



# SCOTTISH TERRIER CLUB OF AMERICA

## Short Story: Mendel to Genome

**Article written by Kathi Brown**

When organisms, including dogs, produce offspring the young usually look similar to their parents. For thousands of years this fact was known based upon observation. People used common sense to choose and breed plants and animals with desirable characteristics for specific purposes. Most are familiar with the groundbreaking studies of Gregor Mendel into breeding and heredity. Through his careful observations and detailed record-keeping he was able to document multiple generations with specific traits. Early dog breeders used similar observations in creating our breeds and recorded these observations to create our standards. Breeding to produce these desired characteristics has required dedication, careful observation and detailed record keeping over generations similar to the processes of Mendel. Our Scottish Terriers were bred for the attributes necessary for controlling vermin in a rigorous climate and terrain. They were required to be fearless with immense power for their size. Structurally, it is a compact, sturdy beastie, with a long head and short-legs.

As with many breeds we are continuously breeding to improve fronts and this is especially true with our big dog that is low to the ground. Although most often seen today with ample furnishings the Scot's short-legs must be capable of supporting and moving this sturdy dog. No one contests that this is a short-legged terrier. The debate has been if it is a dwarf breed similar to others which recognize themselves as such. One characteristic of the shortened leg length has been the structure and shape of the long bones, with the growth plates calcifying early and creating the short bones of the legs. The observations of Mendel, in the mid-1800s, gave a functional model for heredity but he knew nothing about the biochemical and physical processes. Although extracted from a cell nucleus in 1869 it was not until the 1950s that the structure of DNA was studied in detail and then in the 1990s that we launched genome projects including the mapping of the canine genome. The science of genetics and the scientific information available to us has expanded and deepened exponentially. This now provides all breeders with more information that we can use to understand and improve our dogs. One article published in 'Science Magazine' describes replicated studies of the "expressed Fgf4 retrogene which is associated with a short-legged phenotype (what you see) in dogs and specifically mentions the Scottish Terrier. While there is great variation in breeds of dogs there are also a number of similarities, in this case the short legs of many breeds. The study first did a genome analysis and comparison between the short-limbed (Pembroke Welsh Corgi, Basset Hound and Dachshund) and the control breeds not exhibiting the trait (Collie, Whippet and German Shepherd). Specific sites on canine chromosome 18 were identified for the dwarf breeds and found to be homozygous (existing on both of the chromosome pairs). This was consistent across all the three previously mentioned dwarf breeds. Following this scientific determination, additional tests and analysis were done to compare the identified location of the base sequences and identified loci on Chromosome 18 with other short-legged breeds. The study specifically analyzed the Dachshund and Scottish Terrier. This substantiated complete alignment at 100% to growth factor Fgf4 for chondrodysplasia. The studies suggest a long evolutionary history of short-legged canines and subsequent breed development in many different countries for specific purposes although they may not share a recent common ancestry. As Breeders and owners of the Scottish Terrier we can utilize the observations and information to improve our breeding programs while recognizing what science has contributed to

assist us. We should recognize the early shortening of our long bones (big dog on short legs), recognize our standards attempt to clarify these points and invest ourselves in keeping detailed observations throughout our breeding programs.