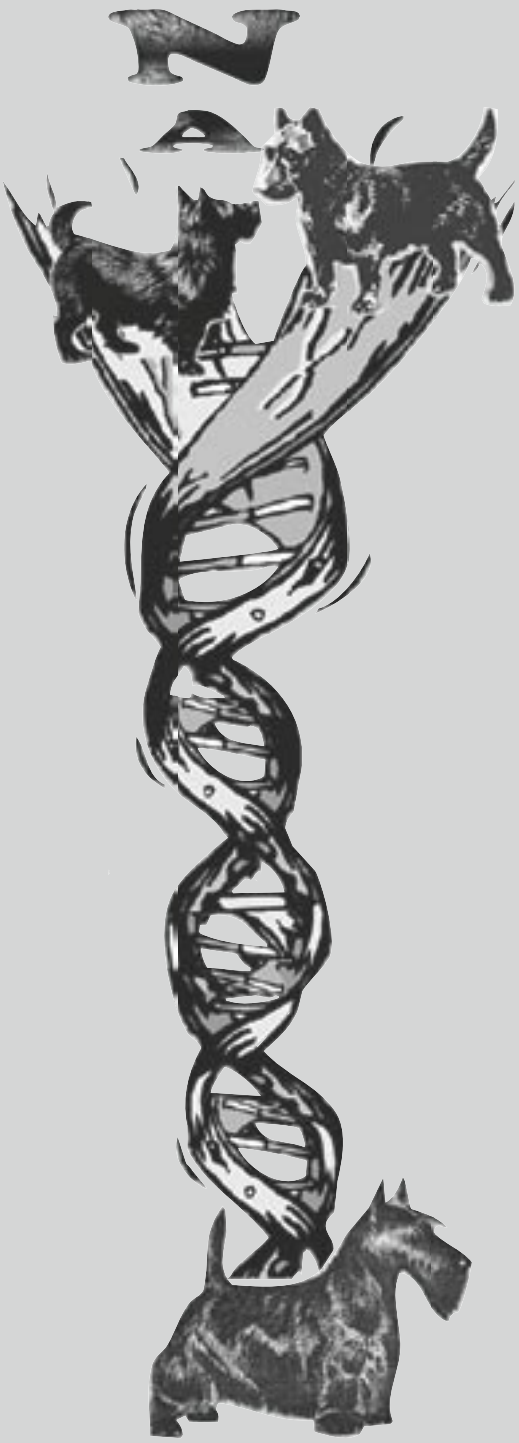
# Deconstructing the Diehard:

## The Genetic Plight of the Scottish Terrier

### Part One:
### Troubled Breed:
### How Did We Get Here?



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He's called the 'diehard,' a nickname given in the 19th century by the Earl of Dumbarton, Scotland, who owned a famous pack of them celebrated for their gameness. Old timers like John Naylor, who introduced the Scottish Terrier in America, and who knew their beginnings in their native land, describe those early Terriers as tough, hard-bitten workmen. They were hunted in packs for destroying foxes, otters, badgers, and other vermin infesting the cairns or rocks of the Western Highlands, and their owners scratched out a living by pay for vermin destroyed. Since their livelihood depended on the quantity of vermin killed, great care was taken by the breed's originators in mating dogs noted for their hunting qualities and gameness. Appearance counted little; hard-scrabble toughness meant everything to the Diehard.

Modern geneticists recognize that kind of breeding for fitness for survival as the path to genetic vigor in the propagation of any species or breed. Unschooled in what is today known as population genetics the originators of our breed endowed their old-time towsy terriers with toughness in their DNA.

**Troubled 'Fancy': From Diehard To Die-Likely**

Sadly for the Diehard, that original focus on breeding for fitness has been followed by a century of breeding for form, not function, breeding driven by pedigrees and appearance, not health. The result is today's Scottie is a genetic shadow of the rugged Highland Chieftan he once was, and worse, he carries a crippling genetic load.

Across the purebred canine world, including also the world of Scotties, our quest for the superior strain—codified in explicit breed standards of appearance— has made a sad mess of dog breeds

leading to problems with neurotic temperament, epilepsy, blindness, deafness, immune system weakness, skin diseases, blood disorders, deliberate deformity, and in some breeds inability to reproduce without breeder and veterinary intervention. To those who love dogs it is bitter compensation to know other breeds have fared worse than our Scotties. Almost a decade ago ***Time Magazine's*** cover story on the purebreed Fancy carried the title: "*That's No Way to Treat a Dog: A Terrible Beauty*" (Dec 12, 1994). ***Time's*** scathing critique of the Fancy and its damaging impacts on breeds such as Labradors, Collies, Great Danes, German Shepherds, Golden Retrievers, Cocker Spaniels, and English Bulldogs, concluded that today canine registration papers reflect so little correlation to genetic health that "the best use of pedigree papers is for housebreaking your dog."

**Scottish Terrier Predicament**

It would be convenient if disease and morbidity were isolated within pet store dogs and we could self-righteously point to 'well-bred' Scotties as genetically sound and robust. But, as I will describe in some detail later, there is compelling reason to believe 'well-bred' lines carry heaviest genetic jeopardy.

According to Dr. George Padgett, internationally known canine geneticist, today's Scottish Terrier breed carries a genetic load of 58 genetic diseases or defects, including endocrine/thyroid diseases, immune system dysfuntion, eye and ear diseases, heart, blood, and lymphatic diseases, liver diseases, muscle and skeletal diseases, and urinary system diseases, to name but a few.

And that may be the good news. Padgett's book and his Scottish Terrier breed research (***Control of Canine Genetic Diseases***, 1998) mentions nothing about predisposition to cancers now killing our dogs: lymphosarcoma, bladder cancer, malignant melanoma, mast cell sarcoma, hemangiosarcoma, and squamous cell carcinoma of the skin (see: Carole Fry Owen, "*Cancer: The Scottie War On Terror*," ***GSM***, May/June 2002).

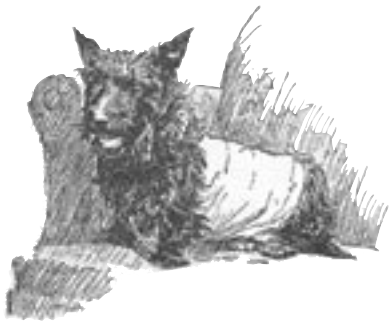
One fact alone is the stunning 'poster exhibit' of our breed's genetic predicament: the Scottish Terrier is 18 times more likely to develop bladder cancer than other breeds. Across all purebred dogs the risk for bladder cancer is 0.74, according to Purdue University researchers. Scotties carry a risk factor of 18.09! There is no plausible explanation for this shocking fact short of polygenic predisposition. After all, our dogs are scattered across the same geographic and demographic variables as other breeds, yet Scotties are 18 times more vulnerable; our dogs are on the whole as well or better cared for as any breed, yet they are at massively disproportionate risk to die of bladder cancer. That simply cannot be blamed on environment. I am convinced it is a frightening but so far unmapped consequence of the genetic 'deconstruction' of the Diehard.

**Wrong-headed Beginnings**

How did the Diehard become the die-likely? What has gone wrong in our breed?

It is common to demonize backyard and puppy mill breeders for their indifference to long-term health and genetics issues in the dogs they produce. They make handy whipping boys as enemies of the Scottish Terrier. But before we who take pride in stewardship of our breed curl the whiplash too lustily we need to take a hard look within. Over the past century the noble Diehard may have suffered most at the hands of friends and protectors.

I say this because the canine purebreed culture which for more than a century has been the bastion of breed purity for all purebred dogs is itself built upon premises, values and assumptions which create genetic timebombs.



Our century-old system built on pedigrees and rigid appearance standards, for all its merits in fixing recognizable Scottie 'type,' is based on a flawed genetic premise: the simplistic notion that aesthetics = genetics, that the best-looking dog is the 'superior strain.' This arbitrary and artificial definition of 'well-bred' is the myth that has driven canine purebreed culture for over a hundred years and has unwittingly deconstructed the gene pool of the Diehard. Confounding aesthetics with genetics is a legacy of Edwardian-era 'superior strain' racist thinking exemplified, to Edwardian minds, in human aristocracies and thoroughbred horses. It is not accidental that the mother of all purebreed kennel clubs in Great Britain and also the American Kennel Club trace beginnings to the historical period when breeding 'best to best' and utilizing sustained inbreeding and selection for 'superior' qualities was believed to develop a bloodline superior in every way to the unrefined, base stock which was the best nature could produce.

The flaw in this premise is not that we attempted to produce a 'superior strain' in the case of the Scottish Terrier; it is that we superficially defined 'superior' in terms of appearance and thus we tragically majored in minors while profoundly skewing deep issues of genetic vitality. The plain truth is the genes that set appearance and 'type' are but a small percentage of the 100,000 genes in the canine genome. Therefore, a 'purebreed' system driven rigidly by 'type' is a system obsessed with but a small portion of the genetic picture and functionally blind to larger gene pool dangers. What has been obscured over the past century's obsession to breed closer and closer to an arbitrary 'type' is that matings do not pass on only desired 'typy' genes. Genes do not assort one trait at a time, they are linked in groups on chromosomes. All of the genes in that mated pair's inherited ancestry are passed into the gene pool, including the 'worst of breed' genes present as recessive traits or polygenic predispositions.

My point is, because our premise as to the 'superior strain' and 'best of breed' has been superficial and flawed from

the perspective of genetic theory, the breeding decisions driven by that premise have unwittingly loaded our breed gene pool with defects and disease and thus genetically deconstructed the Diehard.

**Evolution of a Breed**

To see more clearly the genetic predicament today's Scottish Terrier faces pet owners need some knowledge of how a separate breed of dogs comes about.

Genetically, a combination of four factors are required to establish a new breed: (1) the ***founder event***, in which a finite number of individual canines is chosen to contribute genetic material to found a new and unique canine population; (2) ***isolation*** from genetic exchange in the general canine population, since without isolation within the new founder group only, a new breed will not result; (3) ***inbreeding***, which is the logical consequence of genetic isolation, which 'fixes' a stable genome in which variability is kept within limits defined by the breeders; (4) ***artificial selection***, by which breeders select among individuals produced in early generations so only those displaying desired characteristics are allowed to produce subsequent generations.

The hard truth from population genetics known to wildlife biologists since the 1960s is that while the above four factors are effective and necessary to establish a new breed, rigid continuation of those practices is genetic folly for the long-term propagation of a breed. As Jeffrey Bragg, Canadian breeder and Siberian Husky breed newsletter editor, says:

> [Population genetics] could have warned us about the problems we'd end up with by practicing artificial selection, breeding from small founder groups with no new gene inflow for decades, and relying on sustained incest breeding without the brutal tempering influence of natural selection. Today, when many registered breeds are 50 to 100 years old, bred within a closed studbook the entire time, population geneticists tell us we cannot continue these practices any longer if we want healthy canine companions. They say new genetic inflow is needed to counter random drift in small breed populations and to restore *heterozygosity*—genetic diversity—where it has been lost through inbreeding . . . . If we cannot breed healthy, hardy, happy dogs, there are those in our society who will question whether we have the right to breed at all."

**Genes, Generations, & Jeopardy**

Previously I referred to compelling reason why today's 'well-bred' Scottie, despite her consumate 'typy' good looks, may be the unwitting poster dog for the decline of the Diehard. The compelling reason I refer to is the principle of genetic diversity which modern population genetics identifies as the fundamental axiom of vitality in closed populations such as purebred dogs. Oversimplifying in order to make a point, diversity (*heterozygosity*) in a population spells health; *homozygosity*, or sameness, spells trouble. The bad news for today's 'well-bred' Scottie is that our breed's founding gene pool was perilously small to begin with thus offering slim genetic diversity at the start and that parsimonious original gene pool suffered a century of inbreeding fixated on refining showring 'type,' and was then further constricted by periodic dominance over the breed by a few kennels causing genetic bottlenecks. The result is what geneticist John Armstrong calls "inbreeding depression," glamorous Scotties pushed toward less and less genetic diversity and more genetic problems due to shrunken "effective genetic population."

Breed historians, of course, trace the evolution of the Scottish Terrier, but their reading of Scottie history is through the lens of purebreed culture's 'superior strain' thinking which equates 'well-bred' with championships. Therefore incest, genetic bottlenecks and 'matador effects' created by breeding to a few popular sires—each a red flag to population geneticists— are lifted up by breed historians as breed successes since they are interpreted as milestones of pedigree 'soundness' in certifying 'type.'

> ***"We created the modern Scottish Terrier, nature did not. We made him "longer in head, shorter in body, and lower to the ground than [his] ancestors," as Cindy Cooke has reminded us, and along the way we inadvertently made him 18 times more likely to die of Bladder Cancer than other breeds."***

Two accounts, an early and a recent analysis by important Scottie authorities, illustrate my point.

Consider first Dorothy Caspersz' assessment based on her definitive research first published in 1934 which traced from the breed's origin full records of descent for every British Champion, tracing both dam and sire:

> What is even more remarkable is that every known representative of our breed traces back in direct male line to a dog named Bonaccord, a winner of the period 1879-80. Thus, basically there is only one male line of descent throughout the entire breed, though of course innumerable branches and ramifications have been developed from it since. Bonaccord had a son named Rambler, a dog which was evidently used extensively at stud. Rambler sired several Champions, among them being the two dogs Ch. Dundee and Ch. Alister. Dundee was the result of mating Rambler to his half-sister; Alister was by Rambler out of one of his Champion grand-daughters. These two half-brothers, Dundee and Alister, who may truly be described as the pillars of the breed, were said to differ somewhat in type and to beget puppies showing this same divergence. (***The Scottish Terrier, 1957***.)

Caspersz, of course, had no knowledge of modern population genetics when she compiled her research and traced with

joy the narrow beginnings of our breed. Regarding in-breeding she wrote:

> In-breeding was much resorted to in those days. Whether it was due to shortage of material or because the pioneer breeders were determined to fix what by then had come to be the accepted type, we can only guess. Whatever the reason, certain it is that a definite breed type was established for all time ...."

Just as a single dog defines the foundation stock as patron sire of our breed, so a single history-making bitch dominates Scottish Terrier beginnings as brood bitch to our breed. According to Cindy Cooke that dam was Splinter II, whom she calls "foundation matron of the modern Scottish Terrier." Writes Cooke:

> No written description of Splinter II exists, although Mr. Ludlow described her as 'a lovely little bitch.' For whatever reason, early breeders linebred on this bitch to the virtual exclusion of all others. Mated to Tartan, she produced Worry, the dam of four champions. Rambler, her son by Bonaccord, sired the two founding sires of the breed, Ch. Dundee (out of Worry) and Ch. Alistair (out of a Dundee daughter). (***The New Scottish Terrier***, 1996).

However, the story of Scottish Terrier 'inbreeding depression' is further exacerbated by genetic bottlenecks and 'matador effects.' These occur historically whenever breeding within a closed population is limited to a few individuals. The consequences on the gene pool are diminished genetic diversity and increased homozygosity.

Two such historic bottlenecks in Scottie history are worthy of note, the first occuring between the World Wars, the second in the decade of the 1960s.

Writing about the breeding dominance following WWI by the Chapman brothers and A.G. Cowley, Cindy Cooke describes "the nearly simultaneous appearance of three stud dogs and one fabulous brood bitch."

> The three dogs were Ch. Albourne Barty, Ch. Heather Necessity, and Marksman of Docken. The bitch was Marksman's sister, Albourne Annie Laurie. These four Scottish Terriers, often referred to as The Four Horsemen, established the modern type of Scottie, longer in head, shorter in body, and lower to the ground than their ancestors (***The New Scottish Terrier***, 1996, p. 11).

Similarly, the gene pool was again effectively narrowed in the decade of the 1960s by the dominance of the "Three Bs" from the Bardene Kennel: Boy Blue, his son, Bardine Bingo, and Bingo's son, Bardene Bobby Dazzler. Of the influence of these Bardene dogs on subsequent generations of 'well-bred' Scotties Cooke writes:

> ***"Popular sires among Scottish Terriers allowed to dominate the gene pool are reasons for worry, not celebration."***

> It would be hard to overstate the influence of these three dogs on the breed. By 1970, half of all Scottish Terrier champion pedigrees traced back to one or more of this trio. The modern history of the breed has been written almost exclusively by the Three Bs' descendants. These include: Every Lloyd Trophy winner for the past twenty-five years; all but three of the last twenty-nine National Specialty winners (covering fifty-two Specialties); and all but two of the breed's top twenty American sires (p. 64).

**Aesthetics Or Genetics?**

A population genetics perspective on Caspersz' and Cooke's accounts would today see grounds for dismay in our breed's beginnings and genetic bottlenecks: since closely related individuals have a lot of other genes in common besides the desired 'type,' inbreeding increases the chances that any genes for undesirable recessive traits carried at other locations on the genetic strand will combine to produce trouble.

Writing about consequences of such inbred populations in the July 1999 issue of ***Atlantic Monthly***, Stephen Budiansky says:

> Genetic data confirm that the past century of dog breeding has produced some extremely inbred animals. Surveys using gene markers show that the chance that two members of a typical human family will have a different combination of genes at a given site is about 71 percent. In crossbred dogs it is 57 percent, in most purebred dogs 22 percent, and in some rare breeds four percent . . . This degree of uniformity means that when a bad trait does get locked in by chance, it tends to stay as long as breeding is confined within the group.

The irony in our Scottie historians' honorific tracings of Scottie breed history is that looked at from the perspective of population genetics, which tracks deleterious effects of genetic bottlenecks in closed populations, popular sires among Scottish Terriers allowed to dominate the gene pool are reasons for worry, not celebration.

This official congratulation, not worry, goes to the heart of the deconstruction of the Diehard. After all, it is not puppy mills and backyard breeders overseeing and blessing our breed's gene pool reduced to a gene puddle; it is breed gatekeepers at highest levels choosing 'Best of Breed' in good faith under the auspices of the American Kennel Club; it is the codification of the myth of the 'superior strain' equating aesthetics with genetics. With the best intentions in the world we've bred pedigrees more than dogs, obsessing over 'type' without due diligence to harmful genetic consequences that follow. Now, that century-old genetic bargain with the devil is coming due and our beautiful dogs and their people are paying for it (see Lisa Paddock, *"Our Mr. Holmes: Poster Dog for a Scottish Terrier Open Health Registry—The Face of Chronic Illness in Well-Bred Scotties,"* ***GSM***, May/June 2003).

**Going Too Far?**

Some will think I'm making too much of health issues, after all sickness is part of life and maybe Scotties have always had predispositions to cancers and other serious diseases.

Two things need to be said in response. The first is, we simply do not know or have records of breed health from the early days. No one kept records of Scottie longevity, health, or incidence of diseases. The troubling reason is in the world of purebred dogs 'well-bred' refers to *lineage and looks, not health.* This might be judged an overstatement except for the fact that both AKC and STCA manage meticulous records of parentage and championship points, but neither organization's record keeping includes careful tracking of a dog's or breed line's genetic map to allow sensible health assessment of just how 'well-bred' a dog actually is. Breeders, too, are victims of an official record system long on genetically irrelevent details of showring virtuosity but devoid of critical information as to a prospective sire's or dam's genetic health. How can any breeder make genetically responsible choices, intelligently breeding against known diseases, without accurate and detailed health records on all dogs and their offspring, especially show dogs, in the form of records maintained at least as zealously as we currently keep track of showring points?

There is another point which needs to be made regarding health and history in the Scottish Terrier. One glaring fact renders inappropriate a shrug that says sickness-is-part-of-life-so-accept-it-and-go-on. Genetic disease in the Scottish Terrier is not 'a part of life' in the sense it is inevitable and our inexorable fate; our dogs' genetic problems are of *our* making, not Nature's. We created the modern Scottish Terrier, nature did not. We made him "longer in head, shorter in body, and lower to the ground than [his] ancestors," as Cindy Cooke has reminded us, and along the way we unintentionally made him 18 times more likely to die of Bladder Cancer than other breeds.

We made the modern Scottish Terrier, nature didn't. We skewed the breed's gene pool, nature didn't. The problem is *us*, not our dogs, not nature. We must fix it.

**Beyond Blame to Solutions**

The point of all this is not finger-pointing but insight into how and why our breed's present genetic predicament has come about. I must make it clear the AKC and STCA are not 'the enemy.' These dog lovers are conscientious players who have played the purebreed game by the book in good conscience. The problem is the 'game' itself which has inbred wrong-headed genetic thinking in all of us. Blame and denial are futile. Honestly facing and owning our common jeopardy can move us forward.

I realize mine is a radical appraisal that stands on its head venerable canine purebreed tradition. Mine is a systemic diagnosis, not a call for treatment of symptoms.

I'm saying the genetic plight of the modern Scottish Terrier is a jeopardy for all of us, not just a few; we are all part of the problem and we all must be part of the solution. Today's breeders are under tremendous pressure because they've inherited a contaminated gene pool to work with yet modern consumers expect and demand a 'quality assured' breeding without problems. Pet owners live under the shadow of early death of beloved Scotties and worry over crippling medical bills to treat diseases in their dogs. Saddest of all, the dogs themselves who have no say in how they are bred or deformed or jeopardized put a stoical face on their genetic deconstruction, bearing the burdens of inherited diseases.

I'm saying the problem facing today's breeders, Scottie pet owners, and our dogs, is more pervasive than can be rectified by a quick fix or a biomedical discovery. The problem is deeper and more difficult because *our problem is inculturated shallow thinking about standards for our breed*. So long as our Scotties are officially measured by glamor-quotient rather than fitness, so long as official recordkeeping is myopically fixed on championship records instead of health records, our 'well-bred' Scotties will continue to devolve into beautiful 'Barbie Dogs' for whom no amount of medical research will cure their inbreeding depression.

Without a paradigm shift in our thinking about what 'purebred' could and should mean, the odds for future health and vitality are against our dogs.

**Conclusion**

The issue facing us is not who is responsible for yesterday; the issue is who will take responsibility for tomorrow. Let's excuse prior generations of Scottie stewardship for failure to keep detailed health records, after all, for much of the 20th century the dynamics of genetic health within closed populations was not understood.

Not so today. What is culpable today in light of principles of population genetics is continuation of business as usual. Continued thinking in old discredited ways cannot solve our breed's deepening genetic problems.

Perhaps it is a gift of the gods that our Scotties do not know their odds. The one feature our wrong-headed notion of the 'superior strain' has not yet bred out of the Scottish Terrier from his hard-scrabble beginnings in the Highlands of Scotland is his spirit. Even genetically impared today's dogs still die hard, bearing with grit and valor to the end the burdens of genetic disease we lay on them.

However, our modern make-overs of Highland stock deserve better. They deserve a fighting chance.

[This is the first of a three-part series devoted to the genetic health of the Scottish Terrier, by Joseph Harvill, Ph.D. Part II will focus on a layman's 'Genetics 101' to help pet owners better understand principles and implications for Scotties of the new population genetics. Part III focuses on 'Solutions To Our Breed's Genetic Predicament' with special reference to pet owner roles in the future genetic health of our breed.]