Text: Sigrid van Dort • december 2025

STRINGY-2 THEN & NOW

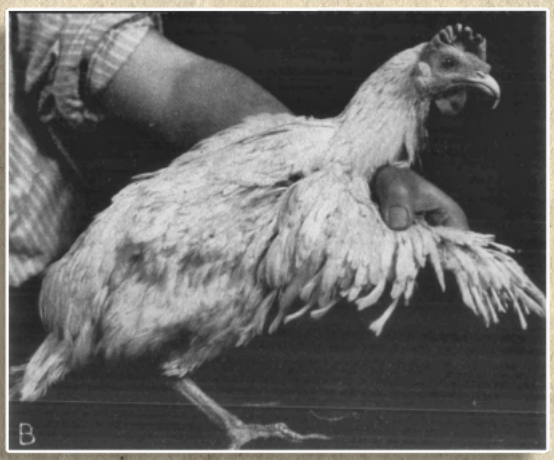
A CLASSIC FEATHER ANOMALY

1950: the inheritance of "stringy," an abnormal feather condition in white leghorn chickens* by e.G. Buss, b.B. Bohren, and D.C. Warren

During the fall of 1946, a breeder of white Leghorn chickens sent seven females and one male to the Purdue Agricultural Experiment Station. The birds appeared to be normal; however, records showed that progeny with an abnormal feather condition had been produced by these birds. The breeder also sent three females and one male which exhibited the abnormal feather condition.

Soon after an investigation of this condition had been initiated at Purdue University, it was learned that an apparently similar abnormal feather condition was being studied at the Kansas Agricultural Experiment Station**).

A check on the sources of the parent stock indicated that the stocks at the two experiment stations had a common origin. The abnormal feather condition was independently investigated at each of the experiment stations, and some of the stock from Kansas State College was sent to Purdue University, where matings between the two stocks established the identity of the causative factor.



Description of Condition

The most noticeable expression of this gene was the condition of the feathers.

The primary and secondary wing and the tail feathers of abnormal birds were generally shorter than the same feathers on normal birds (Figure B).

• The barbs did not spread out to form a normal web. The barbules were absent on most wing and tail feathers, leading to a stringy appearance, from which the name was derived.

• The sheath did not disappear from the feathers so rapidly as on normal feathers.

• Dark spots which were probably dried blood appeared on the back side of the rachis.

• At the Purdue Station, some continuous molting was observed, but the rate increased when the birds were out of production.

• The body feathers exhibited a ragged appearance.

In addition to the abnormal condition of the feathers, other external defects were noted.

• The premaxilla of the beak (upperbeak) was longer than is found on normal birds.

Modern stringy-2 Wyandottes. See the text.

• It was observed at the Kansas Station that many of the abnormally long beaks were crossed.
• Toenails were also longer than usual.

Thus, it may be that the gene which causes this condition expresses it self by modifying the amount or toughness of the keratin.

The down of the chicks which were homozygous for the abnormal feather condition was "sticky" (not fluffy) and was neatly parted on a mid-dorsal line (in the middle of the back). Most of the chicks which later showed abnormal feathers could be identified at the time of hatching (photo A).

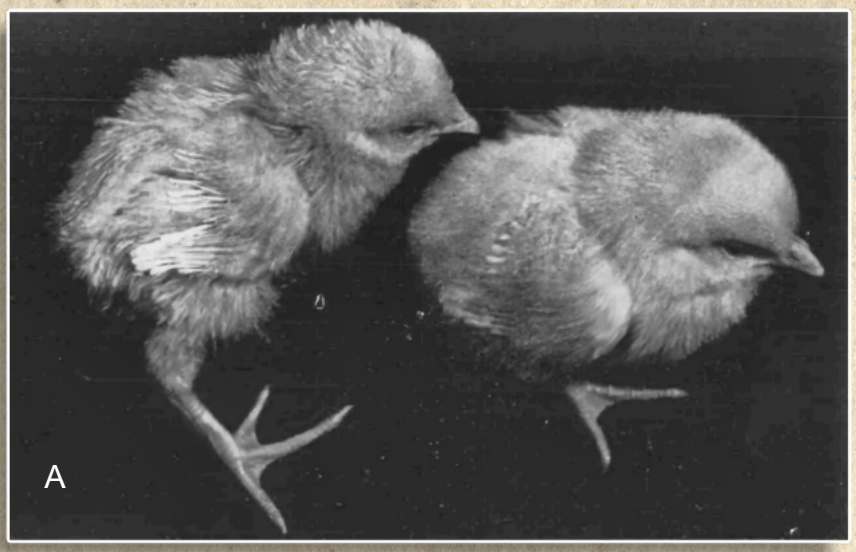
The adult male birds were not so vigorous as normal males even when kept in individual cages. The volume of semen produced was small (usually less than 0.2 cc). The females were also less vigorous than normal females; however, when kept in individual cages, egg production was equal to that of other normal appearing birds of the same stock.

*) Contribution No. 184 from the Department of Poultry Husbandry, Kansas State College and No. 426 from the Purdue University Agricultural Experiment Station. Mr. Buss is now at Colorado A. & M. College, Dr. Warren at North Central States Reg. Poultry Breeding Project, Lafayette, Indiana.

**) Sent by the Kimber Poultry Farm, Niles, California, to Kansas State College.

Procedure
The birds were kept in individual hen cages. Artificial insemination was used; and all chicks were pedigreed-hatched. The chicks were described at the time of hatch and again at eight or twelve weeks so that an accurate classification was possible. Sex was determined at the time of the second description.

Results
The results of the crosses made at the two experiment stations are shown in Table1.
• By combining the data of the two



stations, reciprocal crosses of normal by abnormal produced 87 normal individuals.
• In the F2 population, 214 normal and 62 abnormal individuals occurred approaching a 3:1 ratio.
• When abnormal was mated with abnormal, only abnormal chicks resulted.
• The backcross to the defective produced 70 normal and 64 abnormal individuals.
• Since none of the deviations from expected was significant, the results thus indicate that this abnormal feather condition is produced by a single recessive gene.
• The backcross of an abnormal male by F1 females produced 14 normal males, 15 normal females, 12 abnormal males and 9 abnormal females.
• Since normal females occurred from this cross and only normal individuals resulted from reciprocal crosses of normal by abnormal, it is apparent that this gene is autosomal.

Summary An investigation was made to determine the mode of inheritance of an abnormal feather condition in White Leghorn Chickens which was received by the Kansas and Purdue Experiment Stations. A description of the condition is given. Crosses were made at each of the stations; also crosses between the stocks from the two stations. A single autosomal recessive gene was responsible for this mutant which has been called "stringy."

TABLE I.* Data showing the inheritance of "stringy".

Mating		Normal	Abnormal	χ^2
At Purdue				
Normal ♂ × Stringy ♀	Obs.	23	0	
	Exp.	23	0	.
F_1 ♂ × F_1 ♀	Obs.	44	18	
	Exp.	46.5	15.5	.5344
F_1 ♂ × Stringy ♀	Obs.	33	26	
	Exp.	29.5	29.5	.8230
Stringy ♂ (K) × F_1 ♀ (P)	Obs.	37	38	
	Exp.	37.5	37 5	.0134
Stringy ♂ × Stringy ♀	Obs.	0	21	
	Exj.	0	21	....
Stringy ♂ (P) × Stringy ♀ (K)	Obs.	0	6	
	Exp.	0	6	...
At Kansas				
Stringy ♂ × Normal ♀	Obs.	64	0	
	Exp.	64	0	...
F_1 ♂ × F_1 ♀	Obs.	170	44	
	Exp.	160.5	53.5	2.2493
Stringy ♂ × Stringy ♀	Obs.	0	10	
	Exp.	0	10	...

* P = Purdue; K = Kansas.

FAST FORWARD TO 1980, THE NAME IS ST-2

Stringy-2 (st-2) the description from Crawford (1990) This feather abnormality was studied simultaneously at the Purdue and Kansas Agricultural Experiment Stations. A check on sources of the two stocks indicated that they had a common origin. Subsequent crosses between the stocks proved that they carried the same mutation, and it was reported jointly (Buss et al., 1950). The stringy trait was named after the characteristic appearance of adult birds in which most of the barbules were absent from wing and tail feathers. At one day of age, chicks were 'sticky'; the down feathers were not fluffy and were parted down the middle of the back. Adult wing and tail feathers were generally short, and the barbs did not spread out to form the vane. The sheath also persisted for longer than normal. In addition to feather abnormalities, there was also beak and toenail involvement; the premaxilla and the toenails were longer than normal, and quite often the beaks were crossed (photo B). It was suggested that this condition might manifest itself by modifying the amount or toughness of keratin produced in the epidermis. Adult birds of both sexes had reduced vigour. Although males were very poor semen producers, female egg production was equal to that of normal birds.
Crosses at both stations, as well as a cross between the two sources, demonstrated that only one trait with a common basis was involved. Its inheritance was determined to be that of a single autosomal recessive, to which the symbol st-2 was later assigned by Somes in 1980.

Another modern stringy of the mixed EU-SA columbian group.

The observation of today's stringies
This occurs in a strain of Wyandottes which are a mix of European and South African birds. The columbians (black and blue) are affected most, because they are bred together. The hens can be used as backyard birds, they lay eggs like their normal feathered sisters. Knowing that genes express in various ways, some aspects of the stringy Leghorns from 1946-1950 are similar, others weren't noticed, other things are a new observation supported by the research paper, notably that the quills of the feathers are more flexible than they ought to be.
There are more conditions that affect keratin production, and stringy-2 is the one that fits the birds on the photos best, albeit not identically (gene expression). The toenails and the upper beak being longer can also be seen on the 2025 photos.
The black (blood) specks are not visible, perhaps the timeframe in which they appear has already closed, because when breeding chicks, they are kept in a

group with several colours together, the odd bird is not spotted so soon until it becomes really odd.
Given the location, there are no worries about the welfare of the not-so-well-insulated chickens; it is warm enough. However, the mixing of two totally unrelated lines of Wyandottes resulted in the hidden heterozygous st-2 genes coming together and creating stringy chickens. Compare it to a surprise recessive white that pops up from blacks or partridges, or the surprises that can be caused by hidden travelling of lavender and recessive sex-linked chocolate.

Older research papers are still as valid as they were 75 years ago if they have not been updated. In 'citations' it can be seen that newer papers mentioning this paper on stringy-2 from Buss, Bohren and Warren don't write anything on stringy-2 itself or causative proteins.

You might ask: why stringy-2?
There was a bit earlier another stringy (1) mentioned before the Leghorns of 1946. A variant in down feathers, which became known as stringy, was reported by Kessel (1945a). Chick down was stringy in appearance because the down barbs were twisted and stuck together. The condition was most abundant on the back, in front of and between the wings. At hatching the affected chicks were full size and very active, but by one week of age they began to weaken. All had died before two weeks of age.
The parents of these abnormal chicks were a male and his seven sisters. They all had normal plumage, but 14 of the 85 chicks raised had stringy down feathers. The mode of inheritance would appear to have been recessive, but it is uncertain whether this trait was autosomal or sex-linked. The gene symbol ‘st’ was later assigned to it by Somes in 1980. This is a different sort of stringy, which only refers to the down feathers of the chicks, and it is unknown how they would have looked as adults because they died too soon.

Stringy is not porcupine (see above)
The woodcut above shows that the gene is not 'porcupine' (pc), because those birds have only quills, there is zero vane-like structure on the feathers. Also, day-old chicks don't have fluff. The stringy-2 birds do have some sort of vane, although the vane is missing the hooks on the barbs. Aldrovandi showed the world the first porcupine chicken. The adults didn't do well, according to Waters (1967), who described them. Adult hens laid few eggs and none were fertile, regardless of artificial insemination. From split heterozygous parents, the F1 showed the condition, and it was concluded that porcupine is an autosomal recessive.

Woodcut: Aldrovandi: Ornithologiae tomus alter, page 308 (https://archive.org/details/ARes04103/page/308/mode/2up)