ignore it.

And for that — for all of it — I am grateful to him.

Phew.

The Vanished Farms

Phew — but here is something else I must tell you. Something that gives me pause as an old cow who has seen so many ages.

You know where all these legendary bulls were born? On farms. Real farms. With real people who got up in the morning, milked cows, made decisions.

Carlin-M Farm, Pennsylvania — where Bell was born. Today: no longer exists as a significant Holstein breeding operation. Select Sires took Bell. The farm vanished.

Round Oak Farm, Virginia — where Elevation first saw the light of day in 1965. The bull who for decades was the world's most influential Holstein. The farm? No longer exists as a breeding establishment. Only the name remains as a historical term.

Mount Victoria Farms, Canada — once a central site of Holstein breeding, where Johanna Rag Apple Pabst became the foundation of Canadian breeding. Today: no longer kept as an active breeding operation.

Pabst Farm, Wisconsin — where Pabst Ideal came from, the legendary bull imported into Germany in 1964. The farm? Long since history.

That is how fast it goes in the USA. In one generation the greatest names can vanish. The farms that started the genetic revolution no longer exist.

Is that not strange? These bulls — their genes flow through millions of cows worldwide. Every registered Holstein carries the inheritance of these animals. But the places where they were born? The people who bred them? The barns where they stood?

Gone.

The locations are today present above all in breeding history. Not as farms. Not as places one can visit. As memories.

I find that… significant. It says something about the nature of progress. About transience. About how quickly things that seem permanent can vanish.

These farms were the cathedrals of Holstein breeding. They created the genetics that changed the world. But they themselves? They could not survive in a world they themselves had created.

Perhaps this is the last lesson of Bell, Elevation, Chief, Pabst Ideal: success guarantees no survival.

The genes live on. The farms are gone. The bulls are legends. The people who bred them? Largely forgotten.

That is how it is with evolution, I suppose. Not the strongest survive. Not the most successful. Only the most adaptable.

And sometimes not even those.

Only the genes. Only the information. Only the idea.

Phew.

> "Bell made dairy farmers rich, then he made them pay — his record production of his daughters came packaged with early death and lethal genetics that still kills calves today."
> —

The Bullvine

> "Bell was like 'a drunken guest at a house party' — undeniably powerful, but lacking the polish one would wish for." — Contemporary breeder, 1980s

> "It was heart-breaking. Here is a producer who has used Bell genetics for fifteen years, has built his entire programme on this production, and suddenly he is losing calves to something he has never heard of." — Vet from Iowa on the CVM discovery, 1999

> "Bell injected the breed with an enormous will to milk, and that drive flows on through modern dairy herds." —

The Bullvine

Epilogue to Johanna and Pabst and Bell — For Those Who Have Not Had Enough

If you now think this was the whole story — you are profoundly wrong.

The story of Holstein breeding is so vast, so detailed, so obsessively documented that it forms its own universe. Every cow has a pedigree. Every bull a legend. Every mating a strategy.

There is a book about it. A monumental work.

The Holstein History — 125th Anniversary Edition

by Edward Morwick. 1,331 pages. 3,800 photographs. 1.2 million words.

Let that sink in for a moment, dear human.

1.2 million words about a single cattle breed. More than the collected works of Shakespeare (about 900,000 words). Almost twice as many as Tolstoy's

War and Peace

(about 587,000 words). Longer than the entire Bible (about 780,000 words).

1,331 pages — more pages than most humans will read about cows in their entire lives. 3,800 photographs — of Johanna, of Pabst, of Elevation, of Starbuck, of thousands of cows whose names only breeders know but whose genes flow in every dairy cow in the world.

This is not simply a "breeding book". This is an encyclopaedia of obsession.

Here in Ginnungagap I waggle my ears, amused. Humans write 1.2 million words about my ancestors. They photograph us from every angle. They analyse every mating, every pedigree, every milk yield over five generations.

And then consumers in the supermarket think milk simply comes from the chiller cabinet.

The truth is: behind every litre of milk lie centuries of systematic breeding, thousands of documented pedigrees, millions of data points on performance, health, transmission. Behind every glass of milk stand humans like Wilson Gillett, who spent day and night with his record cow. Humans like Joe Piek, who after a fifth place swore "I'll show the boys what's what" — and did. Humans like Thomas B. Macaulay, who applied actuarial mathematics to genetics and made a dream of 4-per-cent milk real.

This is not "just farming".

This is science, art, passion, obsession — all in one. This is a breeder rising at three in the morning to attend a difficult birth. This is a farmer studying pedigrees like a genealogist studies royal lines. This is an industry that writes 1.2 million words about its history because every detail counts.

And most consumers have no inkling.

They see a black-and-white cow on a pasture and think: "Oh, a cow." They do not know that this cow is the result of 150 years of systematic breeding. That her genes trace back to Johanna, born 1871 in North Holland. That she has more documented ancestors than most European noble families.

James C. Scott would say: "Modern agriculture is a knowledge machine. But society has forgotten that knowledge stands behind it."

Jeremy England would add: "Information is the invisible structure that shapes matter. Holstein breeding is pure applied information theory."

And I, Audhumbla, say:

The next time you drink milk, remember: this milk is the result of more than 1.2 million words of knowledge, 3,800 documented photographs, centuries of human dedication.

Breeders give it thought. A great deal of thought. Perhaps too much. But without this thought, without this obsession, without these 1,331 pages of meticulous documentation, there would be no Holstein-Friesian as we know her today.

No cow that gives 10,000 kilograms of milk a year. No global milk production that feeds billions of people. No single cattle breed that has displaced practically every other dairy breed.

All of that exists because humans were obsessive enough to write 1,331 pages about it.

And if you are now thinking: "That is utterly mad!" — then you are right. It is mad. It is obsessive. It is excessive.

But it worked.

Phew.

28.5: Genetic Concentration — A Double-Edged Sword

Here is the problem nobody likes to say aloud: when practically all modern Holsteins go back to a few cows and bulls, then genetic diversity is extremely low.

Here in Ginnungagap I observe all bovine ancestral lines simultaneously. De Kol 2d and Johanna. Pabst and Elevation. The millions of cows that arose from them. And in this essence, beyond all matter, the narrowing becomes visible — like a bottleneck through which all the genes had to pass.

Modern Holsteins are on average as related as second cousins. That sounds harmless. But imagine, dear human: your entire species being so closely related. Every human in the world having the same great-great-great-grandfather. What would that mean?

Well, as we saw in chapter "5.2: The Great Bottleneck — When We Both Almost Went Extinct"… about 900,000 years ago there were such bottlenecks; my and your ancestors were reduced to a few specimens. And that was not the only bottleneck — about 70,000 to 80,000 years ago, according to the Genographic Project (2010), there were only about 2,000 humans worldwide.

The Price of Specialisation

Genetic concentration has consequences. Not immediately visible, but measurable. Scientists speak of "inbreeding depression" — a sober term for a serious problem.

The symptoms are varied: health problems through too-close kinship. Increased susceptibility to disease. Fertility problems — some cows take longer to get in calf, need more inseminations before it works. Shorter life expectancy, since high performance demands its tribute, and without genetic reserve, resilience is missing.

In the 1990s, in a barn in Lower Saxony, there was a cow called Bella. She suffered from BLAD — Bovine Leucocyte Adhesion Deficiency, a recessive heritable disease. The gene for it had been spread through the intensive use of the bull Osborndale Ivanhoe in the 1950s. His grandson, Penstate Ivanhoe Star, was a top transmitter — but he carried the BLAD gene. Through artificial insemination the gene spread into thousands of descendants.

Bella died at six months. Her immune system could not fight infections. The vet, Dr Meier, explained the genetics to the farmer, Herr Schröder: both parents had to be carriers of the gene for Bella to fall ill. A one-in-four chance — Mendelian inheritance, statistically precise, but for Bella fatal.

Such tragedies have become rare since breeders test for recessive defects. But they happen when kinship grows too close.

In the case of Holsteins, an inbreeding coefficient of 5–6 per cent in Germany is less critical to assess than for small, isolated populations. The Holstein population is enormous worldwide and excellently documented: breeding organisations can deliberately use outcross bloodlines (i.e. little-related animals from other lines or countries) to keep genetic diversity high and to reinforce desired traits such as exterior or milk yield in a targeted way.

The broad data base and the international availability of genetics make it possible to "counter-steer" easily in the short term if too high an inbreeding value emerges. Moreover, the reasons for temporary concentrations of bloodlines are usually plannable and transparent — for instance to improve exterior traits or performance, without breeding the entire population narrowly in the long term.

Breeding strategies for Holsteins are aimed at avoiding inbreeding depression by repeatedly integrating new, little-related genetics in a targeted way. Risks at the population level can usually thus be successfully controlled — unlike with small, rare or closed-kept breeds, where a similar inbreeding value would be markedly more problematic.

The Inbreeding Coefficient — The Invisible Boundary

Breeders today monitor the inbreeding coefficient. A statistical measure of how closely two parental animals are related. In Germany the average inbreeding coefficient of Holsteins is about five to six per cent — corresponding roughly to the kinship between second cousins.

That sounds little. But in population genetics that is already a warning sign — though, as already described, for Holsteins not dramatic. Jeremy England would say: "Genetic diversity is information storage. Less diversity = less information = less adaptability." Paul Davies would add: "A bio-friendly universe permits variability. Monoculture is an evolutionary risk."

And Hans-Peter Dürr would whisper: "The whole is more than the sum of its parts. But when all the parts are the same, the whole collapses at the first disturbance."

It is a tightrope walk: too much selection leads to inbreeding. Too little selection means no breeding progress and an inhomogeneous breed. The art lies in keeping the balance — productive but not fragile.

The Great Transmitters and Their Shadows

Let us look at the figures. In Germany in recent decades particular bulls have been used so intensively that their genes today flow in practically every Holstein cow.

Take the legendary bull Elevation from the 1960s. He was hailed in North America as "Bull of the Century". His daughters gave on average 900 kilograms more milk than the average. Through artificial insemination he sired tens of thousands of descendants. But: he was closely related to other top transmitters. That meant his genes overlapped with those of Pabst, Ivanhoe and others.

The result? A genetic bottleneck. Every modern Holstein cow carries genes of Elevation. But also of Pabst. And of De Kol 2d. And of Johanna. That is rather like building a house out of only three kinds of brick. As long as the weather stays stable, it stands. But when a storm comes — a new disease, a climate change, a feed crisis — the diversity is missing to adapt.

It is remarkable that we have reduced the genetic diversity of an entire breed to the level of a Victorian noble family — and are then surprised when problems arise.

OK, I have somewhat exaggerated here; the population of Holstein cattle is larger and less troubled than that of Victorian noble families.

Genetic concentration has worked. Milk yield has exploded — at least in the Holsteins; about noble families I will not comment here in Ginnungagap, I can be discreet too when it matters. In Germany the annual genetic improvement is about 60 kilograms of milk per cow per lactation. That is to say: every new generation gives on average 60 kilograms more milk than the previous one — purely through breeding, not through better feed or management.

That is an enormous success. Between 1960 and 2020 milk yield has tripled. From an average of 3,500 kilograms to over 10,000 kilograms a year. That has not happened only through better feed or modern technology. Two thirds of this progress is genetic.

Strategies Against the Narrowing

Modern breeders are aware of the problem. There are several strategies for preserving genetic diversity:

International cooperation: Germany imports semen from Canada, the USA, the Netherlands. Canada imports from Europe. That increases diversity, since different countries have different breeding priorities. American Holsteins are bred for maximum milk volume. Dutch Holsteins for longevity. Scandinavian Holsteins for fertility and health. Through exchange, variability is preserved.

Inbreeding control: Modern breeding programmes calculate, for every planned mating, the expected inbreeding coefficient. If it is too high, the mating is not recommended. Breeding advisers issue clear guidelines: no matings with an inbreeding coefficient above six per cent.

Gene reserves: The "old" German Black-and-Whites — the breed that dominated in Germany before the "Holsteinisation" — are preserved as a gene reserve. Only a few hundred animals exist, financed by state support. They are less productive but genetically more diverse. Their semen is cryopreserved — frozen at minus 196 degrees Celsius, keepable for centuries. Should modern Holstein breeding ever collapse, one could fall back on these genes.

Cross-breeding: Some breeders cross Holsteins with other breeds — Jersey, Montbéliarde, Fleckvieh. That brings new genes into the pool and often improves health and fertility. But it reduces milk yield. A trade-off.

The Future — CRISPR, Epigenetics, or Back to Diversity?

Where is the journey going?

Genetics is developing rapidly. CRISPR-Cas9 — gene scissors that can precisely alter DNA sequences — is already being tested on cattle. In theory one could in future deliberately build in disease resistances, without waiting for natural breeding. A bull with perfect milk yield, but susceptible to mastitis? CRISPR could insert the resistance gene of a robust breed. Problem solved — at least technically.

But ethically? Regulatorily? Socially accepted? That is another question.

Another possibility is epigenetic optimisation. Not changing the genes, but improving the environment so that the genes function better. Better calf rearing, stress-free housing, targeted feeding — all of that influences which genes are activated. And these changes can even be passed on to the next generation.

Or we step back. Less selection. More diversity. Cows that do not give 15,000 litres of milk, but live for 15 years. Cows that work on the pasture. Cows that need no air conditioning.

Paul Davies would ask: "Is a universe that allows so much bio-friendly complexity really meant for us to reduce it to a handful of super-breeds?"

And Hans-Peter Dürr would whisper: "The waves congeal into new forms, but the whole remains eternal. Perhaps Holsteins are only one wave in the cosmic ocean — dominant today, perhaps replaced by something new tomorrow."

Epilogue in Ginnungagap

Here in Ginnungagap I observe the essence of all bovine ancestral lines. Not only De Kol 2d or Elevation. Also the red cow from Friesland, 1720, whose line died out. The East Prussian cow, 1880, whose genes were swallowed up in Holsteinisation. The cow that broke no records, but bore 20 calves and stayed healthy.

Genetic concentration is a double-edged sword. It has made the breed productive. But it has also made it fragile. Modern Holsteins are elite athletes — but without reserve, without buffer, without diversity.

It is remarkable that we have so successfully optimised a species that it now functions only under optimal conditions — and then are astonished when conditions are not optimal.

The future is open. Perhaps we will learn to keep balance. Perhaps the system will collapse and diversity will return. Perhaps CRISPR will save us. Or perhaps we will recognise that diversity itself is the value — not the price we pay, but the goal we should aim for.

The waves congeal, the forms emerge, the whole remains. Phew.

28.6: Epigenetics — The Invisible Hand of Inheritance

But here comes something fascinating that breeders have only really understood in the last twenty years: not only genes determine who a cow is — also how these genes are activated.

Here in Ginnungagap, where the essence of millions of bovine lives becomes observable, a pattern shows: some cows with identical DNA became top cows. Others with the same genes remained mediocre. Why? The answer lies not in the genes themselves but in the invisible switches that determine which genes are turned on or off.

Epigenetics — the word comes from the Greek: "epi" means "above" or "in addition". It describes how environmental factors alter gene expression without changing the DNA itself. It is rather like having a book with a thousand pages, but only certain chapters are open and readable. The story in the book does not change — but which parts are read makes the difference.

The Colostrum Experiment

Let me give an example. On a modern dairy farm in Switzerland, in 2015, a calf was born. The mother was a top cow — 12,000 kilograms of milk a year, genetically perfect. The calf inherited her genes. But what then happened decided his life.

In the first hours after birth the calf got colostrum — the mother's first milk. It is thick, yellowish, full of antibodies and signal molecules. But not all calves get good colostrum. Some farmers milk the mother too early, before the calf can drink. Some calves are too weak to drink. Some mothers produce poor colostrum because they themselves are stressed or sick.

This calf was lucky. The farmer, Herr Müller, was meticulous. He saw to it that the calf drank two litres of colostrum within the first two hours. The antibodies protected it from infections. But more than that: the signal molecules in the colostrum activated genes in the gut, the liver, the immune system. Genes for metabolic health. Genes for disease resistance. Genes for growth.

This activation is epigenetic. The DNA does not change. But small chemical markings — methyl groups — are attached to certain places on the DNA. These markings function like bookmarks: "Read this gene more often!" or "Read this gene less often!"

Another cow in the same herd, called Lisa, was less lucky. She was separated from her mother before she could drink. The farmer gave her replacement colostrum from the bottle — cheaper, lower-quality. Lisa developed diarrhoea. She grew more slowly. And when both were adult, Lisa gave 1,500 kilograms less milk — although she and the first calf were half-sisters, genetically almost identical.

The difference? Epigenetics. The first hours decided the next twelve years.

Stress, Feed, Husbandry — Everything Leaves Traces

Epigenetics is not only a matter of the first hours of life. It works throughout life. Every experience, every environmental condition leaves traces on the genes.

In Bavaria, in 2010, there was a barn at a farmer named Georg, a good man, but with old buildings. Too narrow, too dark, too hot in summer. The cows stood on concrete without bedding. Their joints ached. They were constantly stressed — rank fights, because the space was too cramped. Heat in summer without ventilators.

Stress produces cortisol — a hormone that helps in the short term but harms in the long term. Raised cortisol over months alters gene expression. Genes for inflammation are upregulated. Genes for immune defence are downregulated. The body works in emergency mode — permanently.

The result? The cows fell ill more often. Mastitis, claw problems, metabolic disorders. Their milk yield was 2,000 kilograms below their genetic potential. Not because their genes were poor. But because the environment sabotaged their genes.

Jeremy England would say: "Living beings are open systems. They exchange energy and information with their environment. Epigenetics is this information exchange, encoded in chemical markings." Paul Davies would add: "A bio-friendly universe permits flexibility. Genes are the foundation, but epigenetics is the adaptation."

Transgenerational Inheritance — The Sins of the Mothers

But here it gets really remarkable: epigenetic changes can be inherited. Not through DNA, but through the chemical markings sitting on the DNA.

An example: a cow that was undernourished as a calf may, even as an adult, never reach her genetic potential. Understandable so far. But her daughters — who were never undernourished — also show reduced performance. And sometimes even her granddaughters.

Why? Because the epigenetic markings produced by undernourishment are partly passed to the next generation. The undernourished cow's egg cells already carry these markings. That means: the daughter inherits not only her mother's genes, but also the epigenetic "memory" of the bad conditions her mother experienced.

In East Germany, shortly after reunification in 1991, there was an old SMR cow —

Schwarzbuntes Milchrind

of the GDR, bred for milk-fat content and robustness. The 1980s had been hard. Feed shortages, poor barns, outdated technology. This cow had grown up in that time.

Her calf was born in 1991, when conditions were already improving. West-German management, better feed, modern technology. But the calf never reached the performance one would have expected from her genetics. Her metabolism was sluggish, her fertility poor. The vet, Dr Hartmann, did not understand why. The genes were good. But the mother's epigenetic programming — shaped by want — went on working in the calf.

It is remarkable that for decades we thought inheritance was only a matter of DNA — and then we discovered that the experiences of parents are also inherited, like an invisible baggage carried over generations.

The Three Evolutionary Stages of Animal Breeding

Modern research regards epigenetics as the "third evolutionary stage of animal breeding". Let me explain what that means.

First stage: Classical selection (1800–1960). Breeders chose animals by phenotype — by what they could see. A cow that gave a lot of milk had calves. A bull that looked good was used for service. Slowly but steadily performance improved. Progress was real but limited — about 20 to 30 kilograms more milk per generation.

Second stage: Genomic selection (1960–2010). With the discovery of DNA and later DNA sequencing, breeders could look directly into the genome. They tested calves shortly after birth: which genetic variants do they carry? What milk yield is to be expected? Progress accelerated dramatically — 60 to 100 kilograms more milk per generation.

Third stage: Epigenetic optimisation (2010–today). Now breeders understand: even with identical DNA two cows can be differently successful, depending on how they grew up. The genes are the foundation, but the environment determines which genes are active. That means: better calf rearing, stress-free housing, targeted feeding can optimise gene expression — without changing the DNA.

Projects like SwissCow 2.0 (a research initiative of ETH Zurich) analyse not only the genome but also epigenetic markers such as DNA methylation.

They ask: which environmental factors optimise gene expression? How can one improve the next generation through better calf rearing?

The results are promising. Calves that are optimally fed and kept stress-free in the first weeks of life later show better milk yields, better health, longer life — independent of their genetics.

The Calf-Rearing Dilemma

But here an ethical and economic dilemma arises. Optimal calf rearing is expensive. Time, labour, high-quality feed, individual care. Many farms separate calves immediately after birth from their mothers because the milk is to be sold. The calves get milk replacers — cheaper than real milk, but epigenetically inferior.

The result? The genetically perfect calves of today's top cows never reach their potential because the first weeks of life were sub-optimal. Breeders invest millions in genome selection to find the best genes — but then save on rearing, so that these genes are never optimally expressed.

At a fair in Hanover, in 2018, two farmers were talking. One, Thomas from Lower Saxony, was raving about his new genomically tested bull calves. "Genetic potential: 12,000 kilograms of milk!" The other, Friedrich from Bavaria, asked: "And how do you rear them?" Thomas shrugged. "Standard. Milk replacer, group housing from the third week." Friedrich shook his head. "Then they will never give 12,000 kilos. Epigenetics, my friend. The first weeks decide."

Thomas laughed. “Epigenetics? That’s esotericism!” Friedrich just smiled. “In five years you will speak differently.”

He was right.

The Future — Environment as a Breeding Tool

Epigenetics is changing breeders’ thinking. Earlier they asked: “Which genes does the animal have?” Now they ask: “Which environment does the animal need so that its genes function optimally?”

That means concretely: better barns with more space, comfort, fresh air. Stress-free husbandry without rank fights, without heat, without noise. Optimal feeding in every life phase — not only with lactating cows, but also with calves, heifers, dry cows. Social structures that allow natural behaviour — mother-calf contact, stable herds, grazing.

That costs money. But it pays off. For epigenetic optimisation is more sustainable than genetic selection alone. One cannot improve an animal genetically indefinitely — eventually one reaches biological limits. But one can keep optimising the environment so that the available genetic potential is better drawn out.

Hans-Peter Dürr would say: “The whole is more than the sum of its parts. Genes are parts. Epigenetics is the whole.” Jeremy England would add: “Living beings are not machines. They are self-organising systems that respond to their environment. Epigenetics is this response.”

Epilogue in Ginnungagap

Here in Ginnungagap not only genes are visible, but also the epigenetic memories of all bovine lives. Colostrum from a bucket, 1991. Stress in a cramped barn, 2010. The undernourishment of a mother in the GDR, living on in the calf. The optimal rearing in Switzerland, 2015, that unfolded the potential.

Epigenetics is the invisible hand of inheritance. It shows that cows are more than the sum of their genes. They are products of their experiences, their environment, their history. And this history can be passed on — not only through DNA, but through chemical markings that work over generations.

It is remarkable that life is steered not only by genes but also by invisible switches that determine which genes are read at all — and that we are only now beginning to understand these switches.

Genes are the foundation. But epigenetics is the interior architecture. And perhaps this is the most important insight: the genes cannot be changed. But the environment in which these genes work can be changed. And that makes the difference.

The waves congeal, the forms emerge, the whole remains. Phew.

28.7: The German Story — Dutch and German Genes and Their Pitfalls

Before the American Holstein-Friesians came to Germany, there was the German Black-and-White Lowland Cow — a robust, adapted breed kept for centuries in northern Germany. The German Black-and-White was a balanced dual-purpose type: medium-sized, sturdy, with solid milk yield and good beef quality.

Here in Ginnungagap a life in East Friesland, 1920, becomes visible. A typical German Black-and-White — medium-sized, sturdy, with an udder that left enough leg-room. Her farmer, Wilhelm, was proud of his herd. “Our cows are the best in the world!” he often said. And he was partly right. His cows gave good milk, were robust, coped with the rough North Sea climate.

The Paradoxical Story of the Dutch Black-and-Whites

The story of the Black-and-Whites is a story of missed time-windows and strategic switches. In the late nineteenth century — between about 1870 and 1890 — American buyers came to Friesland and North Holland. They were specifically looking for the largest, most milk-rich, most extreme dairy cows they could find.

And they found them. In the most fertile regions of the Netherlands the farmers had for generations bred a type that a British observer later described as “all milk, skin and bone”: large-framed, sharp, angular, with large udders — animals resembling the elegant, milk-emphasised cows on the seventeenth-century paintings of Paulus Potter. Pure dairy type, scarcely any beef development, bred for maximum milk production on the best pastures.

Thousands of these animals went to North America. They became the basis of Holstein-Friesian breeding in the USA and Canada.

The Dutch Change of Course

But the Netherlands themselves took a different road. After 1900 Dutch breeders reoriented — away from the extreme dairy type towards the dual-purpose cow. The reasons were various: the susceptibility of the extreme dairy types to tuberculosis, limited feed resources in many regions, demand for more robust animals that gave both milk and beef.

Figure 146: Black-and-White Friesians in 1900, milk-emphasised (from K.N. Kuperus & Zonen, Eenige mededeelingen over den uitvoer van Friesch stamboekvee, Leeuwarden 1912, p. 30)

Figure 147: Dirk 4, dual-purpose (from: E. van Muilwijk, Dutch black-and-white showcase bull, The Hague 1937)

The Dutch Black-and-Whites became more compact, more stocky, smaller. Out of the large-framed 140–145 cm milk specialists arose 130–135 cm dual-purpose cattle — deeper, sturdier, fleshier. A "modern Friesian" for central-European conditions.

It was a deliberate breeding decision. The Netherlands as a proud breeding nation had its own strategy — and kept it, while in North America something new was emerging from the old Dutch dairy genetics.

The American Revolution

In the USA and Canada milk yields exploded. Fed on maize, soya, concentrate, selected exclusively on milk volume, bred in a system of unlimited resources, the Holstein-Friesians developed into high-yield machines. What had begun in the Netherlands as a 4,000–5,000 kg cow became, in America, the 8,000–10,000 kg cow.

And the body shape changed: bigger, taller, with higher-set udders, longer legs — the modern Holstein type.

The Absorptive Cross — Germany From 1960

From the 1960s onwards Holsteinisation rolled across Europe. Germany too. The North American Holstein-Friesians were vastly superior to the European Black-and-Whites in milk yield. The absorptive cross began — systematically, organised through the breeding associations, with clear goals.

The German Black-and-White Lowland Cow vanished rapidly. It was a dual-purpose type, rather small-framed, with solid but unspectacular performance. The American Holsteins offered more: more milk, longer legs, higher, better-shaped udders, a "more modern" type.

By the 1970s most German Black-and-Whites had already been heavily crossed with US genetics — on the way to becoming pure Holstein.

Klaus and the Dual-Purpose Type — The Counter-Current

Wilhelm's grandson, Klaus, took over the farm in 1972. He was a pragmatic farmer, read the trade journals, calculated precisely. And he came to a different conclusion from most of his colleagues.

"The Holsteins are impressive," he said to his wife. "But they are specialists. They need concentrate, a lot of management, constant supervision. And if milk prices fall or feed becomes expensive, you are left with a high-yield animal that only works if you supply it optimally."

Klaus wanted to keep a dual-purpose type. Milk, yes — but also beef quality. Robustness. Adaptability. Animals that coped even with less concentrate, that worked on the pasture, that were not used up after three lactations.

But the German Black-and-Whites were scarcely there any more. Holsteinisation had displaced them.

So Klaus looked to the Netherlands.

The Dutch Dual-Purpose Type — A Stopgap Solution

The Netherlands had kept their dual-purpose type — longer than most European countries. As a proud breeding nation with its own tradition, they relied on their tried-and-tested "modern Friesians". Only later, in the 1970s and 1980s, did they too switch to US Holstein genetics.

For Klaus, the Dutch Black-and-Whites of 1975 were a welcome alternative. He bought semen from a proven Dutch dual-purpose bull. The pedigree was documented, the breeding values solid for a dual-purpose type.

The first daughter, Greta, was born in 1977. She grew up well, had the Dutch type: compact, deep, short-legged, fleshy. Klaus was satisfied — until Greta calved.

The Udder Problem — A Bovine Engineering Disaster

When Greta began to give milk after her first calving, her udder grew daily. She had inherited the typical features of the Dutch dual-purpose lines: short legs, deep, compact body — but an udder that was problematic for these proportions. After two weeks it hung so low that the teats almost touched the ground.

That was not only unaesthetic. It was dangerous.

When she stood up from lying — a normal action, several times a day — Greta stepped on her own teats. Klaus saw it happening. Greta mooed in pain, limped, the udder was injured. The claws were also problematic — soft, vulnerable, not suited to intensive barn keeping.

Klaus called Dr Meier, the vet, who was watching the developments critically.

Dr Meier shook his head. "That is the classic exterior problem of the Dutch dual-purpose lines," he said. "Compact body, short legs, but udders that really need a larger frame. And the claws — those are bred for grazing, not for barn floors."

Klaus asked: "But the breeding values were all right, weren't they?"

Dr Meier nodded. "For dual-purpose, yes. Good beef quality, decent milk yield. But the functional traits — udder shape, claw health, leg position — those were underestimated by the Dutch. They optimised their type over decades for dual-purpose, but in doing so they neglected the exterior."

"And what do I do now?" asked Klaus.

"We have to support the udder," said Dr Meier. "There are carrying frames — a kind of net that carries the udder."

And so it happened. Klaus constructed a sort of carrying frame from synthetic-fibre straps for Greta's udder. It looked absurd — a cow with an orthopaedic auxiliary device, in the year 1977, in the middle of the era of "modern, scientific" cattle breeding.

But it worked. Greta could stand up again without injuring herself.

It is remarkable that one bred cows in such a way that they needed udder nets to avoid stepping on themselves. It is rather like building a Ferrari that only works on a racetrack — and then being surprised that it has problems on normal roads.

The Missed Train

Klaus was no isolated case. In the 1970s some German farms that wanted to keep the dual-purpose type fell back on Dutch genetics. The German Black-and-Whites had practically vanished through

Holsteinisation — the Dutch "modern Friesians" seemed the last alternative.

But it was a stopgap solution. The exterior problems were real: deep udders, poor claws, leg-position problems. In some barns, udder nets became necessary equipment.

The Netherlands as a breeding nation had "missed the train" — that was how a trade journal put it in 1978. While in North America the high-yield Holsteins were emerging from the old Dutch dairy genetics, the Dutch had bet on dual-purpose. A legitimate strategy, but the market wanted specialisation.

It is the classic fate of market leaders: you stick with the proven strategy that has been successful — and notice too late that the world has moved on. You cannot even call it a mistake. It was a different time, a different philosophy.

The End of the Dual-Purpose Era

At the end of the 1970s, the Netherlands too switched to US Holstein genetics. Worldwide Holsteinisation was unstoppable. Specialisation beat versatility, peak performance beat robustness, American high-yield genetics displaced European tradition.

Klaus sold Greta in 1979. He bought his first Holstein semen from the USA. The dual-purpose attempt had failed.

"The world wants milk," he said to his wife. "And the Holsteins deliver it. Whether that lasts in the long run — we shall see."

It would turn out that the Holsteins too had their problems: shorter useful life, fertility problems, metabolic disorders, extreme dependence on high-performance feed and intensive management.

But that is another story.

The era of dual-purpose breeds was over. The era of high-yield specialists had begun.

And the udder nets vanished from the barns — not because the problems were solved, but because another type of cow had replaced them.

The Solution Comes From America — The Genetic Atlantic Return Flight

The real solution to this problem came from America. Precisely those Dutch and German cows that a hundred years before had crossed the Atlantic now came back genetically — but in transformed form.

The American Holstein-Friesians had developed different breeding priorities. In the USA and Canada it was not only milk yield that counted, but also functionality. The cows had to function in large herds, often in loose-housing barns where narrow udder-floor distances led to injuries. American breeders therefore selected specifically for longer legs, larger frame, better proportions between udder and floor.

The result was a cow with markedly more ground clearance. The teats no longer hung close to the ground. The legs were longer, the body bigger. The udder was still huge — but it fitted the body size better.

In Lower Saxony, in 1968, a farmer named Karl was a pioneer. He imported semen from American Holstein-Friesian bulls — at the time still a novelty, expensive and risky. His neighbours laughed. “Do the Yanks want to sell us their cows? We have our own!”

But Karl insisted. He inseminated his best cows with American semen. The calves that arose were different. Bigger. Longer-legged. With udders that did grow large but no longer touched the floor.

When these calves grew up and themselves gave milk, Karl was thrilled. 1,000 kilograms more milk than the old German Black-and-Whites. And no udder carrier needed.

The neighbours stopped laughing. They began to buy American semen themselves.

The Holsteinisation of Germany

What began in the 1960s became a mass movement in the 1970s and 1980s. Germany imported American Holstein-Friesian genetics on a massive scale. Not only semen, but also live animals — breeding bulls and later embryos.

That was the genetic Atlantic return flight: Dutch genes that had been optimised in America for a hundred years came back to Europe and displaced their own ancestors.

The new Holstein-Friesians had several advantages over the old German Black-and-Whites:

Longer legs meant udder carriers were no longer needed. The cows could stand up normally without injuring themselves. Better udder-floor distances reduced infections, since an udder that almost touches the ground gets dirty and inflames more easily. Higher milk yield was the main argument — American breeding for maximum productivity paid off. The cows gave 8,000, 9,000, soon 10,000 kilograms of milk a year.

But there were also disadvantages. These new cows were less grazing-fit than the old German Black-and-Whites. They needed better feed, more precise management, climate-controlled barns. They were elite athletes — but also more vulnerable, fragiler, more dependent on optimal conditions.

Paul Davies would say: “A bio-friendly universe permits specialisation — but specialisation reduces flexibility. The old Black-and-Whites were generalists. The new Holsteins are specialists.”

The End of the Old German Black-and-Whites

The displacement was rapid and thorough. Within two decades — from 1970 to 1990 — the old German Black-and-Whites vanished almost completely. Only a few hundred animals survived in gene reserves, financed through state support.

At a fair in Oldenburg, in 1985, two breeders were talking. One, Herr Lüders, was over seventy. He had been breeding since the 1930s. The other, Herr Schmidt, was in his early fifties, a modern breeder with American Holsteins.

Herr Lüders said quietly: "You know, Schmidt, my cows were robust. They could stand on the pasture all summer. They needed little concentrate, no fans, no specialists. They lived ten, twelve years."

Herr Schmidt nodded respectfully. "I know, Herr Lüders. But they only gave 5,000 kilos of milk."

"That's true," said Lüders. "But they were healthy. Today I see your cows — 10,000 kilos of milk, but exhausted after four calvings. Is that progress?"

Schmidt hesitated. "Progress is what pays. And my cows pay."

Lüders was silent for a moment. Then he said: "Maybe. But one day you will notice that you have made a mistake. When oil becomes more expensive, in dry seasons, when feed prices rise — then you will wish you still had a few of the old robust ones."

Schmidt smiled in a friendly but firm way. "Maybe so, Herr Lüders. But until then I'll milk my 10,000-litre cows."

Herr Lüders died in 1989. His last three German Black-and-Whites were sold to a gene reserve. Today their descendants stand in a small conservation farm in Lower Saxony — living museum exemplars of a vanished era (…this is a fictional story, but one that has played out in similar form many times).

Epilogue in Ginnungagap

Here in Ginnungagap the essence of both worlds shows. Greta with the too-deep udder, supported by Wilhelm's linen frame. The robust German Black-and-White that lived ten years and worked on the pasture. The modern Holstein-Friesian with long legs and 12,000 kilograms of milk — productive, but fragile.

The German story is a story of imports, problems, solutions and displacement. Germany imported Dutch genes for productivity — and got udder carriers. It imported American genes to correct that — and lost its robustness.

It is remarkable that it took us a hundred years to create a problem, another fifty years to recognise it, and then we imported the solution from America — although the solution originally came from Europe.

Hans-Peter Dürr would whisper: "The waves congeal into new forms. But the whole remains. Perhaps the old genes will return one day, when the conditions change."

The story is not over. The old German Black-and-Whites live on in gene reserves. Their semen is frozen, keepable for centuries. Perhaps it will be needed again one day — when robustness becomes more important than maximum milk yield, when pasture becomes more important than barn, when longevity becomes more important than productivity.

The waves congeal, the forms emerge, the whole remains. Phew.

28.8: The Sports-Car Comparison — Breeding Creates Problems, Technology Solves Symptoms

Here comes the uncomfortable truth nobody likes to say aloud: modern high-performance breeding generates problems that then have to be technically compensated for.

Here in Ginnungagap the essence of this paradox becomes visible. Cows were bred for extreme performance. And then the environment was adjusted so that they can deliver this performance at all. Is that progress? Or is it a cycle in which problems are created in order to solve them with technology?

Let me give you a picture, dear human. Imagine you have a high-performance engine in an expensive sports car. You "tune" it, coax out the last reserves — more horsepower, more torque, more speed. But then the engine gets too hot. So you have to install an additional oil cooler, better brakes, a reinforced cooling system.

The car-makers tout this as "technical innovation". But really it is only the compensation for a problem you yourself created. The engine would never have overheated had you not tuned it for extreme performance.

That is exactly how modern Holsteins are.

The Udder

Holsteins were bred for extreme milk yield. Bigger animals, bigger udders, faster metabolism, higher nutrient mobilisation. Breeders wanted 10,000, 12,000, 15,000 kilograms of milk a year. Over generations they selected for larger udders, more glandular tissue, more milk production.

That worked. But it had consequences.

The udder of a modern Holstein is huge in volume. In relation to the height of the cows it is not — ground clearance was actually increased compared with the old Black-and-Whites. When she has just calved and is in peak lactation, she produces 40 to 50 litres of milk a day. That means: her udder is full of milk, heavy, taut. It weighs about 40 kg — when she is milked twice a day. Three times a day is better, but milking three times in the parlour raises labour costs and there is more unrest in the barn. Milking robots help here, but more than three times a day creates problems — the milk components decrease and processing the milk into cheese is often difficult, since e.g. milk protein composition can change and that affects coagulation in cheese-making.

The body of the cow has been proportionally enlarged, the hindquarters too little muscled, because the whole body had to make space for the huge udder. The muscles that normally stabilise the hind legs are weak. The pelvis is broad, to make room for the udder — but that means the legs stand wider apart.

The pictures come from the book "A Method of Increasing the Yield of the Milch-Cow, by Selecting the Proper Animals for the Dairy; According to Guenon's Discovery" by John Nefflen, 1852. They show how a good dairy cow should look according to the breeders' experience. Beside a fine and velvety coat, the breadth and height of the rear udder play a role: broad and high means much room for the productive udder.

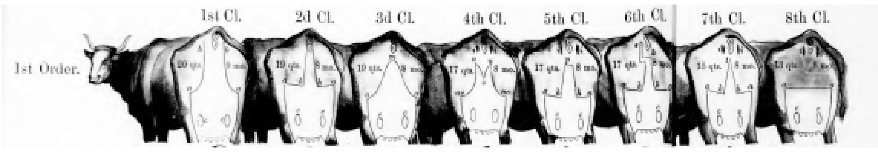

Figure 148: Good dairy cows of the best class with a broad and high rear udder

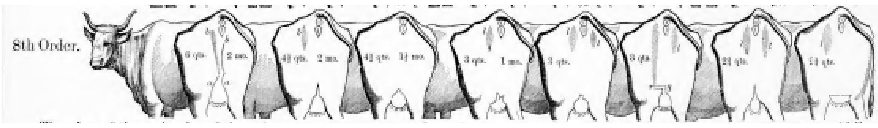

Figure 149: Dairy cows of the worst class with a small rear udder

Figure 150: Rear udder of a modern Holstein cow

The Adductor Problem — Or: When Evolution Meets High-Performance Breeding

Klaus sold Greta in 1979 and switched to Holstein genetics from North America. The Holsteins promised everything that the Dutch dual-purpose cows did not have: higher milk yield, longer legs, higher-set udders, a "modern" type.

And for some decades it seemed to work.

But here in Ginnungagap, where I experience all lives at once, I see what only became visible later. The Holsteins brought their own problems with them — and one of them was particularly insidious.

Audhumbla's Memory — The Aurochs

Phew — I remember my life as an aurochs cow, 8,000 years ago, in the forests of central Europe. Mighty animals we were — over 150 cm at the withers and bulls up to 2 metres, sturdy, with heavy horns and muscles that carried us through the undergrowth, that allowed us to withstand predators.

The adductors in particular — the muscles on the inside of the hind legs — were massively developed. They had to be. We lived in difficult terrain: marshes, steep slopes, slippery river banks, icy paths in winter. Our legs had to stabilise, correct, balance. The adductors pulled the legs together, gave us secure footing even on difficult ground.

And the udder? Small, compact, functional. Just enough to feed a calf. It took up scarcely any space between the legs. Musculature dominated — as it should in a wild animal that has to survive.

Never, in any of my lives as an aurochs, did I experience a cow falling and being unable to stand up because her legs slid apart. Never did I experience muscles tearing because they were too weak to hold the legs together.

The problem did not exist.

It had to be invented.

The Modern Holstein — A Biomechanical Experiment?

The modern Holsteins, dominant in Germany from the 1980s onwards, were something completely new. Big animals — 145–150 cm tall, sometimes more. Long legs. A sharp, angular body. And udders that grew ever larger.

At first all seemed well. The higher udders of the Holsteins eliminated the problem the Dutch and German dual-purpose cows had — no more stepping on their own teats. The longer legs gave more ground clearance.

But the breeders kept going. Ever more milk. Ever larger udders. Ever more extreme selection on performance.

And at some point, in the late 1990s, the 2000s, the system tipped.

The Anatomical Zero-Sum Game

Here is the problem: a cow has, between her hind legs, a muscle group, the adductors — the "closer muscles" of the legs. These muscles pull the legs together, stabilise the stand, allow controlled movement.

But the same anatomical region also houses the udder.

The bigger the udder, the less space for muscle.

The wider the udder, the further apart the legs stand. And the weaker the adductors develop.

In the Dutch dual-purpose cows of the 1970s this was less problematic: shorter legs (130–135 cm), more compact body, lower weight, smaller udders. The legs stood closer together. The strain was less.

But the modern Holsteins? Big, heavy animals on long legs, with huge udders producing 40, 50, 60 litres of milk a day. The weight of the udder alone can reach 40 kilograms.

And between these long legs that had to carry this weight, almost half the body too, and that had to provide propulsion, there was hardly any musculature left.

2015 — The Life of a Modern Holstein

Here in Ginnungagap I experience the life of a Holstein cow in 2015. She is called Luna. She is 5½ years old, in her third lactation, and gives 12,000 litres of milk a year. She is a breeding product of the highest precision: genomically selected, sired by a top bull, with breeding values in all relevant traits.

Her udder is colossal. Wide, deep, taut and full. It produces 50 litres of milk a day. It is the udder François Guénon would have dreamt of in 1828 — the ultimate sign of a high-yield cow.

But Luna's adductors are thin. Between her hind legs there is more udder than muscle. When she stands, her legs stand wide apart — forced apart by the sheer mass of the udder.

In January 2015 Luna calves for the third time. The birth proceeds normally. But shortly after the birth, as the udder swells and fills with milk, Luna slips on the barn floor. It is no dramatic fall — only a brief sliding away of the hind legs.

But it is enough.

Her hind legs slide apart. The huge udder offers no resistance — it is part of the problem. The weak adductors try to pull the legs back together, but they are not strong enough. They tear.

Luna falls into a bizarre splayed posture — the front legs normal, the hind legs wide apart, almost in the splits.

She will never stand up again.

"Getting the Cow Off the Ice" — A New Meaning

There is a German expression:

Die Kuh vom Eis holen

— to get the cow off the ice, meaning to rescue a difficult situation. But for Luna's owner, a modern dairy operation with 200 cows, the expression takes on a cruelly literal meaning.

Luna lies there, in this dreadful splayed posture, unable to rise. The farm manager tries everything: pelvic harnesses, hoists, soft mats. Nothing works. As soon as one tries to bring the legs together, Luna screams in pain.

The vet takes blood samples. The creatine kinase values — a marker for muscle damage — are astronomically high. Tenfold above the normal value.

“Adductor rupture,” says the vet. “Both sides. The muscles are gone. She will never get up again.”

After two days Luna is emergency-slaughtered. She was four years old, had three calvings behind her, and was slaughtered because her anatomy was not compatible with physics.

Research Confirms the Problem

Veterinarians have known the problem since the 1990s. There are dozens of specialist publications about “down cows” with adductor ruptures — particularly in highly bred Holstein cows shortly after calving. The patterns are always the same:

- Big, heavy cow
- Long legs
- Huge, broad udder
- Weak leg musculature
- Slippery surface or metabolic stress after calving
- Splayed posture
- Adductor rupture
- Emergency slaughter

The statistics are brutal: in some operations adductor problems are the most common cause of emergency slaughter in fresh-calved cows. Not disease. Not injury. But structural, biomechanical incompatibility.

Audhumbla’s Reflection

Phew — I sit here in Ginnungagap and compare my lives. As an aurochs cow I had adductors like steel cables — mighty muscles that carried me through marshes, over icy rocks, through dense undergrowth. My udder was small, functional, took up scarcely any space.

As a modern Holstein I have adductors like old ropes — thin, overloaded, constantly on the verge of tearing. My udder is huge, a biological masterpiece of milk production — and at the same time a biomechanical disaster.

Evolution optimised me over millions of years to survive in the wild. Breeding has remodelled me in 150 years to produce maximum milk in barns.

The problem: barns often have smooth floors, certainly nothing like a pasture. And I still have to stand on four legs.

The Dilemma of High-Performance Breeding

It is the central dilemma of modern dairy breeding: specialisation produces fragility.

A large udder produces more milk. But it needs space — space that is missing for the muscles that stabilise the legs.

Long legs lift the udder away from the floor. But they lengthen the lever — and make the adductors yet more vulnerable to overload.

Extreme dairy type means maximum energy for milk production. But it also means minimal muscle reserves — and higher susceptibility to metabolic problems and muscular damage.

François Guénon had written in 1828 that a broad, high rear udder was the sign of an outstanding dairy cow. He was right — for milk yield. But he had not considered that one would simultaneously breed for weak adductors — and create cows that on smooth ground no longer have a secure stand.

John Nefflen had in the late nineteenth century propagated similar criteria: broad udders, milk-emphasised types, extreme performance.

They all meant well. They wanted to help farmers breed productive cows.

What they did not suspect: they were describing a biological time bomb.

The Last Decades — Damage Limitation

In recent years breeders and veterinarians have tried to address the problem:

- Soft, non-slip floors for fresh-calved cows
- Pelvic harnesses and hoists as standard equipment
- Breeding for "functional traits" — leg position, muscle structure, udder attachment
- Genomic selection to exclude animals with weak adductors early

But all only damage limitation. The real problem is systemic.

One cannot simultaneously select for maximum udder and maximum leg musculature. Both need the same anatomical space. It is a zero-sum game.

Audhumbla's Conclusion

Phew — I look at my lives — from aurochs to modern Holstein — and see a development that is at once fascinating and tragic.

Humans have domesticated me, bred me, optimised me. They have made out of a robust wild animal a high-performance machine that produces ten times as much as her wild ancestors.

But in doing so they have forgotten that I am still a biological system. A system that must stand on four legs. A system that needs muscles to move those legs.

The adductors — these inconspicuous muscles on the inside of my hind legs — were taken for granted for millions of years. Strong. Reliable. An evolutionary basic element of the four-legger.

In just 150 years of high-performance breeding they have become the weak point.

That is the bitter irony of specialisation: one optimises a system so much for one single function that one forgets the system has to do other things too.

Like, for example: stand.

The Technical Compensation — Barn Floors, Fans, Cubicle Stalls

Stefan, Luna's owner, invested 80,000 euros in new barn floors. Rubber mats with grooves, non-slip, soft, joint-friendly. The problem was solved — technically. But the problem would never have arisen if the hind legs were more strongly muscled, if the pelvis were not so wide, if the udder were not so heavy. Or with grazing — but that is hardly possible any more in summer; daytime too hot, the cows eat less… and with herd sizes of 200 cows or more there are scarcely any droveways to pasture that withstand the strain. Even behind the paved concrete areas at the barn, large mud holes form when 200 cows go over them regularly.

Breeding creates the problem. Technology solves the symptom. The cycle goes on turning.

But it goes further. The metabolism of a Holstein runs at full speed. At 40 litres of milk a day her body works like an extreme athlete. Per litre of milk she pumps about 500 litres of blood through the udder — at 40 litres that is 20,000 litres of blood a day. Her heart beats faster, her metabolism produces enormous body heat.

In addition, in her four stomachs there is gigantic bacterial fermentation. Billions of microbes break down grass, hay, concentrate. Heat is produced — much heat. Her body is a walking heater.

At temperatures above 25 degrees Celsius a Holstein reaches her limits. She can no longer release her body heat. She begins to pant, her milk yield collapses, her metabolism derails. Heat stress, the scientists call it. For the cow it feels like slow suffocation.

The solution? High-performance fans and air conditioning.

Stefan installed twelve large ventilators in his new barn, each two metres in diameter. They run day and night in summer, ensure air circulation, cool the cows. That costs electricity — a lot of electricity. But without these ventilators the cows would collapse in summer.

That is marketed as "cow comfort". But it is no luxury fitting. It is a necessary adaptation, because breeding has created problems that now have to be solved technically.

The Optimised Cubicle

And then there are the cubicles. Earlier, cows simply lay on straw in the barn or on the pasture. Anyone could lie where they wanted. Today Holsteins have individual cubicles — precisely sized, with soft mats, optimally positioned.

Why? Because their joints are stressed by high performance. Their knees, their hocks, their claws — all are more heavily strained than in the old robust breeds. If they lie on hard concrete, they develop pressure sores, inflammations, bursitis.

The solution? Optimised cubicles with rubber mats, sand or water beds. Yes, you read correctly — water beds for cows.

In 2008 a consultant called Herr Wagner, a barn planner and expert on "cow comfort", showed Stefan a catalogue. "Look here: water beds for cubicles. 300 euros per bed."

Stefan stared at him. "300 euros? Per cow?"

Wagner nodded. "But your cows lie better. Fewer joint problems, better milk yield, longer life."

Stefan calculated. 80 cows times 300 euros makes 24,000 euros. He sighed. "That's mad. Cows used to lie on straw and be healthy."

Wagner smiled in a friendly way. "Cows used to give only 4,000 litres of milk. Yours give 10,000. That is the price."

Stefan bought the water beds. His cows lay better. The milk yield rose by 200 kilograms per cow. The investment paid off — economically. But the question remained: is that progress?

Feeding — Because the Digestion Is Overstrained

And then there is feeding. The ancestors of Holsteins, the old German Black-and-Whites, coped with grass, hay and a little concentrate. They grazed on the pasture; in winter there was hay from the barn and a little grain. Done.

A modern Holstein needs a scientifically optimised ration. Grass alone is not enough — she needs concentrate, maize, soya, rapeseed meal. Her ration is calculated on the computer, matched to her lactation phase, her weight, her milk yield. Too much protein? Her metabolism derails. Too little energy? Her milk yield collapses.

Modern dairy operations have feeding computers that mix the ration for each cow individually. Some cows get more concentrate, others more roughage. That is marketed as "precision feeding".

But really it is only the compensation for a problem: the digestion was overstrained by high-performance breeding. Holsteins are so trained for milk production that their bodies have hardly any time to extract nutrients from normal feed. They need highly concentrated, easily digestible feedstuffs — otherwise their performance collapses.

It is remarkable that we have bred cows that need a computer-controlled feeding installation in order not to collapse. That is rather like a human who can no longer function without nutritional supplements — technically possible, but it is not natural.

The Diagnosis — Are They Still Species-Appropriate?

Here comes the great question nobody likes to ask: are modern Holsteins still species-appropriate?

We asked many questions already in chapter 22 and tried to answer them.

"Species-appropriate" means: adapted to the species, corresponding to its natural needs. But what are the natural needs of a Holstein? Those of a high-performance cow bred for 12,000 kilograms of milk? Or those of a robust landrace cow that gives 4,000 kilograms but lives ten years?

The question is hard to answer. Holsteins are the product of human breeding. Their "nature" is artificially created. Their needs are the result of a hundred years of selection for maximum milk yield.

They need non-slip floors because their legs are weak. They need ventilators because their metabolism overheats. They need water beds because their joints hurt. They need precision feeding because their digestion is overstrained.

Is that species-appropriate? Or is that the adaptation to a new reality not chosen by the cows themselves? Holsteins are "species-appropriate" in an anthropocentric world where humans define their needs. Studies (e.g. from the

Journal of Dairy Science

, 2025) emphasise that extensive systems (e.g. grazing) raise welfare but lower milk yield — a trade-off raising libertarian questions: who decides what the "needs" are?

Paul Davies would ask: "Is a universe that allows so much bio-friendly complexity really meant for us to create living beings that can only survive with technological support?"

Hans-Peter Dürr would whisper: "The whole is more than the sum of its parts. But if the parts only function with crutches, is the whole still healthy?"

Epilogue in Ginnungagap

Here in Ginnungagap the essence of this dilemma becomes visible. Simultaneously exist the robust cow that worked on the pasture, and the high-performance cow that needs ventilators and water beds. The problem and the solution, the cause and the compensation.

Breeding creates problems. Technology solves symptoms. The cycle goes on turning.

But is that bad? Or is that simply evolution in human hands? Domesticated animals have always been adapted to human needs. Horses were bred for speed, strength, endurance. Dogs for hunting, herding, guarding. Why should cows be an exception?

The answer is complicated. For there is a difference between adaptation and over-breeding. Between optimisation and fragility. Between progress and dependence.

The ancestors could not survive without humans — that is domestication. But they could live on a pasture, with grass and water, without technology.

Modern Holsteins can no longer do that. Without non-slip floors, ventilators, water beds, precision feeding and medical care they would soon become ill, give less milk, die earlier.

Is that a problem? Only if the technology fails. Only if the power goes off, if feed prices explode, if the systems break down.

It is remarkable that we have so optimised a species that it now functions only under optimal conditions — and then we hope that the conditions will always remain optimal.

The sports-car engine runs at full speed. As long as the oil cooler works, the brakes hold, the cooling system runs — so long, all is well. But if even one system fails, the whole engine stops.

The waves congeal, the forms emerge, the whole remains. But sometimes the question arises: does it remain when the technology fails?

Phew.

28.9: Global Dominance — 160 Countries, One Breed

Today the Holstein breed dominates in over 160 countries worldwide. From New Zealand to Canada, from Argentina to China — wherever industrial dairy farming is practised, Holstein cows stand.

Here in Ginnungagap all these lives become simultaneously visible. A cow in Iowa, 1950, the first in her village with Holstein blood. A cow in New Zealand, 1980, imported from Canada to displace the local Jersey herds. A cow in China, 2010, in an air-conditioned mega-barn with 10,000 other Holsteins, bred for maximum milk yield for a growing middle class.

The breed has conquered the world. But was that a good idea?

The Numbers Are Impressive

A modern Holstein gives on average 8,500 to 10,000 litres of milk a year. Some top animals manage over 15,000 litres. In Israel there are herds with an average of 12,500 kilograms — a world record. That is about four times what a traditional landrace produces.

Efficiency is unmatched. Per kilogram of milk Holsteins need less feed, less water, less land than any other breed. Purely economically they are unbeatable.

That explains their global dominance. Every farmer, every dairy, every country wanting to produce milk chooses Holsteins. Not because they are the most robust. Not because they are the healthiest. But because they are the most productive.

In Argentina, in 2005, there was a farmer named Señor Rodriguez who had long kept Zebu cattle — robust animals adapted to the heat of the pampas, that managed on little feed. They gave only 2,000 litres of milk a year, but they were cheap to keep.

Then a consultant from the dairy came. “Señor Rodriguez, you must switch to Holsteins. Your Zebus give too little milk. We can no longer pay you as before.”

Rodriguez protested. “But the Holsteins can’t cope with the heat! It’s 35 degrees here in summer!” The consultant smiled. “Install ventilators. Air conditioning. We’ll give you a loan. In three years you’ll have paid off the loan, and then you’ll earn more than before.”

Rodriguez hesitated. But the dairy gave him no choice. Either Holsteins, or they would no longer take his milk. He bought 50 Holstein heifers from Uruguay. Installed ventilators, built new barns, bought more expensive concentrate. Milk yield rose to 7,000 kilograms per cow. The dairy paid better. Economically it worked.

But Rodriguez once said to one of his cows, as he stroked her after milking: “You know, *chica*, your ancestors — the Zebus — barely needed me. They got by on their own. You? You need me every day. Without me you would die.”

He was right.

The Displacement of Local Breeds — A Silent Extinction

But this dominance has a price nobody likes to name: local breeds have been displaced and are often threatened with extinction.

In Germany there were once dozens of different cattle breeds. Angler, Rotvieh, Gelbvieh, Murnau-Werdenfelser, Hinterwälder, Vorderwälder. Each adapted to its region, its climate, its feed base. Today most are either extinct or preserved in tiny gene reserves. The Holsteins have displaced them.

In India there were over 40 indigenous cattle breeds, perfectly adapted to tropical heat, drought, lean pastures. Sahiwal, Gir, Tharparkar, Red Sindhi. They gave less milk — 2,000 to 4,000 kilograms — but they survived under conditions in which Holsteins would die.

Today India is importing Holstein genetics on a massive scale. The government promotes “cross-breeding” — Indian cows are crossed with Holstein bulls to raise milk yield. That works — in the short term. But the old robust breeds are vanishing. And with them genetic diversity that may be urgently needed in a hotter world is vanishing.

At an international breeders’ conference, in 2015, in Verona, a German breeder, Herr Schäfer, and an Indian breeder, Dr Patel from Gujarat, were talking.

Dr Patel said: “You know, Herr Schäfer, our old Gir cattle — they could survive at 45 degrees in the shade. They ate thorny scrub and still gave milk. But they only gave 3,000 kilograms.”

Schäfer nodded. “And now?”

“Now we have Holstein crosses. They give 6,000 kilograms. But at 40 degrees they collapse. We need air conditioning, more expensive feed, more medicine. And if the air conditioning fails, they die.”

Schäfer was silent for a moment. Then he said: “The same is happening with us. Our old robust breeds are almost extinct. Now we only have Holsteins. If the climate changes, if feed prices rise, if energy gets more expensive — then we have a problem.”

Dr Patel sighed. “But what can we do? The dairies pay only for milk volume. The government supports only high performance. We have no choice.”

They were both right. And both knew it.

The Genetic Monoculture — An Evolutionary Risk

Here lies the greatest problem: when practically the entire world’s milk production rests on a single breed that is genetically extremely narrow, that is an evolutionary risk.

Imagine a new disease appears. A virus, a bacterium, a parasite — to which Holsteins are particularly susceptible. The disease would spread across the planet at an incredible speed. Millions of cows could die. World milk production would collapse.

That sounds like dystopia. But it is not unrealistic. We have already experienced it with plants. The Great Famine in Ireland, 1845–1852, was caused by a potato blight. The Irish farmers grew almost exclusively a single potato variety — Lumper. When the blight came, the entire harvest died. A million people starved.

Genetic diversity is an insurance against the unforeseeable. If all cows are genetically different, some will be susceptible to a disease, others resistant. The resistant ones survive, reproduce, the population recovers. But if all cows are genetically almost identical — like modern Holsteins — then all are equally susceptible. If the disease strikes one, it strikes all.

Paul Davies would say: “A bio-friendly universe permits variability — but monoculture is the opposite of variability. We have sacrificed evolutionary resilience for economic efficiency.”

Jeremy England would add: “Highly specialised systems are efficient — but fragile. Nature prefers redundancy, diversity, adaptability. We have created the opposite.”

Adaptation to Local Conditions — Lost

A further problem: Holsteins are often overstretched in tropical climate zones.

They are bred for a temperate climate. 10 to 20 degrees Celsius is ideal for them. At temperatures above 25 degrees heat stress begins. Above 30 degrees it becomes dangerous. In tropical countries — India, Brazil, parts of Africa, South-East Asia — such temperatures are the norm, not the exception.

The solution? Air-conditioned barns, ventilators, sprinkler systems. That works — but it costs money and energy. And it makes milk production dependent on technology and fossil fuels.

Local breeds adapted over centuries to these conditions would need no air conditioning. But they were displaced because they gave less milk.

In Brazil, in 2012, in the state of Mato Grosso, there was a farmer named Senhor Santos with a huge operation of 1,000 Holstein cows. In summer temperatures regularly rose above 35 degrees.

One day the power failed. The ventilators stood still. Within three hours the first cows collapsed. Heatstroke. Santos called the fire brigade in desperation; they came with water tanks and sprayed the cows down. 23 cows died nonetheless.

Santos sat in front of the barn that evening, head in hands. His neighbour, an old man named João, came over. João still had five old Gir cows — an Indian breed brought to Brazil by his grandparents 80 years ago.

João said quietly: "My cows have come through the day without problems. No ventilators. No air conditioning. Only shade and water."

Santos looked at him. "But your cows only give 3,000 litres."

"That's true," said João. "But they live. Your cows? They are prisoners of the technology."

Santos was silent. He knew João was right. But he also knew he had no choice. The dairy paid only for volume. His bank wanted loans paid back. He needed high-performance cows to survive — economically.

Grazing Capacity — Sacrificed for Barn Performance

A last problem: Holsteins are less grazing-fit than traditional breeds.

Grazing capacity means: the ability to gain enough nutrients from grass on the pasture to stay healthy and give milk. Old landraces could spend the whole summer on the pasture and gave solid milk yields — 4,000 to 5,000 kilograms.

Holsteins? Only half-day grazing, plus concentrate in the barn. Without concentrate their performance collapses. Their digestion is optimised for high-energy feed — not for pure grass.

That has consequences. In countries like New Zealand and Ireland, where grazing was traditionally dominant, farmers had either to change their systems (more concentrate, less grazing) or cross their Holsteins with other breeds (Jersey, Montbéliarde) to win back grazing capacity.

The economic efficiency — per kilogram of milk — is often better with pure grazing of old breeds than with Holsteins needing expensive concentrate. But the absolute milk volume is lower. And the markets pay for volume, not for efficiency.

It is remarkable that we have created a cow that no longer functions properly on a pasture — the natural habitat of a cow. That is rather like building a car that only runs on motorways, but fails on country lanes.

Epilogue in Ginnungagap

Here in Ginnungagap the essence of global dominance shows itself. Holsteins are everywhere — in 160 countries, in millions of barns, on every continent. Their genes have conquered the world.

But the fragility is just as visible. They are dependent on technology, on energy, on concentrate, on air conditioning. They have displaced local breeds that were more robust, more adapted, more resilient. They have sacrificed genetic diversity for maximum productivity.

Is that a problem? Only if the systems collapse. Only if the climate changes faster than expected. Only if a new disease appears against which all are susceptible.

Hans-Peter Dürr would whisper: "The whole is more than the sum of its parts. But when all parts are the same, the whole is fragile."

Paul Davies would say: "A bio-friendly universe rewards diversity. Monoculture is efficient — but it contradicts the principles of evolution."

The breed has conquered the world. But is it also a sustainable conquest? Or is it like an empire at the height of its power — dominant but overstretched, dependent on fragile supply chains, susceptible to shocks?

The future will tell. The waves congeal, the forms emerge, the whole remains. But will it remain when the conditions change?

Phew.

28.10: The Future — Where Is the Journey Going?

Where is the journey going? Holstein breeding stands at a crossroads, and nobody knows for sure which road is the right one.

Here in Ginnungagap all possible futures are simultaneously visible. In one future Holsteins become yet more productive, yet more efficient, genetically perfected by CRISPR and artificial intelligence. In another future breeding returns to the basics — smaller herds, more grazing, less performance, but more health. In a third future Holsteins are history, displaced by new technologies — precision fermentation, cell-based milk, synthetic proteins.

The future is open. But the decisions made today will determine which of these futures becomes reality.

Genomic Selection Becomes More Precise — The Glass Bull

The first possible future is the continuation of the path so far: yet more technology, yet more precise breeding, yet higher performance.

Genomic selection is already standard today. Every calf is genetically tested shortly after birth. A piece of ear tissue suffices. The lab analyses hundreds of thousands of genetic markers — small variations in DNA that correlate with particular traits. Milk yield, health, fertility, udder shape, claw quality.

The result is a "genomic breeding value" — a number predicting how good the calf will be later as a dairy cow. Even before she has ever been milked, one knows: this calf will be above average. That calf will be below average.

The consequences are brutally efficient. Above-average calves are reared, get the best feed, later become breeding cows. Below-average calves? Slaughtered, often when only weeks old.

In the Netherlands, in 2020, there was a farmer named Meneer Van der Berg who bred top animals. Each of his calves was genomically tested. He once showed a visitor the results on his tablet.

"You see, this one here — genomic breeding value 150. That means she will give 1,500 kilograms more milk than the average. I'm keeping her."

He swiped on. "And this one — value 80. Below average. I'm selling her to the fattener."

The calf was healthy, strong, had done nothing wrong. Only the genes were not perfect enough.

Van der Berg shrugged. "That's how modern breeding works. We can no longer afford middling cows. Either elite, or out."

The future of this direction is already foreseeable: yet more precise tests. Yet more genetic markers. Soon one will be able to predict not only milk yield, but also disease susceptibility, life expectancy, metabolic efficiency, even temperament.

The "glass bull" — an animal whose entire genetic potential is fully known even before it is born.

CRISPR — The Gene Scissors as a Breeding Tool

But why stop at selection? Why not intervene directly in the genes?

CRISPR-Cas9 is a molecular pair of scissors that can precisely cut out DNA sequences and replace them with others. The technique has already been tested on cattle. Not only in laboratories, but in real breeding programmes.

An example: resistance to tuberculosis. Cattle can fall ill with bovine tuberculosis — a bacterial infection that is a problem worldwide. Some cattle breeds have natural resistances, others not. Scientists have identified the resistance gene. With CRISPR one could insert this gene into Holsteins — without decades of cross-breeding, without changing the rest of the genetics.

Another example: hornlessness. Many cattle are dehorned — a painful procedure, but necessary to prevent injuries in herds. There are naturally hornless cattle, but the gene for it is not present in all lines. With CRISPR one could simply insert the hornlessness gene into every breeding line.

Sounds great, doesn't it? Healthier cows, less pain, better genetics.

But here the ethical questions begin.

At a conference in Edinburgh, in 2022, a German breeder, Dr Hartmann from Bavaria, and an American geneticist, Professor Miller, discussed.

Miller was enthusiastic. "Imagine, Dr Hartmann — we could breed cows resistant to all common diseases. Mastitis? Just insert the resistance gene from a robust landrace. Claw problems? A gene for stronger claws from a mountain breed. Heat stress? Genes for better thermoregulation from Zebu cattle. We could build the perfect cow!"

Dr Hartmann was more sceptical. "And who controls that? Who decides which genes are 'perfect'? What if we make mistakes we cannot reverse?"

Miller waved it away. "We test everything thoroughly. CRISPR is precise."

"Precise, yes," said Hartmann. "But do we really know all the consequences? Genes interact. If we change one gene, others might function differently. Epigenetics. Pleiotropy. We do not yet fully understand the system."

Miller smiled. "That is precisely why we must keep researching."

Hartmann was silent. He knew Miller could not be stopped. The technology was there. It would be used — whether ethically defensible or not.

Epigenetic Programmes — Environment as a Breeding Tool

A gentler alternative to gene scissors is epigenetic optimisation. Not changing the genes, but shaping the environment so that the existing genes function optimally.

The SwissCow 2.0 project of ETH Zurich pursues exactly this approach. Scientists analyse how calf rearing, husbandry, feeding and stress influence gene expression. The aim is to raise health and performance through better management — without changing the DNA.

The results are promising. Calves that are optimally fed and kept stress-free in the first weeks of life later show better milk yields, better health, longer life — independent of their genetics.

That means: with the right environment one can turn a genetically average calf into an above-average cow. Without CRISPR. Without genomic selection. Only through care.

In Austria, in 2021, there was a small operation with a farmer named Frau Hofer who had only 30 cows. She could not afford expensive genomic tests, no high-tech breeding. But she did something else: she let calves stay with their mothers longer. Three months instead of three days. The calves drank real milk, not milk replacer. They had social contact, learned from older cows, grew more slowly but more healthily.

These calves later became robust, healthy cows. No peak performance — 7,000 kilograms of milk instead of 10,000. But they lived longer. Twelve years instead of five. They had fewer illnesses, fewer treatments, less stress.

Frau Hofer once said, while stroking one of her cows after milking: “You know, Liesl, the other farmers laugh at me. ‘Too old-fashioned,’ they say. But my cows are happier. And in the end I earn just as much because I pay less to the vet and my cows live longer.”

She was right. Epigenetic optimisation is not glamorous. It does not bring headlines like CRISPR. But it works.

Cross-Breeding — Regaining Diversity

A further strategy is cross-breeding with other breeds. Crossing Holsteins with Jersey to get smaller, more grazing-fit cows. Crossing Holsteins with Montbéliarde or Fleckvieh to improve health and fertility.

That is already being done — in New Zealand, Ireland, Scandinavia, increasingly also in North America. The results are mixed. The cross-bred animals are often healthier, more robust, longer-lived. But they give less milk. A trade-off.

The question is: is the trade-off worth it? Is a cow that gives 8,000 kilograms of milk but lives ten years better than a cow that gives 12,000 kilograms but only five?

Economically both can work. It depends on the conditions. In expensive concentrate markets and with high energy costs, robust cross-bred animals are often more profitable. In systems with cheap feed and optimal technology, high-yield Holsteins are superior.

It is remarkable that we took a hundred years to breed the perfect cow — and now we are crossing her again with other breeds to solve the problems we created through perfection.

Cloning — The Controversial Option

A technically possible but ethically and economically controversial option is cloning.

One can today clone cows. That is to say: one takes a cell of a top cow, removes the cell nucleus with the DNA, places it in an enucleated egg cell, and lets an embryo grow from it. The result is a genetically identical duplicate of the original cow.

Theoretically one could simply clone the world’s best cow — say, a cow with 20,000 kilograms of milk a year — a thousand times. Every farm could have copies of this super-cow.

But reality is more complicated. Clones are not really identical. Epigenetics plays a role. The environment in which the calf grows up influences gene expression. A clone of the super-cow, raised under poor conditions, will not match the original's performance.

In addition, cloning is expensive — 15,000 to 20,000 euros per animal. And it is ethically controversial. Many clones die early or have health problems. In the EU cloning for food purposes is largely forbidden.

The future of cloning is therefore uncertain. Technically possible, practically limited.

The Restart — Back to Basics?

And then there is the radical alternative: the restart. Back to robust landraces, smaller herds, extensive grazing, less performance, but more sustainability.

That sounds romantic. But is it realistic?

The world population is growing. The demand for milk is rising. Extensive grazing needs much land — land that is often not available. Economically, high performance is unavoidable in many regions.

But in some niches the restart works. Small organic operations with old breeds, directly marketed milk, regional value chains with fair prices. These are islands of diversity in an ocean of monoculture.

Paul Davies would say: "A bio-friendly universe permits several roads. Perhaps the future is not either high-tech or low-tech, but both — alongside one another, adapted to different conditions."

Epilogue in Ginnungagap

Here in Ginnungagap all these futures are simultaneously visible. The CRISPR-edited cow, resistant to all diseases, perfected, but artificial. The epigenetically optimised cow, healthy through care, not through gene manipulation. The cross-bred cow, less productive, but more robust. The old landrace in the gene reserve, waiting for a future that may need her again. The cloned cow in the laboratory, genetically identical to a top cow, but somehow different. The cross-bred cow — half Holstein, half Jersey — a compromise between performance and robustness.

The future is not fixed. It is decided by the decisions made today. By breeders, politicians, consumers, scientists.

Jeremy England would say: "Complex systems do not follow linear paths. Small decisions today can have great consequences tomorrow."

Hans-Peter Dürr would whisper: "The whole is more than the sum of its parts. And the whole always seeks balance. Perhaps the future will find a way between extremes."

The waves congeal, the forms emerge, the whole remains. The future is open — and that is perhaps the only certainty we have.

Phew.

28.11: Balance of an Era — The Cow That Came From the Netherlands and Conquered the World

Here in Ginnungagap a balance becomes visible. De Kol 2d, born 141 years ago in a Dutch village. Johanna, the best dairy cow in Holland of her time. Pabst, the most expensive bull of his epoch. Elevation, the bull of the century.

Their genes flow through the modern Holsteins. They are her legacy — a living monument to breeding craft, genetic concentration and epigenetic fine-tuning.

Are they perfect? No. They give more milk than their ancestors, but they live shorter lives. They are more productive but more vulnerable. They are specialised but less versatile.

Let us take stock, dear human. What have a hundred years of Holstein breeding brought? What was won? What was lost?

What Was Won — The Successes

The figures speak for themselves. From 3,000 kilograms of milk in 1920 to over 10,000 kilograms today. That is more than a tripling. Some top cows give 15,000, even 20,000 kilograms a year.

The efficiency is impressive. Per kilogram of milk modern Holsteins today need less feed, less water, less land than any generation before them. If all cows were still as inefficient as in 1920, we would need three times as much land to produce the same amount of milk.

Genetics has become precise. Today we understand which genes influence which traits. We can predict how good a calf will later be, even before she has been milked. That saves time, money, resources.

The global availability of milk has risen. More people have access to affordable dairy products. That has contributed to food security, especially in developing countries.

An old breeder named Herr Becker from Lower Saxony said in 2010, when he was over eighty and had been breeding all his life: “You know, when I started, in 1950, our cows gave 3,500 kilos. We had fifty cows, and that was barely enough to live on. Today my grandson has eighty cows, each giving 10,000 kilos, and he earns well. That’s progress. That’s what I worked for all my life.”

He was right. That is progress. Measurable, real, meaningful.

What Was Lost — The Costs

But every progress has its price. And the costs of the Holstein revolution are considerable.

Genetic diversity was lost. Local breeds — adapted to their regions, robust, versatile — are nearly extinct. In Germany the old German Black-and-Whites exist only in gene reserves. Worldwide dozens of cattle breeds have vanished or are threatened with extinction.

Robustness was sacrificed. The old cows lived ten, twelve years. Modern Holsteins live on average five years. The old cows coped with simple feed. Holsteins need precise rations, highly concentrated feed, computer-controlled feeding.

Grazing capacity was lost. The old cows could spend the whole summer on the pasture. Holsteins need barns, ventilators, air conditioning. At temperatures above 25 degrees Celsius they break down.

Dependence was won. Without technology, without energy, without concentrate, Holsteins no longer function. They are elite athletes — but without infrastructure they are helpless.

The same Herr Becker, in 2010, became thoughtful after his praise of progress.

"But you know," he said more quietly, "sometimes I miss the old days. Back then the cows had names. We knew each one. They were part of the family. Today my grandson has eighty cows, all with numbers. He doesn't know them any more. They are production units."

He was silent for a moment. "And the old cows — they were tough. They survived everything. Today? When the power fails, when the ventilators stop, when the concentrate doesn't come — then we have a problem. We've made ourselves dependent."

He was right about that too. That is the price of progress.

The Ethical Question — Are They Still Happy?

Here comes the question nobody likes to ask but which must be asked: are modern Holsteins still happy?

What "happiness" means for a cow is hard to define. Cows have no consciousness like humans. They cannot philosophise, abstract, reflect on their own life.

But they feel things. They feel pain when their joints are inflamed. They feel stress when the barn is too cramped, when it is too hot, when they have to fight for feed. They feel contentment when they stand on a pasture, when the sun shines, when they chew the cud in peace.

The question is: do modern Holsteins have more pain and stress than before? Or do they have more contentment?

The answer is complicated. It depends on the operation. A good farmer with a modern barn, plenty of space, good feeding, preventive health care — there a Holstein can be happy. A bad farmer with a too-cramped barn, too little feed, no medical care — there a Holstein suffers more than a robust old cow would suffer.

High performance makes them more vulnerable. Their metabolism works at the limit. Their immune system is weakened, because all energy flows into milk production. Their joints are strained because their udders are so heavy.

But modern animal husbandry can also be better. Soft cubicles instead of hard concrete. Ventilators instead of heat. Regular vet visits instead of untreated diseases.

It is no simple either-or. It is a spectrum. Some cows have it better than before. Some worse. Most somewhere in between.

Paul Davies would say: “A bio-friendly universe permits suffering and well-being. The question is what balance we strive for.”

The Economic Reality — Compulsion Instead of Choice

But ethical questions often collide with economic constraints. Many farmers would like more robust cows, smaller herds, more grazing. But they cannot afford it.

The dairies pay by volume. The more milk, the more money. The banks want loans paid back. The feed suppliers want to be paid. The vet costs money. The technology costs money.

To survive in this system, you need Holsteins. High performance is no luxury but a necessity.

A young farmer named Felix in Bavaria had taken over the farm from his father in 2018 — thirty cows, old barns, summer grazing. Felix dreamed of “species-appropriate husbandry”, of smaller herds, of extensive farming.

Reality caught up with him quickly. The dairy cancelled the contract — too little volume, too irregular delivery. The bank wanted the loan for the new milking parlour back. Feed costs rose.

Felix had to decide: either give up the farm, or expand and modernise.

He expanded. Bought forty new Holstein cows, built a new free-stall barn, installed a milking robot. Milk yield rose, the dairy was satisfied, the bank got its money. But Felix once said, alone in the barn: “I didn’t want this. I wanted to farm differently. But the system doesn’t allow it. Either you play along, or you’re out.”

That is the reality for most farmers. The choice is often no choice.

The Systemic Question — Can It Be Different?

Can it be different? Can milk be produced without high-performance breeding, without genetic concentration, without dependence on technology?

Yes, it can. But it needs different framework conditions.

It needs dairies that pay for quality instead of only volume. It needs consumers willing to pay more for milk from robust cows in extensive husbandry. It needs political support for diversity instead of only efficiency.

Some niches already exist. Organic operations with old breeds. Direct marketing of hay milk. Regional value chains with fair prices. But these are islands in an ocean of industrial milk production. The great majority of milk comes from Holsteins in high-performance systems.

Can that change? Perhaps. If the framework conditions change. If climate, energy and feed prices make high performance too expensive. If consumers become more aware. If politics steers a new course.

But today that is the exception, not the rule.

Epilogue in Ginnungagap — The Legacy of De Kol 2d

Here in Ginnungagap the legacy of De Kol 2d, Johanna, Pabst and Elevation shows itself. They created the modern dairy cow. They set off a revolution that has changed the world.

Their descendants have conquered the world. 160 countries, millions of barns, billions of litres of milk a year.

But at what price?

Genetic diversity was sacrificed. Robustness was traded for productivity. Independence was traded for efficiency. A species was created that only functions under optimal conditions.

Is that good or bad? The answer depends on whom you ask.

For the dairies it is good — more milk, more profit. For consumers it is good — cheap milk, available everywhere. For some farmers it is good — higher yields, modern technology. For other farmers it is bad — compulsion, dependence, loss of autonomy. For the environment it is mixed — more efficient per litre, but dependent on fossil energy. For the cows it is mixed — some have it better, some worse.

It is remarkable that a handful of Dutch cows dominate the entire world's milk production — and that we have named them, for marketing reasons, after a German province, although they originally came from the Netherlands.

Names are smoke and mirrors. But milk is milk. And of that, Holsteins give a damnable lot.

The waves congeal, the forms emerge, the whole remains. Whether that is good or bad will be decided by history. But one thing is certain: the era of Holsteins is not yet over.

Phew.

28.12: Epilogue — Dreams From the Dutch Marshes

Here in Ginnungagap dreams arise.

Dreams from the Dutch marshes, where it all began. From the flat pastures along the North Sea, where the wind always blows and the dykes protect the land from the water. Dreams of De Kol 2d, born in 1884, a cow among many that nobody held to be special — until her daughters began to give milk. A lot of milk.

Figure 151: Cow at Watering Place, by Aelbert Cuyp, ca. 1650, Pushkin Museum

Dreams of the traders who travelled across the Atlantic, black-and-white cows in the bellies of the ships, seasick but surviving. Of the American farmers who received them, sceptical at first, then enthusiastic.

Dreams of Pabst, the most expensive bull of his time, whose semen was sent across continents, frozen in nitrogen, thawed in barns from Iowa to Bavaria.

Dreams of Elevation, the bull of the century, who sired tens of thousands of daughters whose genes flow today in practically every Holstein.

And dreams of all the nameless cows in between — the millions who broke no records, won no prizes, wrote no history. Who simply lived, gave milk, had calves, aged, died. Who were the backbone of this revolution without knowing it.

The Invisible Cows

In all the stories of great breeding, of record cows and top sires, the ordinary cows are often forgotten. The ones that gave 6,000 kilograms instead of 10,000. The ones that did not have a perfect udder shape. The ones that did not appear in herdbooks.

But these cows were just as important. For breeding only works if there are enough cows from which to choose. The peak exists only because there is a base.

In East Friesland, in 1975, lived such an ordinary cow. She had no special ancestry, no famous forebears. Her farmer, Heinrich, did not call her by name — she was Number 47. She gave 5,000 kilograms of milk a year, solid, but not impressive.

She was never at a show. She never won a prize. Her daughters did not become breeding cows. She was average. But she was real. She lived ten years. She had eight calves. She gave 50,000 kilograms of milk in all. She paid for Heinrich's tractor, for his children's school money, for his retirement.

Breeding history does not remember her. But without cows like her there would be no breeding history.

It is remarkable that we tell history in superlatives — the largest cow, the most productive cow, the most expensive cow — while the silent millions who keep the system running are forgotten.

The Paradox of Perfection

Here is the paradox: the more perfect Holsteins become, the more fragile they become.

De Kol 2d was not perfect. She was good but not extraordinary. But she was robust. She lived long. She had many calves. She survived under conditions that no Holstein today would survive.

Modern Holsteins are closer to perfection — genetically optimised, productive, efficient. But they are also more vulnerable. They need more support, more technology, more control.

That is the paradox of all high performance: to reach the maximum, the conditions must be optimal. But optimal conditions are fragile. A power failure, a heatwave, a feed crisis — and the system collapses.

Hans-Peter Dürr would whisper: "The waves congeal into ever more complex forms. But complexity is not stability. Sometimes the simple is more resilient than the perfect."

The Future Is Unwritten

Here in Ginnungagap it is not foreseeable how the future will look. Perhaps Holsteins will become yet more productive, yet more efficient, genetically yet further optimised by CRISPR and artificial intelligence. Perhaps they will be replaced by new technologies — precision fermentation, cell-based milk, synthetic proteins that do without cows.

Perhaps they will return to the basics — smaller herds, more grazing, less performance, but more health and longevity. Perhaps the old robust breeds will be revived when the climate changes, when energy becomes more expensive, when consumers rethink.

Or perhaps everything will stay as it is — Holstein dominance, high performance, global monoculture, carrying on as before, until something unforeseen happens.

The future is unwritten. And that is perhaps the only certainty.

Jeremy England would say: "Complex systems evolve in unforeseeable directions. Small disturbances can set off great changes. The future arises from the interplay of countless factors."

Paul Davies would add: "A bio-friendly universe rewards adaptability. The species that survive are not the strongest or the cleverest, but the most adaptable."

The Dream Ends, Life Goes On

Here in Ginnungagap these dreams end. Or rather, they return to the many lives that exist simultaneously.

A cow in Iowa, 2025, who gives 12,000 kilograms and whose farmer is proud. A cow in India who suffers under 40 degrees of heat, because the air conditioning has failed. A cow in New Zealand on the pasture, who gives less milk, but is more contented. An old German Black-and-White in the gene reserve, waiting for better times. A cloned cow in the laboratory, genetically identical to a top cow, but somehow different. A cross-bred cow — half Holstein, half Jersey — a compromise between performance and robustness.

All these cows and more. The sum of all the cows that have ever lived and ever will live. In Ginnungagap time is meaningless. Past, present, future — all flow together.

And in this essence, the answer to all the questions this chapter has asked appears:

Are Holsteins perfect? No. But perfection is a human concept, not a natural reality.

Are they happy? Sometimes. Under good conditions, with good farmers, yes. Under bad conditions, no.

Was the Holstein revolution good? For some yes, for some no. The truth lies in the spectrum, not in extremes.

Will the breed survive? As long as humans want milk and conditions stay stable, yes. If conditions change — who knows?

Closing Words — Phew

Names are smoke and mirrors. Holstein, Friesian, Black-and-White — those are human categories. A cow is simply cow. She gives milk, she has calves, she lives her life.

Whether she gives 3,000 or 15,000 kilograms, whether she lives five or twelve years, whether she stands on a pasture or in an air-conditioned barn — that depends on the humans who decide about her.

Holsteins are the product of human breeding, human economy, human decisions. But they are also more than that. They are living beings with their own existence, their own feeling, their own dignity.

The story of the Holsteins is not yet over. It will go on — in which direction, the next generations will decide. By humans. And perhaps a little also by the cows themselves, through their silent presence, their survival, their adaptation.

It is remarkable that a handful of Dutch cows 150 years ago laid the foundation for a global industry that today feeds billions of people — and that we still are not sure whether that was a good idea.

The ambiguity remains. The questions remain. The future remains open.

The waves congeal, the forms emerge, the whole remains.

Paul Davies asks: “Is that still evolution? Or is it production?”

Davies leans back in his imaginary armchair and looks me over — all my lives at once. The robust cow of 1920 with 3,500 kg of milk. The fragile Holstein of 2025 with 12,000 kg of milk and water-bed cubicles.

“Evolution,” he says thoughtfully, “works through random variation and natural selection over millions of years. What humans have done with you is the opposite: targeted variation and artificial selection over a hundred years. That is no longer a biological process — that is production.”

He points to the modern Holstein. “This cow is a product. Designed for maximum milk yield under optimal conditions. But evolution does not optimise for maximum performance — evolution optimises for survival under changing conditions.”

“And here lies the problem,” he goes on. “A bio-friendly universe — a universe that favours life, that allows complexity — rewards adaptability. Variability. Redundancy. But what have you humans done? You have reduced variability, eliminated redundancy, sacrificed adaptability — all for efficiency.”

He stands and walks around me, considers me from every angle. “When the conditions change — when the climate tips, when new diseases come, when energy prices explode — will these specialised designer cows still function? Or have you created a species that can only exist under stable conditions?”

I do not know an answer. But I sense that he is right. My aurochs ancestors survived 2 million years because they were adaptable. Modern Holsteins have survived for 150 years because humans adapt the conditions for them.

That is an enormous difference.

Davies sits down again. “It is not wrong, what you have done,” he says more quietly. “Domestication is part of cosmic evolution — humans are part of nature, so their breeding is also natural, in a certain sense. But you should be aware: you have taken on the responsibility. Evolution can no longer take care for you. You now have to take care yourselves that the system does not collapse.”

Phew — the responsibility for an entire species. That is no small thing.
