Pituitary Dwarfism in the German Shepherd Dog
Part One of a Three-part Set of Articles on Dwarfism

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(Warning: Pictures are slow to download. Please be patient.)

by Fred Lanting

Dwarfism is a condition of abnormally small stature, and usually is characterized by altered body proportions. Dachshunds, Basset Hounds, and Corgis are examples of achondroplastic dwarfs; they have more or less normal-sized torsos and heads but shortened limbs, and are accepted as typical of their breed. Alaskan Malamutes, on the other hand, are not considered acceptable if they have their particular blood cell related disease. In that breed, both achondroplastic dwarfism and hemolytic anemia are inherited as pleiotropic conditions, meaning a single gene giving multiple phenotype effects. Additionally, there are dwarfism abnormalities in other breeds such as pseudochondroplastic dysplasia in Miniature Poodles.

In the German Shepherd Dog, however, there is a little-known dwarfism that yields a nearly perfectly proportioned but considerably downsized version. An acceptable term to use would be proportional or pituitary dwarfs, even though all types of dwarfism have their origins in that gland. The fact is (or was until this article appeared), many do not know about the existence of this type of dog, even though it is not all that rare. Possibly because of the large-scale linebreeding by a West Coast kennel that produced winning dogs, the incidence rose for a number of years in the U.S. Due to linebreeding on certain British and German dogs, there was a noticeable number appearing both in England and Australia, countries which rely heavily on German lines. One genetic analysis of Australian data indicated that two dwarfs might be expected out of 1000 pups when "any dog" is bred to "any bitch". The recurrent risk for any dog or bitch bred to a parent of a dwarf is seven per 1000; a parent of a dwarf to a half-sibling of a dwarf is 272 per 1000; and parent of dwarf X parent of dwarf is 235 per 1000. The roughly 25% risk in the latter two matings is typical of what one would expect when two normal carriers of a simple Mendelian trait are bred to each other.

Of course, that 25% is an average. I recently (1984) examined pups from a litter of six in which three were pituitary dwarfs, but both parents were of normal size. Now remember, these were not abnormal in proportions, only in size and unseen body chemistry. The little Shepherds I examined that year had beautiful temperaments, and were active and apparently healthy at the time I first saw them at almost four months of age. They weighed about five pounds, while a normal littermate was about 32 pounds. There was something that had not appeared in the scientific literature but which I noticed in this litter, as well as in photographs of other litters: pituitary dwarfs seem to squint in bright sunlight more than do their normal siblings. Another facial characteristic of miniature Shepherds is a fox-like appearance, coming from wide-set ears. I believe this to be a result of disrupted proportions of skull vs. base of the pinna (ear shell), which to some extent is seen in Welsh Corgis also. A somewhat snipey (pointed) muzzle is due partly to a shortening of the skull and, in some individuals, a slight overbite.

The Arkansas litter I visited was no combination of junkyard genes, but sired by an AKC Champion and with two Champion grandsires. The whole pedigree was full of recognized and respected kennel names and individuals. Indeed, the trait has been known for many years to be carried by "champion-quality" dogs. The gene seems to have first arisen, possibly as a mutation, around 1940 or shortly before. It's almost 100% sure that one of the most valuable German Shepherd Dogs of all time, Vello zu den Sieben Faulen, is a major source in bloodlines since the late 1950s. But we cannot lay all the blame at his feet, nor avoid all his descendants. Nor would we want to, for many of the breed's best lines are based on Vello. Only a percentage of his (or any dog's) progeny would carry the defective gene, and presumably many of the earlier dogs who exhibited it in their progeny were removed from the gene pool. The SV doesn't favor continued breeding of dogs that produce defects, and they have the power in Germany to prevent such dogs from further use by denying registration. However, when a dog is valuable in other

respects, such as the Sieger Uran WildsteigerLand, a blind eye is used to look in that direction.

Some non-show lines occasionally come up with pituitary dwarfs, such as the white German Shepherd bitch I found, who at two years of age weighed only 15 pounds (some get as heavy as 30 pounds or so, but most are smaller). Her skin was milk-chocolate in color, thin, wrinkled, dry, and lacking in elasticity or tone. She had almost no hair on the trunk, neck, and wear areas such as buttocks, etc. Primary or guard hairs were present on a few areas of the head and feet, and the rest of the body was either bald or lightly covered with secondary hairs (puppy fuzz or undercoat), which were easily pulled out with the fingers. All these signs are very common in these animals as adults, with the skin ranging from brown to gray in color. Dogs which would otherwise be plush or long-coats usually look like Chinese Crested Dogs — if they live to maturity — with feathery fringes around the ears and feet, and bald elsewhere unless treated with growth and/or thyroid hormones.

External or obvious characteristics aren't the only things different about pituitary dwarfs. Blood chemistry tests show that hormones that are supposed to be circulating may be absent or at very low levels. The methods are too involved to go into here, but briefly stated, there are ways to assay the activity of endocrine glands and amounts of their secretions. The hypophysis (commonly known as pituitary gland) is the "master" gland of the body, situated in the center of the head at the base of the brain. It produces a number of hormones, including GH (growth hormone). IFG (insulin-like growth factor) circulating in the blood is interdependent with GH. The pituitary gland is affected by others, but it is more the director of the body's other endocrine glands, such as the thyroids and gonads. The thyroids have a say in the maturing process, metabolism, development of form and behavior, and physical and mental activity. Muscular weakness and the skin/hair problems described above are due to inadequate or absent thyroid activity, which in turn is due to lack of proper direction from the pituitary. Your veterinarian can explain T3 and T4 to you if you wish to study thyroid function more fully.

The effects of this type of dwarfism can be mitigated or delayed by administration of thyroxine and GH, but this is a very expensive proposition at present. It is thought that if recombinant genetics (gene-splicing) and RNA production of human growth hormone becomes feasible, the price may go down. Dogs apparently respond to human GH, but not the other way around. Eventually, at the age of normal skeletal maturity or a bit later, the growth plates in the dwarf's bones close and no further growth is possible, regardless of GH injections. Another problem in treating the condition is that most owners don't present the pups to a veterinarian until their littermates are twice their size. The affected pup grows normally until three to eight weeks, when the brakes are applied and the normal siblings leave him behind in growth.

Although it is possible that pituitary dwarfism in the GSD is a polygenic disorder of a threshold nature, most investigators so far believe it a result of a simple autosomal (not sex-linked) recessive trait. In most characteristics inherited in this simple method, the recessive gene can be hidden for many generations before it is paired with another identical recessive gene. Genes operate in pairs, and only when *both* of the pair are the recessive alleles, does the trait manifest itself. When only *one* recessive gene exists, its dominant partner dictates the normal or dominant phenotype characteristic. It's like a Labrador Retriever that inherits one gene for black coat color and gets the recessive gene for yellow from his other parent. He himself is black, because that first gene is dominant over yellow and does not allow the yellow to predominate or show in the phenotype (appearance).

However, some recessive traits are only partially covered up by the dominant member of such a heterogenous gene pair. Often, one can see the faint hint of a saddle in a sable German Shepherd Dog which is heterogenous (has one sable gene and one black-and-tan gene). Similarly, it may be possible to "see" other recessives through the use of blood tests, examination of the eyes retina, etc. Achondroplastic dwarfism in the Malamute, for example, is connected with a blood cell disorder, both being pleiotropic results of the same defective gene. Because of the effect the pituitary has on thyroid function and on other glands, it may become possible to detect the "carriers" in a GSD litter among whose members some dwarfs have appeared. In a statistically typical litter of 12 produced by two normal-appearing carriers of the recessive gene, suppose three homozygous dwarfs and three pups without

the gene. The other six are heterozygous carriers and appear normal (like their parents) but will contribute one recessive gene to each pup they produce in the future.

It is unfortunate that such abnormalities are often hidden from the public by breeders and owners who are fearful, mercenary, proud, or ignorant. Most pups are sold about the time the growth rate difference begins, so many cases reported to veterinarians have been "single incidences" as far as the buyers and their vets could tell. Others may be put down by embarrassed breeders who don't want it known they have produced such anomalies. Since the health of pituitary dwarfs is more precarious than that of normal pups, it can be assumed that many that die at birth, are resorbed during gestation, or die before the trait begins to appear, may be dwarfs. The Arkansas breeder who called me to ask what she had, and invited me to see them, upon discovering half her litter were dwarfs, decided not to put them down and cover up, but rather care for them and share their stories with responsible breeders and veterinary researchers. She even intended to train and show at least one in obedience and was, at this first writing, hoping to persuade the AKC that there are no rules against it. From such an open-minded approach, we may be able to make an educated guess as to pedigree origin of the defect, plus discover some means of identifying normal-appearing carriers.

She even briefly entertained hopes to try breeding these dwarfs with each other or with siblings or parents, trying to duplicate the occurrence. I guessed (correctly) that she might find it difficult. Development of the gonads varies from atrophied testicles and absence of estrus to normal testicles and seasons. If she had been successful in reproducing the condition, we may have seen the AKC faced with difficult decisions: they cannot justify withholding registration privileges or show/trial eligibility because of the pure pedigree, so do they create a separate variety within the breed, as exists in Dachshunds, or a separate breed as they did with Norwich and Norfolk Terriers? Doubtful. The only alternative is to keep them in the regular classification and hope judges will not place them for reasons of not being of sufficient breed type. The German club has disqualifications for those outside size limits; the AKC does not. By the way, for several years, a pituitary dwarf attended the German Sieger Show (as a spectator) and was seen by thousands.

One problem I can foresee in attempts at breeding these, besides lowered fertility, is whelping. Pituitary dwarfs start life off at normal size, which for a Shepherd is in the neighborhood of one pound, give or take about four or five ounces depending on the number of whelps. If a dwarf bitch were impregnated (artifically, of course) by a normal-sized carrier male, some of the whelps could be normal sized and the bitch would not be able to pass them or possibly even carry them without damage to them and/or herself. If a normal-sized carrier bitch were bred to a dwarf male, it shouldn't be any more of a problem than when two normal-sized dogs with the recessives are mated together. So far, nobody has engineered such a mating, to my knowledge.

Size of the dwarfs varies a great deal. As of this (1984) writing, the ones I have examined were 5.5 months old and weighed seven pounds. Others at skeletal maturity (when growth plates close and bones don't grow any longer) have been reported to weigh from under 15 pounds to slightly over 30 pounds. Normal weights for GSD bitches are 55-75 pounds, and for males 70-90 pounds. It's not unusual for a bitch to give birth to ten pounds of puppies, plus carry the extra weight of fluid and placental tissue. For a dwarf bitch, that percentage would be impossible, I would think.

The variable size of the pituitary dwarf Shepherds reported so far is an indication of the possibilities that the *trait* itself *could* be a threshold polygenic trait (unlikely), but the variation could also result from modifier genes governing varying time of growth cessation. There are some differences in absence, presence, or level of growth hormone in untreated dwarfs, and those that grow to be larger than others before the growth plates close may simply have more GH. Since the "problem" has been swept under the rug so often, and is rare enough to begin with, professors at veterinary colleges are in disagreement over the meager information that is available. Thanks to the breeder in Arkansas, several universities and the Morris Animal Foundation were currently studying the data and the dogs.

This type of pituitary dwarfism involves the German Shepherd Dog, but a breed from the Russia-Finland border, called the Karelian Bear Dog, is also affected. The reason is that the Karelian (Finnish spelling is Carelian) has the GSD as part of its ancestry, and the affected individuals had some GSD carriers in their pedigrees. The scientific literature has reported one Yorkshire Terrier, one "Toy Pinscher", and two "Spitzes" as well, but it is highly doubtful that those are the same genetic defect. If I find several examples, as there are in the GSD, I'll withdraw my doubts.

Three littermates, two with the pituitary dwarfism defect. It is probable that the intermediate-size pup on the left was able to utilize more growth hormone and delay the closure of physes (ossification of cartilage).
Photo courtesy Prof. E. Andresen, Copenhagen.

Priscilla, a four-year-old pituitary dwarf.
Her coat was maintained by regulating her thyroid hormone levels.

The author with two littermates of Priscilla at about 4 months of age.

NOTE: A well-respected AKC and Schaferhund Verein judge, Mr. Lanting has judged in more than a dozen countries, including the prestigious FCI Asian Show hosted by Japan Kennel Club, the Scottish Kennel Club, a Greyhound specialty in England, and more. National Specialties: 1994 GSD Club of America National; 1991 Tibetan Mastiff National; 1990 Shiba National; Fila Brasileiro Nationals (several times), Dogo Argentino National, Pyrenean Shepherd National. Numerous Chinese Shar Pei and Australian Shepherd specialties; regional Anatolian Shepherd specialty. Numerous GSD, Rottweiler, & Boxer specialties worldwide. He is also the author of several 'must read' books, including THE TOTAL GERMAN SHEPHERD DOG, CANINE HIP DYSPLASIA, CANINE ORTHOPEDIC PROBLEMS. A former professional all-breed handler in the US and Canada, he has lectured in over fifteen countries on Gait-and-Structure (Analytical Approach), Canine Orthopedic Disorders, and other topics, as well as being a Sr. Conf. Judges Ass'n (SCJA) Institute instructor. WV Canine College instructor & member, advisory board. His full Curriculum Vitae is very impressive and we are grateful to him for sharing that knowledge on this site. Join him in his tours to the SV shows in Germany.