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for

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Wool Follicle Initiation: Regulation of Diameter and Density.

Produced for the CRC for Premium Quality Wool undergraduate program by;
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Follicle Density

- Density is determined at follicle initiation.
- Follicle density differs across breeds/genotypes.
- Follicle density is a major determinant of fleece weight (in conjunction with fibre diameter).

$$n = (D) (SA),$$

n = follicle number, D = density,
 SA = surface area of animal.

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Fibre Diameter

- The other major determinant of fleece weight.
 - Determined by follicle bulb size.
- Bulb size/diameter highly correlated with dermal papilla volume.
- Bulb size/DP size largely determined during follicle development.

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Density and diameter genetically linked

- Both follicle density and fibre diameter are heritable, quantitative traits.
- Follicle density and fibre diameter are negatively correlated.
 - Selection for low diameter also selects for high density.
 - Selection for high density also selects for low diameter.
- Selection for fleece weight alone tends to select for higher diameter.

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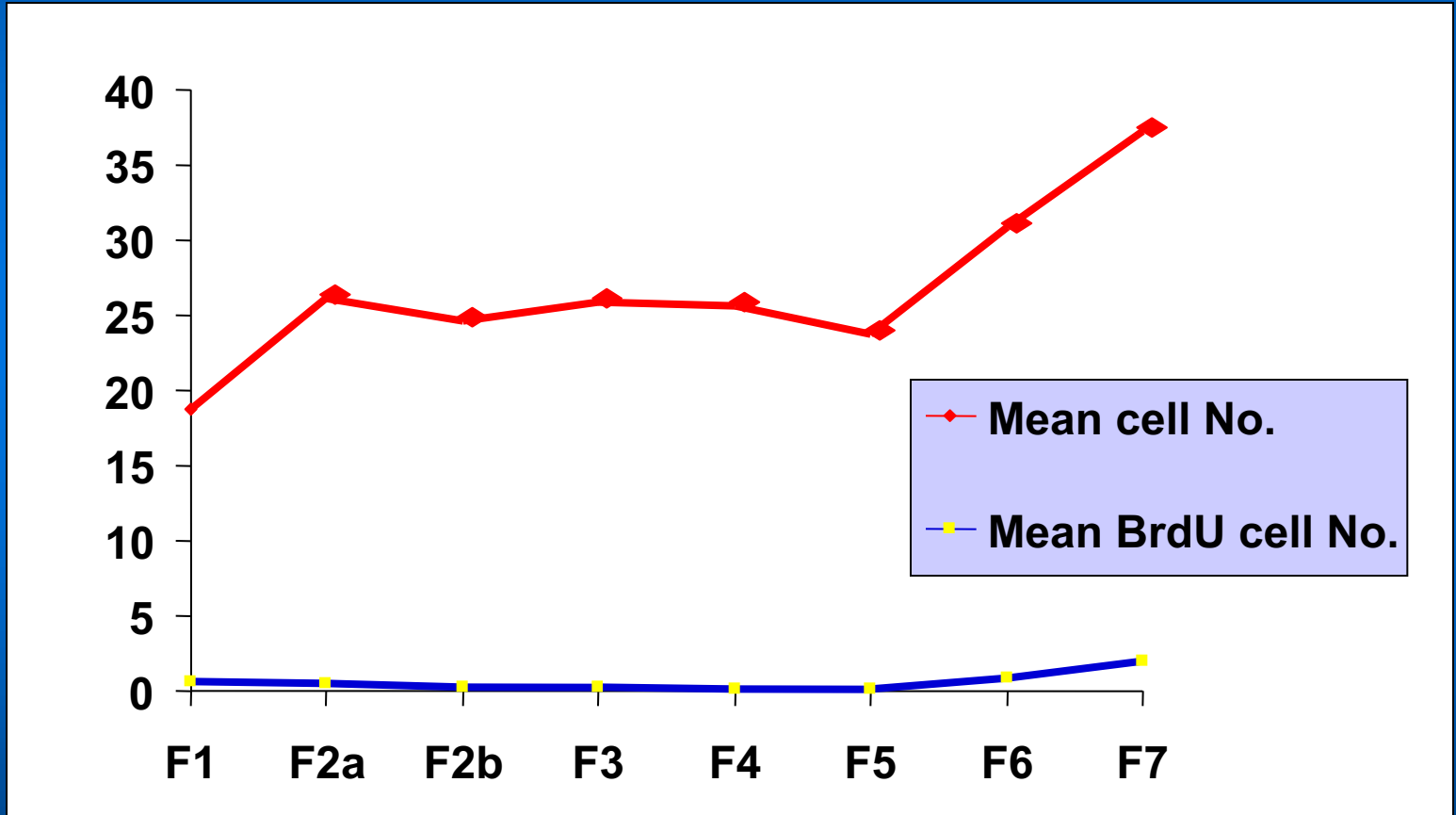
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Cell division in developing dermal papillae

- The dermal papilla grows during development

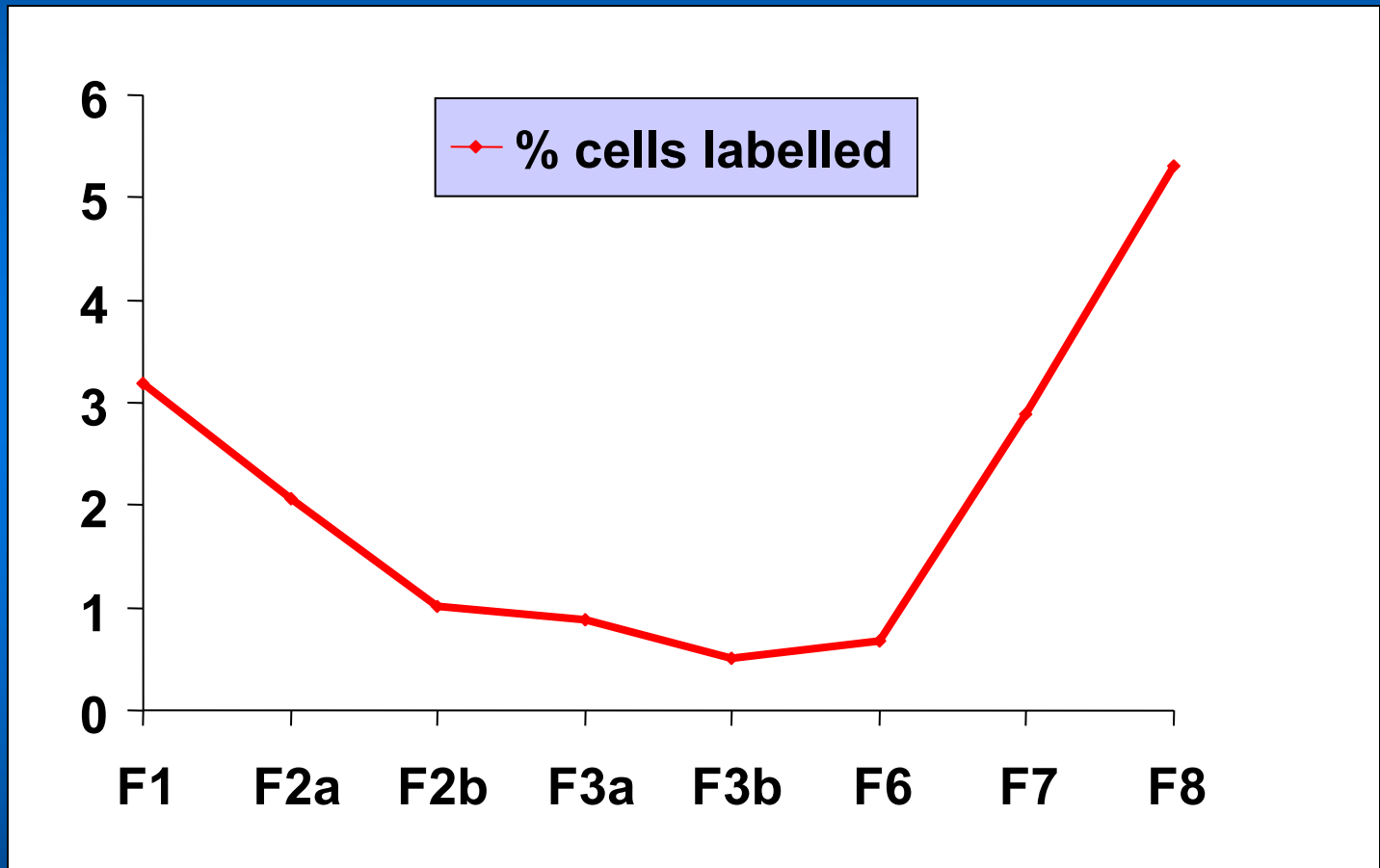


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Rate of cell division in dermal papilla

- Rate is regulated by stage of development



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Density and diameter at initiation

Table 1.

Wool follicle diameter and density means, adjusted for nuisance effects (where significant to the 10% level) at two foetal ages.

Primary Follicles											
Age	Genotype	Corrected Diameter at gland height (μm)		Corrected Density (mm^{-2})		Corrected Diameter at base of follicle (μm)		Dermal Condensate Area (μm^2)		Dermal Condensate Diameter (μm)	
		mean ⁽¹⁾	sem	mean ⁽³⁾	sem	mean	sem	mean ⁽⁵⁾	sem	mean	sem
ca. 80d	AB73/++	57.1	2.24	75.2	4.52	64.5*	2.42	1508***	88	68.3	2.01
	AB73/-	53.2	2.24	97.2***	4.52	63.5*	2.42	1773	83	66.6	2.01
	B.LEICESTER	58.1	1.95	68.7**	3.92	77.9***	1.80	2465***	62	74.8**	1.50
	FINE WOOL	58.2	1.29	78.3	2.60	68.9	1.39	1741**	48	68.5	1.16
	STRONG WOOL	56.8	1.95	80.7	3.93	70.4	1.80	1953	64	71.3	1.50
Secondary Original Follicles											
ca. 100d	AB73/++	25.2	0.98	176	14.8	nd	nd	653	48	40.6	1.62
	AB73/-	26.1	0.75	207***	10.5	nd	nd	686	34	40.8	1.25
	B.LEICESTER	26.8	0.67	88**	9.1	nd	nd	836***	30	38.3	1.08
	FINE WOOL	27.5	0.82	158	9.7	nd	nd	695	32	42.0	1.15
	STRONG WOOL	24.6	0.79	179	9.1	nd	nd	748	30	40.1	1.08

*, **, *** indicates statistically different deviations from the overall mean at the 5, 1 and 0.1% levels respectively. Nuisance terms fitted (1) drop, (2) drop and sex, (3) drop, (4) drop and sex, (5) sampling site, (6) sex.

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Adult density and diameter

Table 2

Wool follicle diameter and density means, adjusted for nuisance effects (where significant to the 10% level) at hogget stage.

Genotype (n)	Pm Diam (μm)		Psd Diam		Sm Diam (μm)		Ssd Diam	
	mean	sem	mean	sem	mean ⁽¹⁾	sem	mean	sem
AB73/++ (7)	22.6	1.23	3.75	0.581	17.7*	1.16	3.48	0.256
AB73/- (6)	16.2***	1.33	2.50*	0.627	14.7***	1.24	2.37***	0.277
B.LEICESTER (9)	37.5***	1.09	6.94***	0.512	32.9***	1.06	7.45***	0.226
FINE WOOL (9)	15.6***	1.09	2.35**	0.512	15.7***	1.05	2.16***	0.226
STRONG WOOL (9)	21.6	1.09	3.50	0.512	20.3	1.22	3.79	0.226
	Primaries				Original Secondaries			
	CP Foll (mm^{-2})		CP Fib		CS Foll (mm^{-2})		CS Fib	
	mean ⁽²⁾	sem	mean ⁽³⁾	sem	mean	sem	mean	sem
AB73/++ (7)	4.19**	0.228	4.05**	0.317	53.4	5.46	49.6	5.50
AB73/- (6)	3.96	0.317	3.51	0.358	94.9***	5.90	90.8***	5.94
B.LEICESTER (9)	2.35***	0.254	1.97***	0.273	11.6***	4.82	9.4***	4.85
FINE WOOL (9)	3.52	0.257	3.21	0.291	68.6*	4.82	65.5*	4.85
STRONG WOOL (9)	3.59	0.255	3.49	0.274	62.3	4.82	59.0	4.85

*, **, *** Indicate statistically significant deviations from the overall mean at the 5, 1 and 0.1% levels respectively.

Nuisance terms fitted (1) sex and drop, (2) type of birth and sampling site and age, (3) type of birth and age.

Pm Diam = mean primary fibre diameter; Psd Diam = standard deviation of Pm Diam; Sm Diam = mean secondary fibre diameter; Ssd Diam = standard deviation of Sm Diam; CP Foll = corrected primary follicle density; CP Fib = corrected primary fibre density; CS Foll = corrected secondary follicle density; CS Fib = corrected secondary fibre density. The discrepancies between follicle and fibre densities are due to some hair canals having no fibre within. This is due to a combination of natural shedding and fibre loss during histological processing.

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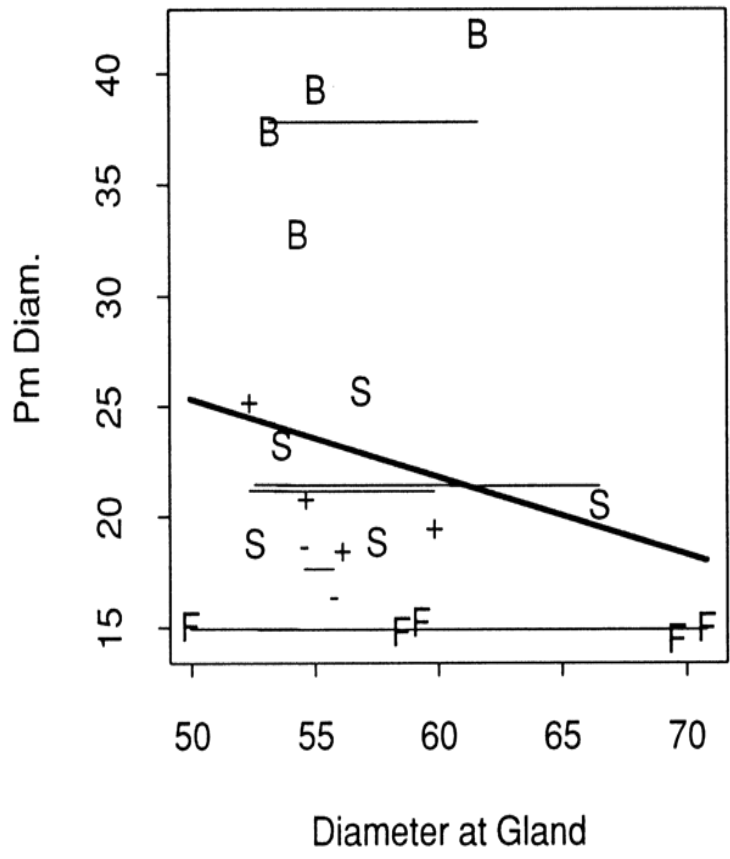
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So does foetal diameter correlate with fibre diameter?



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