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CRYING OVER SPILT ONIONS?

Fifteen years into the industry, and still I struggle with the jargon. Was there ever an industry more beset with quaint and often archaic jargon than the textile industry? Noils, warp, weft, sliver, carding, tops, etc etc—where do they find these words, and to whom are they useful apart from textile manufacturers and Scrabble tragics?

Today, in a casual but lively discussion with Cameron Holt, conducted during breaks in the less than lively Australian Open Tennis Final, I confronted my own confusion regarding the terminology that we apply to the feral fibres that we are all trying so hard to eliminate from our fleeces. You know, the ones that cause prickle factor, the ones we hear judges rail against as "medullated fibres", the ones we learnt about in skin histology as "primary fibres", the ones dismissively cast out with the skirtings as "guard hair".

All the same, right? Wrong!

What we see in a fleece as individual fibres that stand out from the underlying softer and finer fleece are *guard hairs.* I remain uncertain as to what they are meant to guard against, but perhaps they are referred to as guards in much the same way as we refer to sentinels: they stand out boldly from the crowd of surrounding fibres, and are the fibres of first contact with the outside world, protecting the skin underneath. It is generally accepted that these guard hairs are likely to be longer, straighter, coarser, and perhaps more brittle than the surrounding throng of softer fibres that make up the undercoat, and they stand out both tactilely and visually.

Medullated fibres, as described and classified by Villarroel, are fibres with a central core, which may be continuous, interrupted, or fragmented. Here, the cortical cells, that make up the walls of the fibre, are wrapped around a medulla, or core, that is made up of another type of cell (surprisingly called medullary cells). Later, these cells may contract or disappear, and hence the proud reference to "hollow fibres" that was so often heard in the early days of the industry, which in fact was a reference to medullated fibres.

Finally, there are the *primary fibres.* These are quite specifically those fibres arising from the primary follicle, which are histologically and embryologically identifiable as the first crop of hair follicles to appear in the skin, and are histologically unique in having not only sebaceous (wax) glands nourishing the emerging hair, but also a sudoriferous (sweat) gland and a smooth muscle (the so-called pili-erector muscle, which is the one that "makes your hair stand on end"). The latter two structures distinguish them from the secondary follicles, which appear later in the skin development, and lack the sweat gland and the muscle fibre. Primary and secondary follicles are arranged together into distinct entities called follicle groups, in each of which there are three primary follicles arranged together with a variable number of secondary follicles.

OK, so primary fibres, guard hair and medullated fibres are often one and the same right? Right! Always one and the same? Wrong!

To start with, you can't *see* medullated fibre. You might guess, often correctly, that a guard hair is medullated, but the only way you can know for sure is to look at it under the microscope. So why do judges and fleece judging sheets refer to "medullated fibre?" Well, quite simply, what they *mean* is guard hair, which *can* be seen and distinguished by the naked eye, according to the definition above. And most often, if one *were* to look at them under the microscope, they would be found to be medullated, but to call them medullated on visual inspection is just an educated guess. If one were to examine the guard hair of an impossibly fine and dense alpaca, it is theoretically possible that the guard hairs would be longer, coarser and straighter than the fibres of the undercoat, but still be non-medullated.

Now to the primary fibres. It is probably fair to say that most guard hairs are primary fibres: if they stand out from the crowd, if they are longer and coarser than the fibres around them, then almost certainly they are primaries. *But not all primaries are guard hairs.* Take the advanced Merino fleece: every follicle group still has three primary fibres and a whole bunch of secondary fibres, but on visual inspection, you can't distinguish between them. This is because selective breeding has made them finer (Jim Watts says the increased density of the secondary follicles leaves less room for the primary follicles, which are effectively squeezed down until their fibre diameter approaches that of the secondary fibres). So they have effectively eliminated guard hair, and possibly eliminated medullated fibre, by progressively reducing fibre diameter, but the primary follicles remain as a histologically indelible fact of life, as do the primary fibres. We do not aim to eliminate primary fibres—it is doubtful that we could—and if we did so, the loss of sweat glands would quite possibly have profound implications for the alpaca in terms of thermoregulation and electrolyte balance. The aim is to reduce primary fibre diameter until it approaches that of the secondary fibre, so that we produce a more even fleece, of *whatever* average fibre diameter.

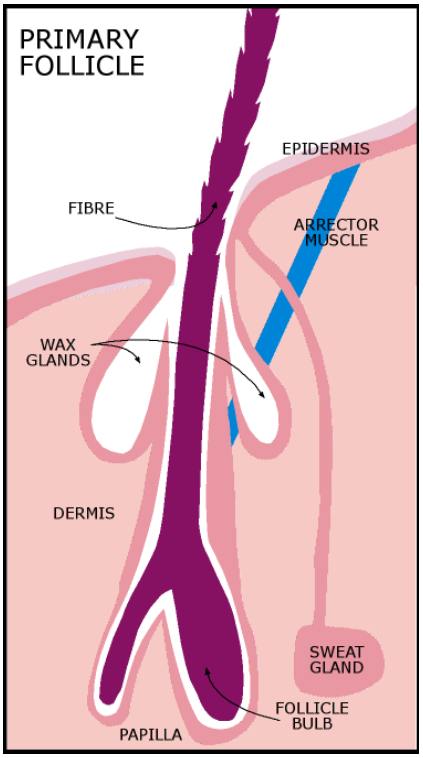
And remember, *any* fibres, including secondary fibres, may be medullated, partially or completely. Naturally, the coarser the fibre, the more likely this is to be true. So a judge may well remark that a coarse fleece contains a lot of medullated fibre, and there is every likelihood of his/her being quite correct in that statement. However, only a microscope can resolve that question, whereas the message can be just as easily inferred from the factually correct statement that the fleece is 1) not fine, and 2) shows significant guard hair.

So let's all say what we *mean*, rather than trying to sound scientific, and when we inspect fleeces, describe what we see—*guard hair*—rather than what we think it might look like under the microscope, or from what kind of follicle we think it might have grown.

The tears shed in the showring by an exhibitor may well be shed in sadness; but equally, they may be shed in joy, or pain, or (extraordinarily) from the smell of onions. The only thing that can be said with certainty is that the bugger's crying.

Dr Ian Davison, Illawarra Alpacas

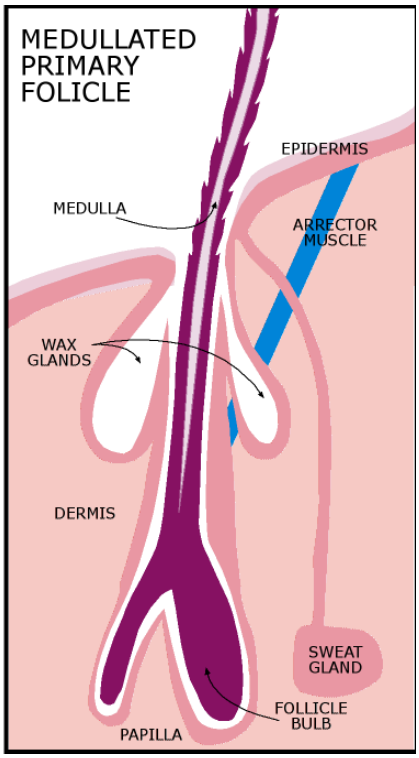
I have invited Cameron Holt to comment on my perceptions as outlined above, and the following is his response:



PRIMARY FIBRE

The primary follicle is the first follicle to form in the skin. It has two major glands associated with it
1 – Sebaceous gland (wax) which lubricates and protects the fibre.
2 – Sudoriferous gland (sweat). These glands produce differing degrees of sweat in various animals. Also,
3 – Erector pili muscle

The primary fibre can normally only be identified from the structure from which it grows. However, with the possible exceptions of elite fibre in sheep, the primary fibre tends to be the longest and most coarse of the fibres within the fleece, and this is the present wihth alpaca. This primary fibre (depending on micron) may be partially medullated and this medullation will not be visible to the naked eye. This should not be confused with the highly medullated guard hair shown below.



MEDULLATED FIBRE
(most likely guard hair)

The medullated fibre normally grows in the primary follicle structure, having all associated glands similar to the normal solid primary fibre.

The structure found in medullated (guard hair) fibres is probably an inheritance from previous wild primitive animals that used these fibres for protection.

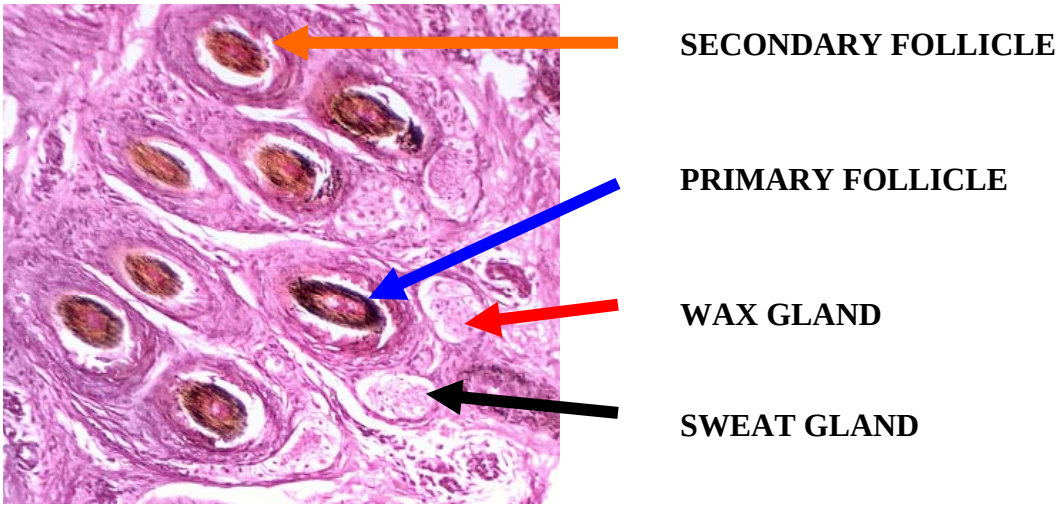
Medullary cells are formed at the dome of the papilla (see beside) and are confined to the central region of the fibre as it develops up through the follicle.

The medullary cells may break down before the fibre emerges, and if so the centre of the fibre will be empty (hollow).

SECONDARY FIBRE

The secondary fibres are those fibres which grow from the secondary follicle. This follicle forms after the primary follicle and is identified by its singular wax gland, and absence of sweat glands and the pili-erector muscle.. The secondary follicles are divided into two groups, that is secondary and secondary derived. The secondary fibres that grow from these follicles are shorter and finer than the primary fibre and the secondary derived are slightly shorter and finer again than the secondary. These secondary derived normally share a common opening in the secondary follicle. Secondary fibres can also be medullated, that is have some form of medulla structure within the fibre without affecting the visual appearance to the naked eye.

As mentioned previously mentioned by Ian, these fibres grow from a follicle structure normally called "trio groups." This means that there are three primary follicles with a surrounding number of secondary and secondary derived follicles attached to each primary follicle. It is from this group that we get our term S/P Ratio, that is the number of secondaries to one primary. The photograph below has an S/P Ratio of 3 to 1. This is obviously the very lowest range for alpacas but measurements have been taken as high as 17 to 1. The current average S/P Ratio is approximately 9 to 1.



Some terms used to describe particular types of medullated fibre:

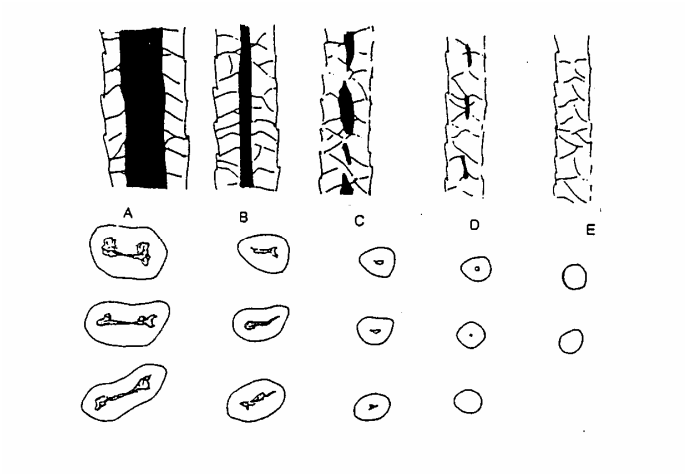
KEMP consist of short, brittle, chalky white medullated fibres found about the head and legs of most breeds of sheep and in crossbred goats.

GARE refers to the long hairy coarse fibres which may be found in the britch area of a fleece. As these fibres lack crimp they are easily detected. They may be shiny and are either totally or partially medullated.

GUARD HAIR

Medullated fibre grown by goats, and some camelid animals as a protective fibre for the fine underdown. These may be short like kemp fibres or quite long. They normally grow from the primary follicle. In the cashmere goat they are the coarse fibres forming the primary coat of the two coated primitive fleece. This fibre is generally very coarse in fibre diameter with a broad medulla cell within.

Alpaca fibre, depending on micron, has some medullation. J. Villarroel defined medullated types into 5 categories for his alpaca research in 1959.



Types of medulla and typical cross-section shapes in white Alpaca fibres.

(a) Unbroken very wide (near to lattice type), 60 or more micron diameter
(b) Unbroken medium wide, 40-60 micron diameter
(c) Interrupted, 30-40 micron diameter
(d) Fragmented, 20-30 micron diameter
(e) Non medullated fibres, 15-20 micron diameter

Group "A" is considered undesirable in Alpaca fleece.

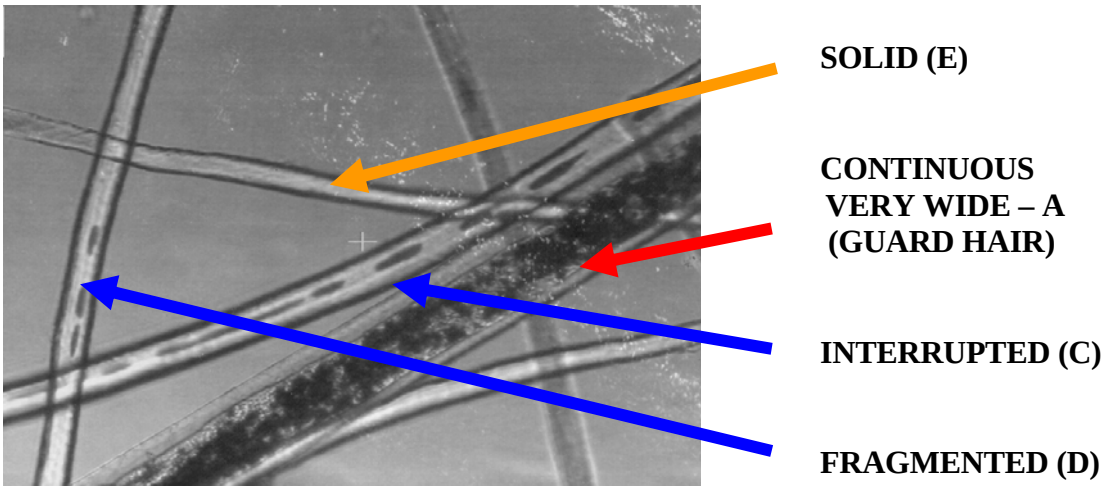
C Holt and I Stapleton, in there research on alpaca fibre for the AAA (1993), confirmed the findings of Villarroel. Example of midside measurements (percentages of fibres) in alpaca:

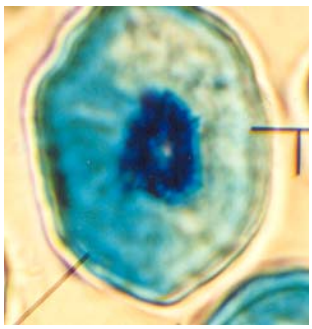
AVERAGE MICRON	SOLID (E)	INTERRUPTED (D & C)	CONTINUOUS (B & A)
21.8	58	33	9
22.6	65	24	11
26.9	87	10	3

27.8	**3**	**48**	**49**

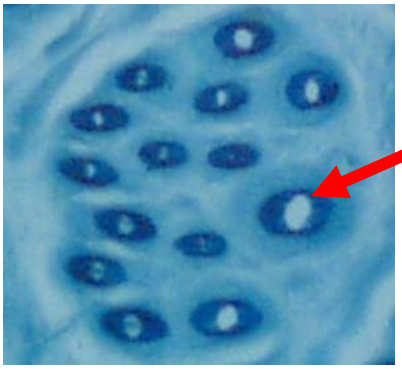
To fully appreciate the above figures you need to picture a histogram which you would receive when you test your fleece. You will find a spread from the very finest to the very coarsest and an average micron is given for all these measurements. In each micron group in the example above, the finest of the fibres will be solid, the middle group fragmented and interrupted, and the coarsest of the fibres will be continuously medullated. For higher average micron fleeces, the percentage of medullated or partially medullated fibres will be greater.

The following microscopic images (Holt, unpublished data) from Australian Alpacas can be identified and graded using those categories.





A huacaya cross-section showing the bi-lateral structure (para and ortho cortex cells) and the medulla cell in the centre. This fibre is an INTERRUPTED (C) type and would appear normal, with crimp. You could not tell with the naked eye that there was any medullation contained within.



A normal solid primary fibre, growing from a primary follicle

A medullated fibre growing in a primary follicle

AVERAGES FROM PERUVIAN ALPACAS
(extract from J WATTS, J HICKS)

	AVERAGE	RANGE
PRIMARY		
Micron	**28**	**17.3-44.1**
Medullation (all types)	**89%**	
SECONDARY		
Micron	**19.4**	**13.5-29.4**
Medullation (all types)	**45%**	

(again think of the histogram)

My thanks to Ian Davison for raising this important topic, and for his invitation to comment and elaborate on his article.

Cameron Holt