

Dealing With Wrong Ideas about Hip Dysplasia

A Magazine, Newsletter, and Website Article by [Fred Lanting](#)

Background

Friends and fellow dog fanciers: I was asked to comment on some accusations and remarks re HD that have been on chat lists. First, so you understand where I am coming from, you should know a little history of my involvement in dogs, veterinary science, and hip dysplasia in particular. I got my first purebred dog in 1937, bred my first litter in 1945, got my first GSD in 1947, started handling and more extensive breeding in 1966, gave up all-breed pro handling to become a judge in 1979, am one of only two in North & Central America licensed by the SV (world parent club for the GSD), and I lecture and judge around the world. I have done so in some 20 countries, lately several countries per year. Among other books, I wrote "The Total GSD" and "Canine Hip Dysplasia". I received early encouragement and support in my research and study in orthopedic problems from the founder of the OFA, Dr. Wayne Riser of the U. of PA ("Penn"). Although I was accepted to that university's vet school around 1958, I could not attend because of financial and family reasons. I continued my studies in science instead, and added to my earlier B.S. in Organic Chemistry with graduate work in chemistry and physics. I approach all serious matters with the open and inquiring, analytical mindset of a true scientist.

Having constructed that frame, I will now fill in more of the picture. Vet schools, breeders' associations, and other groups across the globe do not invite me to speak and judge without good reason. Nor do I write this from an antagonistic point of view. It is strictly because of my dedication to the philosophical science of logic and to the physical sciences that I feel compelled to rebut statements that run contrary to those principles. I do so in a completely impartial manner, and from the historical perspective mentioned above. Quotes from Internet remarks by one Mr. D.N., for example, should not go uncorrected. I have corresponded with him before and it is my impression that he does not read the veterinary literature with comprehension, or he has some personal bone to pick with Penn, or else he has some unreasonable attachment to or bias toward OFA. I use his initial(s) instead of a name because his attitude and misunderstanding are near-clones of those found in a few others. However, with enough time, patience, and scientific evidence, most of such anti-progress naysayers are eventually converted by the facts and deductive reasoning. I hate to mix personalities with science, but this situation has been a source of irritation throughout the history of science, and there is no avoiding it.

Nature of Hip Dysplasia

The facts about HD, if they can be reduced to bare bones, are as follow: It is a developmental and variably progressive disorder with incidence and severity that are related to breed and body type as well as pain threshold. It is completely genetic in origin (dogs do not get HD unless they have sufficient "bad genes") but the expression of those genes can be modified somewhat by environment, notably overnutrition but also exercise and weight. In the days before X-radiography, when tending dogs (for example) worked hard for 18-20 hours a day, the worst carriers of HD in such working dogs were weeded out by not breeding (or even allowing to live) those dogs that could not perform. As sheep gave place to urbanization and modernization, there was less vocational culling, and people needed an alternative means of detecting carriers. Fortunately, the Curies had paved the way with X-rays; by the World-War-2 era, diagnosis of canine and other animals' degenerative joint diseases by casting X-ray shadows onto photographic film became that means. Thanks largely to Dr. Gerry Schnelle, it was also recognized in the 1920s and '30s that loose ball-and-socket hip joints had much to do with pain and loss of usefulness. We refer to that loose

condition as laxity or subluxation. Laxity had been palpated (felt) by a few methods of manipulating some dogs' joints and estimating the displacement of the ball (femoral head) from the socket (acetabulum). We used the term subluxation more to describe what we saw on radiographs, but the two terms have become nearly synonymous for most people.

The important thing about hip-joint laxity that the people of Schnelle's day knew intuitively in the 1930s, the OFA proclaimed via deductive reasoning since Riser's work in the 1960s, and PennHIP has scientifically, statistically proven since Smith & Biery's work began in the early 1980s, is that there is a definite correlation between laxity and degenerative joint disease (DJD). This connection might be relatively weak, as in Saint Bernard type bodies, or very strong as in gundogs and herding breeds. Regardless of breed, however, PennHIP has shown that as laxity increases, the relative risk of DJD also increases. The slope of the curve or line on the X-Y graph may vary from breed to breed, but the correlation is nevertheless real in all cases. The hip-extended (leg-extended) position is ideal for viewing DJD, and has been the "backbone" of the accepted radiographic diagnostic technique in every country since OFA in America and the Schäferhund Verein (SV) in Germany accepted it in the early 1960s. This position also demonstrates many, but by no means all, cases of laxity in dogs that do not have DJD (perhaps we should add "yet"). The term "not all" is important. It is the main clue as to why breeders and scientists have been unhappy with the amount of progress in limiting or decreasing incidence of HD. It's analogous to the "glass ceiling" that women workers have complained of, where they can only go so far up the corporate ladder or wage scale, compared to opportunities for men. In HD control and reduction, the leg-extended view has allowed us to climb to a certain plateau, but not to scale the high step to the next one.

Central to this barrier against progress when relying only on the leg-extended view is the fact that the position tends to unnaturally and artificially wind up and tighten the soft tissues in the joint. The joint capsule is composed primarily of ligaments, with muscles and tendons playing a supporting role. Like a rubber band or a tourniquet that is twisted, these hip joint capsule tissues tend to force the head of the femur more deeply and tightly into the acetabulum. Thus, in many dogs, we get a false sense of security, a "false-negative" reading for HD's laxity component. Since the leg-extended registries such as SV, OFA, BVA, etc. have always used either DJD or laxity to define HD, that means we erroneously give a green light to the breeding of dogs with such false negatives. This reintroduces an undesirable (and to many of us, an unacceptable) number of bad genes into the gene pool. Obviously, good breeders want to eliminate or reduce this pollution of the pool. Therefore, the need arose for a diagnostic technique that would be more sensitive to true laxity than current methods were. The technique developed at Penn in the 1980s was just such an answer to that need, and this alternate route to the next plateau was as real as a new and better approach to the summit is for a mountain climber. Using another metaphor, it is like an improved sieve that traps pollutants and prevents them from re-entering our potable water supply.

The (University of) Pennsylvania Hip Improvement Program utilizes, in addition to the leg-extended view for DJD, a neutral-natural position that closely duplicates the standing position of the dog, but on its back. That position midway between the most-forward and the most-rearward extremes of the dog's stride, is the one in which the joint capsule tissues are most relaxed, and therefore laxity can be most accurately and easily manifested. PennHIP supplies a mechanical device by which the veterinarian can distract (displace) the femoral head, take a picture, and objectively compare that with the picture taken before distraction. When I use the word "objective", I refer to something that we can measure --- a mathematical value. Just as figures do not lie, laxity cannot hide from the distraction view; you may get tired of me repeating that, but it should be drummed into our heads. What looseness is there definitely will be demonstrated, and the measurement will be repeated exactly or very closely. This is in contrast to the leg-extended, twist-

tightened, older method in which different evaluators may come up with a range of laxity diagnoses days, hours, or even minutes apart. Furthermore, there is far more subjectivity in the leg-extended procedures. The only objective portion of that latter view is the use of the Norberg angle, which has been shown to have rather poor predictive value for dysplasia's DJD development. Today and for the foreseeable future, the distractive view as expressed in Penn's "DI" (Distraction Index) is the most accurate, precise, objective picture of current laxity, and the best indicator of relative risk, the best predictor of probable eventual DJD. In my seminars, I make comparisons in much greater detail than is feasible here.

Attacks From The Misinformed

To return to the aforementioned sniper attacks on the new knowledge of HD, an unpleasant task but necessary response must be made. People who fall for DN's misinformed accusations do so mostly because they have not been clearly shown the superior science of the newer technique, the understandable explanations of the method. Very succinctly, he is completely wrong when he says (without the backing of peer-reviewed, scientific data) that PennHIP gives false positives for the presence of HD. The truth is that Penn's definition of HD is DJD; the OFA's definition is either DJD or laxity, or both. The truth is that laxity is always shown in the neutral distraction view but it very often is undiscovered in the leg-extended view. The truth is that Penn's method is far more indicative of actual genotype because of far better information re actual phenotype, and therefore that PennHIP is a much more advanced tool for the conscientious breeder. The truth is that PennHIP gives us more relevant and useful data, virtually no false positives, and almost zero false negatives, which are the greatest hindrance to progress in genetic disease reduction.

DN recalls "from reading and discussions" many supposedly false positives in other techniques (unproven and undocumented in the science literature) and illogically ties these vapors to PennHIP. He very erroneously claims that DI is the same as the "fulcrum" or "wedge X-ray" of the 1970s, an untrue and misleading statement. Position alone (neutral-natural or wound-up) is sufficient to blow that statement out of the water. The misinterpretations continue; he says the force used to distract the femoral head runs counter to the concept of diagnosis and creates the condition of laxity. That is so transparently nonsense that it boggles the mind to imagine anyone believing his statement. The whole idea of "raising the bar" for diagnosis is to detect more covert HD than has been possible with the leg-extended view! This head-in-the-sand approach coupled with that artificial tightening of the hip joint capsule in order to take a picture conducive to more false negatives should be obvious to any of our respective readers. Distraction does not create laxity; it reveals it!

The assertion that a strong vet would produce more distraction and displacement than would someone with a light touch is understandable, but unfounded. Anyone with knowledge of basic physics and anatomy knows that the relative inextensibility of white connective tissue (ligaments) in the joint capsule is not at all analogous to the coiled steel spring in a weighing scale. The latter will produce a nearly perfect linear slope in a stress-strain graph, which means that the pulling force applied is directly proportional to the displacement (distance the weighted end of the spring moves). In any hip joint there is a certain amount of looseness, and it takes but a very minimal distractive force (perhaps a couple of Newtons (or less than a pound) of load) to displace the femoral head to its furthest "out" position --- a child could do it. On the other hand, not even a gorilla with a DVM degree will displace the head any significant distance further. That is because the limit of "stretchability" or displacement has already been reached with the initial, minor force. Adding more tensile force has practically no further effect on displacement. In my lectures I frequently hear questions that reveal people's lack of education in physiology, physics, and soft tissue

anatomy/properties, so it is easy to see how many can be initially fooled by statements such as those made out of innocent ignorance by DN and others. The amount of pressure has almost nothing to do with the amount of displacement, a fact that some have simply failed to grasp. This concept has been scientifically proved in two biomechanical studies published in the American Journal of Veterinary Research in 1993 and 1997.

For this point, Dr. Smith of Penn likes to use the “ball-on-a-rope” analogy. In the hip-extended (OFA-type) position, the ball (femoral head) is hooked to a spring; the harder you pull, the further the spring elongates, meaning that the strength of the operator will have a marked effect on measured laxity. But in the neutral (knees up, flexed) distraction position, the constraints of the hip act like the ball is hanging vertically on a rope. You can pull the ball laterally with very little force until the rope gets tight but after that point there will be no increase in hip laxity, no matter how much additional force is added. They have never broken the rope, by the way.

The “silence” DN reports re his questions on what equipment is used to measure force is simply because the U. of PA does not have time to fight snipers. I have trained on that equipment and it does indeed exist. Every PennHIP-certified vet must go through the same training and practice on the force-measurement device. This is a laboratory instrument, different from the distractor device used in their clinical practice. The reason P-H fails to respond any further to antagonists is that there is no good that can come out of a spitting contest, and sometimes there is no amount of fact or reason that can convince an “unbeliever”. The old adage holds here: “A man convinced against his will is of the same opinion still”. I ran into the same brick-wall mentality with DN that he indicates Penn did. I offered to debate him at any seminar or function set up by a neutral party or group, but he has failed to take me up on the debate forum idea. Talk about “crashing silence”! He makes a blanket statement (no proof) that in human medicine, measurements are not taken on radiographs. Even if one were to consider that extremely implausible statement as having any factual content, it is illogical to automatically apply that deductively to the subject at hand. Even inductively, it makes for a very weak argument. His conclusion that PennHIP is a sham is ridiculous, especially in the light of the “score and more” of peer-reviewed, independent and Penn-generated scientific journal reports.

During the early and mid 1960s when I began my research in HD, I was a weekend pro handler in the USA and Canada, and handled many Setters as well as the more numerous sighthounds and working-herding breeds. Some of the old-timers on e-mail/Internet discussion lists may recognize my name. I also wrote the book on hip dysplasia (working on the 2nd edition now), and lecture all over the world on the subject... at least seven countries this year, for example. People would not fly me around the globe if they did not respect my credentials, briefly summed up by Dr. Corley of OFA when he said, “Lanting is the world's leading non-veterinarian authority on hip dysplasia”.

I have had correspondence run-ins with Mr. N, and unfortunately find him to be a sincere but closed-minded, somewhat illogical person with opinions set in epoxy (a scientist always leaves the door open to possible change based on evidence). People must eventually decide whom to trust, and ride that particular horse across the river... changing in mid-stream or choosing the wrong horse are equally disastrous. I was just reading the Bible last night where it advises people not to hang between two decisions. I get especially tired of trying to help people who allow themselves to be blown in all directions by every changing wisp of wind. More frustrating than a fickle friend and worse than a determined opponent.

From Another Quarter: Faking?

The editor of a breed magazine for certain stock- and companion-dogs wrote: "We were discussing PennHIP on the Internet, and someone said her vet talked them out of it. According to this vet, PennHIP is notoriously easy to fake. By not exerting the right amount of pressure, the x-raying vet can purposely cause a dysplastic dog to get good results. According to the vet who made these claims, it's done all the time, and consequently PennHIP results cannot be trusted. (The person who posted this is a HUGE fan of OFA, mainly because of OFA's 'gossip factor', methinks. Club people like to print OFA results in their newsletters, and resent PennHIP not playing along with the game.) Your thoughts on the subject, please?" Well, if I can help anyone on the "Setter-L", the English Shepherd list, or any other group, I think the first response should be to refer you to a small collection of some of my articles on a leading GSD website called "<http://realgsd.net>". But to answer this editor's request, the best thing to say to such a brainwashed (I almost typed "brainless") vet is the old adage, "Put up or shut up". In other words, "Where's the proof?" This is the most ridiculous thing I have ever seen in the way of opposition to PennHIP. It is similar to DN's charge, except that instead of supposedly damaging the joint (creating HD), it now supposedly hides it because of not enough force! I have been through the training sessions and I have first-hand knowledge of the force applied. I also have the scientific knowledge to understand the difference between a linear stress-strain curve such as what you get when you pull a coiled spring (for the greatest part of the force) and the high-stiffness, nearly parabolic curve you get when you pull on a nearly non-extensible material such as ligaments. That veterinarian is obviously not acting in his clients' best interests, and he certainly is not being a credit to the scientists he had as professors in college and vet school.

It is one thing to voice an opinion that a procedure might be easy to fake (and I know that it's easier to put one over on OFA than it is on PennHIP because "laxity doesn't hide from the Distraction technique"); but it is downright irresponsible and probably malicious to use a word like "notoriously". You simply don't use "extreme" words when disagreeing from a position of ignorance. Unless of course, you are following the advice that I believe was attributed to one Adolph H. that if you tell a lie that is big (preposterous) enough, often enough, and loudly enough, people would believe it. That vet does not understand the procedure, and I'd bet cold cash he has never seen a demonstration. If you do not exert enough distractive force on the hips, one or more of three things are bound to happen:

1. there will not be sufficient difference in a relatively tight-hipped dog between the compressed and distracted views, and P-H would tell him to do it over; or,
2. the hips are going to be so loose that you can see the laxity anyway.
3. the radiolucent rods of the distractor are covered with a tough Neoprene sponge rubber which must show on the film that it has been squeezed enough; if it does not, the film would be rejected.

There are only a very few who read and evaluate the films at Penn, so there is not the reader-to-reader variance found in other registries that use the hip-extended view. There are other incentives/penalties working to the advantage of the breeder/owner: PennHIP vets would lose their certification and therefore their prestige amongst other vets and the breeder community if they played games like that described. Even incompetence is not tolerated, if it ever appears... vets who don't do many P-H films might "lose their touch" temporarily, but getting a film set sent back and having to call the client in for a repeat because it wasn't done properly, is a powerful motivator to get the job done right the first time.

Now, to be fair, we must realize that the vet is being semi-quoted in a third-hand way, so unless one got this directly from him/her, the malice or ignorance should be considered as having come primarily from that "person who posted this". It is apparent that person did not do his homework and investigate for himself the reliability of either PennHIP or the naysayer's statements. To fail to check out both sides or sets of arguments is irresponsible. If that person would keep his mouth closed and his ears open for a couple of hours during my seminar (except to ask honest questions) he would take another tack. I see it happen all the time. It isn't because I'm so persuasive; it's because the science is so convincing. I present the Orthopedics Disorders seminar all over the world, and would be happy to consider a date in anybody's hometown if it fits my calendar. By the way, I'm not sure what the writer meant by "resenting PennHIP for not playing along with the game", but it seems to hint at the pass/fail list that OFA distributes, compared to the breed DI averages that PennHIP publishes. Those clubs and magazines that print the OFA statistics, biased as they are because not all films are sent in, can also get the PennHIP unbiased updates simply by asking for them. I don't have Internet myself, but I'm sure they could get that info from <www.synbiotics.com> and qualified breed club representatives (magazine editors, health committee heads) could get on Penn's mailing list.

Estrus

Another magazine has asked me to comment on the effect of estrus (heat cycle), and I felt it would be a good idea to put that into this piece as a sort-of "p.s." For many years we breeders have been assuming that there were (regularly) differences in observable hip joint laxity between films made in or near estrus and those made in complete anestrus (not close to a heat cycle). We also told each other that to get the best picture and the best chances of "passing OFA", we should take the pictures in the afternoon, after the dog had been exercised and "toned up", on a dog with good muscle development from regular exercise over a longer period of time, not within a couple weeks of estrus or several weeks of pregnancy, and without sedation. This was based on intuitive supposition, and the OFA even made statements to the effect that they were true concepts. There are two holes in this otherwise neat scenario. One is that there has never been any scientific study to prove the idea that joints are tighter or looser than at other times. It simply "made sense" to many of us, because conventional wisdom shows us that we are slightly longer when we wake up than after a day of gravity compressing our spinal disks, and that hormones in late pregnancy cause a woman's pelvic symphyses to relax or bend so that there is more room for the child exiting the birth canal. But does that necessarily mean that the other joints are likewise affected, and that ligaments somehow relax more than they would in other circumstances? No. It was a faulty assumption, and there is no published study to support that. On the other hand, a definitive study in *Veterinary Comparative Orthopaedics and Traumatology* (1997;10:69-74) showed that hip laxity is NOT changed by estrus cycle using either the OFA or the PennHIP method. All of the OFA's contentions (and breeders' assumptions about the effect of estrus) are untrue, according to this journal report.

The other problem with that reasoning is that we were basing our assumptions on the old and imprecise leg-extended position. As I have mentioned, this natural position for humans but unnatural position for quadrupeds tends to wind up and artificially tighten the muscles, tendons, and ligaments in the area of the hip. We do not always get repeatable results with that position. With the knees flexed and the distractor unit employed in the PennHIP technique, however, the same amount of laxity is seen (with few and minor exceptions) time after time. The dog's full laxity is seen each time the dog is radiographed in this position. There is no change in DI attributable to a bitch being in heat or the other reasons, when this method is used. In fact, researchers at Penn have scientifically proved the point (see comment above) that it simply is not true in the leg-extended view... although I have been saying that there are as many examples that do not show this as those that seem to do

so, Penn's study-based statement is that no examples show significantly increased laxity with estrus.

So, the conclusion of the estrus-laxity question is (again) that true laxity does not hide from the distraction procedure, that it very well might from the leg-extended view, and that the role of hormones in canine hip joint laxity (whatever it might be in other species and anatomical locations) is not present, or it is immeasurable.

Note: *Fred Lanting is a world-renowned judge, author, and lecturer on canine topics, especially including anatomy and orthopedics. He also does behavioral and other consulting, and may be available for seminars at national specialties and other sizeable-audience events or on show weekends where he is on the judging panel.*

Recommended Reading:

Some Scientific Publications

(This is an abbreviated bibliography. For more, see the <www.Synbiotics.com> or <www.vet.upenn.edu/pennhip> websites.)

Puerto DA, Smith GK, Gregor TP, LaFond E, Conzemius MG, Cabell LW and McKelvie PJ. Relationships between results of the Ortolani method of hip joint palpation and distraction index, Norberg angle, and hip score in dogs. *J Am Vet Med Assoc* 1999;214:497-501.

Smith GK, LaFond E and Gregor TP. Within-and between-examiner repeatability by experienced and inexperienced examiners in performing distraction stress-radiography to quantitate canine coxofemoral joint laxity. *Am J Vet Res* 1997;58:1076-1077.

Smith GK, LaFond E, Heyman SJ, Cofone MA and Gregor TP. Biomechanical characterization of passive laxity of the canine coxofemoral joint. *Am J Vet Res* 1997;58:1078-1082.

Hassinger KA, Smith GK, Conzemius HM, Hill CM and Gregor TP. Effect of estrus cycle on coxofemoral joint laxity. *Vet Comp Ortho Traum* 1997;10:47-69.

Smith GK. Advances in diagnosing canine hip dysplasia. *J Am Vet Med Assoc* 1997;211:1451-1457.

Smith GK, Popovitch CA, and Gregor TP. Evaluation of risk factors for degenerative joint disease associated with hip dysplasia in dogs. *J Am Vet Med Assoc* 1995;206:642-647.

Smith GK, Gregor TP, Rhodes WH and Biery DN. Coxofemoral joint laxity from distraction radiography and its contemporaneous and prospective correlation with laxity, subjective score and evidence of degenerative joint disease from conventional hip-extended radiography. *Am J Vet Res* 1993;54:1021-1042.

Submitted or In Press

Fordyce HH, Gregor TP, and Smith GK. Correlation of OFA hip scoring to passive hip laxity derived from the hip-extended and distraction radiographs. Submitted. *Vet Ortho Soc Ann Mtg, Val D'Isire, France, 2000.*

Kapatkin AS, Hearon K, Fordyce HH, Gregor TP and Smith GK. Breed-specific passive hip laxity and the variation of hip laxity measurement as a function of radiographic positioning. Submitted. Vet Ortho Soc Ann Mtg, Val D'Isire, France, 2000.

Smith GK, Fordyce HH, Gregor TP, Puerto DA, Rhodes WH, Reid CF, Biery DN, LaFond E, Iriye A and Elliot E. Within and between examiner agreement of subjective hip scoring from the ventrodorsal hip-extended radiograph in dogs. Submitted.

Leighton EA, Smith GK, Biery DN, Gregor TP, Stankovics M, and Holle D. Heritability of the distraction index in German Shepherd Dogs and Labrador retrievers and its relationship to subjective hip scores in the hip-extended view. In press.

Abstracts

Fordyce HH, Smith GK, Gregor TP. Relative sensitivities of three methods to measure passive hip laxity in the dog, in Proceedings. Vet Ortho Soc Ann Mtg, Sun Valley, Idaho, 1999.

Puerto DA, Smith GK, Gregor TP, LaFond E, Conzemius MG, Cabell LM, and McKelvie PJ. The relationship of Ortolani palpation results and quantitative measurements of passive hip laxity, in Proceedings. Vet Ortho Soc Mtg, Snowmass, CO, 1998;26. -- also in Vet Comp Ortho Traum, 1998;11:A58

Smith GK, LaFond E and Gregor TP. Within-and between-examiner repeatability by experienced and inexperienced examiners in performing distraction stress-radiography to quantitate canine coxofemoral joint laxity. J Am Vet Med Assoc 1997;211:1260.

Smith GK, Hassinger KA, Conzemius MC, Saunders HM, Hill CM, Gregor TP. Effect of estrus cycle on coxofemoral joint laxity, in Proceedings. ACVS Scientific Mtg, Orlando, FL, 1997;23.

Smith GK, LaFond E, Heyman SJ, Cofone MA, Gregor TP. Biomechanical basis for clinical repeatability of PennHIP distraction radiography of the canine hip, in Proceedings. ACVS Scientific Mtg, Orlando, FL, 1997;23.

Smith GK, Biery DN, Iriye A, Gregor TP, LaFond E. Frequency of hip dysplasia in Golden Retrievers and Rottweilers and the effect of prescreening of radiographs on reported CHD prevalence figures, in Proceedings. Vet Ortho Soc, 1997; 61. -- also in Vet Comp Ortho Traum 1997;10:68.

Hassinger KA, Smith GK, Conzemius MC, Saunders HM, Hill CM, Gregor TP. Effect of estrus cycle on coxofemoral joint laxity, in Proceedings. Vet Ortho Soc, 1997; 31. -- also in Vet Comp Ortho Traum 1997;10:77.

LaFond E, Smith GK, Gregor TP, McKelvie PJ, Shofer FS. Synovial fluid cavitation of the canine coxofemoral joint: frequency, risk factors and effects in 6649 purebred dogs undergoing distraction radiography for hip evaluation, in Proceedings. Vet Ortho Soc, 1997;40. -- also in Vet Comp Ortho Traum 1997;10:80.

Smith GK, LaFond E, Heyman SJ, Cofone MA, Gregor TP. Biomechanical characterization of passive laxity of the canine coxofemoral joint and its role in clinical repeatability of laxity measurements, in Proceedings. Vet Ortho Soc, 1997;13. -- also in Vet Comp Ortho Traum 1997;10:68.

Smith GK, Biery DN, Rhodes WH, Reid CF, LaFond E, Gregor TP, Waldman A, and Elliot E. Between- and within- radiologist accuracy of subjective hip scoring of the VD hip-extended radiograph, in Proceedings. Eur Assoc of Vet Diag Imaging Ann Mtg, 1996;2-3. also, in Proceedings. International Symposium on Hip Dysplasia and Osteoarthritis in Dogs, Cornell University, Ithaca, NY, 1996.

Smith GK, Biery DN, Rhodes WH, Reid CF, Gregor TP, LaFond E, Waldman A, Elliot E. Between- and within-radiologist accuracy of subjective hip scoring of the ventrodorsal hip-extended radiograph, in Proceedings. International Symposium on Hip Dysplasia and Osteoarthritis in Dogs, Cornell University, Ithaca, NY, 1996.

Meinen J, Dueland RT, Adams WM, O'Brien R and Smith GK: Correlation of early diagnosis of hip laxity by stress radiography, CT, OFA radiography, Norberg Angles and clinical palpations. A preliminary report, in Proceedings. 20th Ann Vet Ortho Soc Mtg, Lake Louise, Canada, 1993

Smith GK, Gregor TP, Biery DN, Rhodes WH and Reid CF: Hip Dysplasia Diagnosis: A comparison of diagnostic methods and diagnosticians, in Proceedings. Symposium on Comparative Aspects on Hip and Knee Joint Lesions in Dog and Man, Uppsala, Sweden, 1992, p 8.

Fred Lanting ~ Author of

"The Total German Shepherd Dog"

This is the expanded and enlarged second edition, a "must" for every true GSD lover. It is an excellent alternative to the "genetic history" by Willis, but less technical and therefore suitable for the novice, yet very detailed to be indispensable for the reputable GSD breeder.

Chapters include: History and Origins, Modern Bloodlines, The Standard, Anatomy, The German Shepherd in Motion, Shows, Showing, and Training, The Winners, Nutrition and Feeding, General Care and Information, Health and First Aid, Parasites and Immunity, Diseases and Disorders, The Geriatric German Shepherd, Breeding, Basics of Genetics, Reproduction, Whelping, The First Three Weeks, Four to Twelve Weeks, Trouble-shooting Guide