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**FIBRILLAR COLLAGEN
STRUCTURE IN OVINE LEATHER
AND RELATED MATERIALS AND
ITS RELATIONSHIP TO STRENGTH**

A thesis presented in partial fulfilment of the
requirements for the degree of
Doctor of Philosophy in Engineering
at Massey University, Palmerston North, New Zealand

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2013

ABSTRACT

Leather is used for a number of products including those of the garment, automotive and footwear industries. The footwear industry provides a consistent demand for leather. However, due to strength properties of leather produced from ovine skins, ovine leather is not currently used in significant quantities in this industry. A greater understanding of the structure of ovine leather could assist in designing processing steps to increase ovine leather strength. Fibrillar collagen is a major structural component of a number of tissues including skin and is the main component of leather. Small angle X-ray scattering (SAXS) is an X-ray diffraction technique that can be used to investigate fibrillar collagen structure and distribution.

A relationship is found between the orientation of collagen fibrils in ovine leather and tear strength. Stronger leather has a greater alignment of collagen fibrils parallel to the leather surface while weaker leather has more fibrils out of this plane. The fibrillar collagen structure is fairly consistent across the entire ovine leather skin, with the relationship between orientation index and tear strength maintained at all positions investigated. The fibrillar collagen structure of ovine skins changes during leather processing with the alignment of collagen fibrils, in the direction parallel to the skin surface, consistently increasing after the pickling stage.

Significant changes occur to the fibrillar collagen structure of ovine leather during uni-axial stretching. Initial strain results in reorientation of collagen fibrils followed by stretching of individual fibrils. The response to strain varies, with stretching of fibrils occurring more evenly across cross-sections in stronger samples than in weaker samples. The response of a different collagen rich material, a decellularized extracellular matrix biomaterial, to uni-axial strain is similar to that of leather.

The findings of this work greatly increase the knowledge of the fibrillar collagen structure of ovine leather. Through this work a fundamental relationship between fibrillar collagen orientation and tear strength has been identified. The results of this work can be used to develop appropriate processing techniques to create leather with desired characteristics.

The knowledge gained in this work is applicable to leathers produced from different species and may extend to other processed collagen rich tissues and tissue products.

ACKNOWLEDGEMENTS

I would like to thank a number of people whose help has made this work possible.

Firstly, I would like to thank the New Zealand Leather and Shoe Research Association Inc. (LASRA) who, in conjunction with the Foundation for Research Science and Technology (grant number LSRX0801), assisted financially with this project. I also wish to thank LASRA, and especially: Richard Edmonds; Sue Cooper; and Warren Bryson, for providing their assistance and input throughout this project.

I would like to thank my supervisor Richard Haverkamp for his significant assistance. Your continued support and positive outlook have been an enormous help. I would also like to acknowledge the contribution of my co-supervisor Gillian Norris.

This research was undertaken on the SAXS/WAXS beamline at the Australian Synchrotron, Victoria, Australia, with the NZ Synchrotron Group Ltd providing travel funding. I would like to thank everyone who helped with experimental work especially Katie Sizeland and Leah Graham for their assistance collecting data. I would also like to thank the SAXS/WAXS beamline staff, particularly; Nigel Kirby and Adrian Hawley, for their helpfulness and patience.

Finally, I wish to thank my partner, Michael, and my family for being so supportive of my decision to commence further study and for attempting to understand my work.

TABLE OF CONTENTS

	Page
CHAPTER 1 INTRODUCTION	1
1.1 Outline of the Problem	1
1.2 Aims and Objectives	3
CHAPTER 2 LITERATURE REVIEW	4
2.1 Collagen	4
2.1.1 Network Collagens	5
2.1.2 Filamentous Collagens	6
2.1.3 Fibril Associated Collagens	6
2.1.4 Fibrous Collagens	6
2.1.4.1 Primary Structure	7
2.1.4.2 The Triple Helix	8
2.1.4.3 Microfibril Structure	9
2.1.4.4 Collagen Banding	9
2.1.4.5 Native Cross-Linking in Collagen Molecules	10
2.1.4.5.1 Enzymatic Cross-Linking	10
2.1.4.5.2 Non-Enzymatic Cross-Linking	11
2.1.4.6 Fibril Structure	12
2.2 Skin	13
2.2.1 Skin Structure	13
2.2.1.1 Dermis Structure	14
2.2.2 Skin Components	14
2.2.2.1 Collagen	15
2.2.2.2 Keratin	16
2.2.2.3 Elastin	17
2.2.2.4 Proteoglycans	17
2.3 Leather	18
2.3.1 Leather Production	18
2.3.1.1 Skin Preparation	18
2.3.1.2 Hair Removal and Liming	18
2.3.1.3 Deliming and Bating	19
2.3.1.4 Pickling	19
2.3.1.5 Tanning	19
2.3.1.6 Retanning and Fat-liquoring	20
2.3.1.7 Drying and Finishing	20
2.3.2 Leather Structure	20
2.3.3 Leather Composition	21
2.3.3.1 Collagen	22
2.3.3.2 Effect on Leather Quality	22
2.4 Physical Properties of Collagen Rich Materials	23

	Page
2.4.1 Rheology of Tendon	23
2.4.2 Rheology of Leather.....	24
2.4.2.1 Tensile Testing	24
2.4.2.2 Tear Testing.....	25
2.4.2.3 Effect of Splitting	25
2.5 Biological Scaffold Material ..	26
2.5.1 Tissue Sources.....	26
2.5.2 Processing	26
2.5.3 Composition.....	27
2.5.4 Assistance in Healing	27
2.5.5 Introduction to the Biology of Wound Healing	27
2.5.5.1 Types of Wounds.....	27
2.5.5.2 Exudate Production.....	28
2.5.5.3 Normal Healing Process	29
2.5.5.4 Proteinases	29
2.5.5.5 Proteinases in Chronic Wounds	29
2.5.5.6 Proteinase Inhibitors ..	30
2.5.5.7 Inhibitors in Chronic Wounds..	30
2.6 Microstructure Measurements	30
2.6.1 Small Angle X-ray Scattering.....	31
2.6.1.1 Theory of Small Angle X-ray Scattering.....	31
2.6.1.2 Bragg Scattering	32
2.6.1.3 Small Angle X-ray Scattering of Fibrillar Collagen.....	32
2.6.1.4 Small Angle X-ray Scattering of Leather.....	34
CHAPTER 3 EXPERIMENTAL METHODS	35
3.1 Leather Sampling	35
3.1.1 Leather Preparation.....	35
3.1.2 Sample Selection..	38
3.2 Decellularized Extracellular Matrix Sampling... ..	40
3.2.1 Decellularized Extracellular Matrix Production.....	40
3.3 Tear Strength Measurement ..	41
3.4 Small Angle X-ray Scattering..	43
3.4.1 Sample Preparation	43
3.4.1.1 Unstrained Samples	44
3.4.1.2 Stretched Samples.....	45
3.4.2 SAXS Experimental Set-up.....	47
3.4.3 SAXS Diffraction Patterns.....	48
3.4.4 Analysis of SAXS Diffraction Patterns	50
3.4.4.1 Collagen <i>d</i> Spacing.....	50
3.4.4.2 Amount of Crystalline Collagen	50
3.4.4.3 Collagen Fibril Orientation	51
3.5 Scanning Electron Microscopy	54
3.5.1 Sample Preparation	54
3.5.2 Image Recording..	54

	Page
CHAPTER 4 VARIATION OF FIBRILLAR COLLAGEN STRUCTURE OF LEATHER SAMPLES WITH STRENGTH	55
4.1 Introduction.....	55
4.2 Results.....	56
4.2.1 Amount of Crystalline Collagen.....	56
4.2.2 Orientation of Collagen Fibrils	59
4.2.3 <i>d</i> Spacing.....	66
4.3 Discussion.....	69
4.3.1 Amount of Crystalline Collagen.....	70
4.3.2 Orientation of Collagen Fibrils	68
4.3.3 <i>d</i> Spacing.....	72
4.4 Conclusions.....	74
CHAPTER 5 VARIATION IN COLLAGEN STRUCTURE FROM DIFFERENT POSITIONS ON THE ANIMAL FOR OVINE LEATHER.	75
5.1 Introduction.....	75
5.2 Results.....	76
5.2.1 Thickness	76
5.2.2 Tear Strength.....	78
5.2.3 Directionality of Normalised Tear Strength.....	81
5.2.4 Visual Variation in Structure across Cross-Sections	82
5.2.5 Amount of Fibrillar Collagen	83
5.2.6 <i>d</i> spacing.....	85
5.2.7 Orientation	89
5.3 Discussion.....	93
5.3.1 Thickness	93
5.3.2 Absolute Tear Strength.....	93
5.3.3 Normalised Tear Strength	93
5.3.4 Amount of Crystalline Collagen.....	95
5.3.5 <i>d</i> Spacing.....	95
5.3.6 Orientation	96
5.3.7 Variation of Tear Strength and Collagen Orientation with Direction of Measurement in the OSP.....	96
5.4 Conclusions.....	96
CHAPTER 6 CHANGES IN FIBRILLAR COLLAGEN STRUCTURE DURING PROCESSING OF OVINE LEATHER.....	98
6.1 Introduction.....	98
6.2 Results.....	99
6.2.1 Orientation Index	99
6.2.2 <i>d</i> Spacing.....	100
6.2.3 Thickness	102
6.2.4 Tear Strength.....	103
6.3 Discussion.....	105
6.3.1 Orientation Index	105
6.3.2 <i>d</i> Spacing.....	106

	Page
6.3.3 Thickness	107
6.3.4 Tear Strength.....	107
6.4 Conclusions.....	108
 CHAPTER 7 THE EFFECT OF STRAIN ON THE FIBRILLAR COLLAGEN STRUCTURE OF LEATHER.....	 109
7.1 Introduction.....	109
7.2 Results.....	110
7.2.1 Stress-Strain Curves	111
7.2.2 Variation of <i>d</i> Spacing and Fibril Orientation with Strain	113
7.2.3 Variation of <i>d</i> Spacing and Fibril Orientation with Stress	115
7.2.4 Variation of <i>d</i> Spacing across Sample Thickness.....	117
7.2.5 Variation of Fibril Orientation across Sample Thickness	119
7.3 Discussion.....	122
7.3.1 Cross-Sectional Samples.....	122
7.3.2 Flat Samples	124
7.4 Conclusions.....	126
 CHAPTER 8 FIBRILLAR COLLAGEN STRUCTURE IN DECELLULARIZED EXTRACELLULAR MATRIX PRODUCED FROM OVINE FORESTOMACH...	 127
8.1 Introduction.....	127
8.2 Results.....	128
8.3 Discussion.....	129
8.4 Conclusion	130
 CHAPTER 9 CONCLUSIONS.....	 131
9.1 Research Overview	131
9.2 Directions for Future Research	133
 CHAPTER 10 APPENDICIES.....	 135
10.1 Appendix I: Publications	135
10.1.1 Journal Articles ..	135
10.1.2 Conference	136
10.2 Appendix II: Sample Information.....	137
10.2.1 Information for Samples included in Chapter 4.....	137
10.2.2 Information for Samples included in Chapter 5.....	145
10.2.3 Information for Samples included in Chapter 6.....	150
10.2.4 Information for Samples included in Chapter 7.....	150
10.3 Appendix III: Raw Data	151
10.4 Appendix IV: Additional Processed Data.....	155
10.4.1 Extra Data Relating to Chapter 4 .	155
10.4.1.1 Additional SEM Images.....	155
10.4.1.2 Absolute Tear Strength.....	158
10.4.1.3 Tensile Strength	161
10.4.1.4 Tensile Extension	163

	Page
10.4.2 Extra Data Relating to Chapter 7	166
10.4.2.1 Cross-sections	167
10.4.2.2 Flat Samples.	179
10.4.3 Extra Data Relating to Chapter 8	187
CHAPTER 11 LIST OF REFERENCES	189

LIST OF FIGURES

	Page
Figure 2.1: Diagram illustrating different forms of collagen a) network collagens, b) filamentous collagens, c) fibril associated collagens and d) fibrous collagens. ...	5
Figure 2.2: Diagram displaying the hierarchical organisation of fibrillar collagen.	7
Figure 2.3: Illustration of the alignment of collagen molecules in a microfibril.....	9
Figure 2.4: Diagram of the thought location of; a) immature and b) mature, enzymatic cross-links in fibrillar collagen.	11
Figure 2.5: Diagram of the cross-sectional structure of skin... ..	14
Figure 2.6: A photograph showing the different layers of leather. The thickness of this leather cross-section is approximately 2.2 mm.	21
Figure 2.7: Diagram illustrating the general response of tendon to tensile deformation.	23
Figure 2.8: Diagram demonstrating the effect of particle size on scattering angle.	32
Figure 2.9: Sample SAXS diffraction pattern showing the locations of equatorial and meridional scattering.....	33
Figure 3.1: Flow diagram of the key stages of leather production illustrating the systematic variations in processing that took place to create a greater range of tear strengths.	38
Figure 3.2: Diagram of sample locations on leather skin with direction of backbone indicated.	39
Figure 3.3: Diagram showing the direction of samples cut from leather skin in relation to the direction of the animal's backbone.	39
Figure 3.4: Directions of X-ray beam with descriptors used in the text shown relative to the direction of the animal's backbone (Basil-Jones <i>et al.</i> 2011).....	40
Figure 3.5: Diagram and photograph of tear strength sample. Units in diagram are in mm.	42
Figure 3.6: Photograph of a tear test on a leather sample a) placement of sample in the Instron device and b) part way through the tear testing process (Sizeland <i>et al.</i> 2012)....	43
Figure 3.7: Diagram and photograph of unstrained sample plate (12 x 11 grid).....	44
Figure 3.8: Photograph of position of sample plate in relation to X –ray beam (Basil-Jones <i>et al.</i> 2010).....	45
Figure 3.9: Diagram (Basil-Jones <i>et al.</i> 2012) and photograph of the position of the sample in the stretching device during SAXS measurements.	46
Figure 3.10: Photograph of stretching device installed in the SAXS/WAXS beamline.	46
Figure 3.11: Optical image of a cross-section of ovine leather as seen by the SAXS X-ray beam. The height (leather thickness) of the section shown is 2.2 mm, but varies between samples. The rectangles indicate the size of the beam used to probe the sample and the spacing between sampling positions for unstrained cross-sections (Basil-Jones <i>et al.</i> 2011).	48
Figure 3.12: Example of SAXS diffraction pattern generated from leather (Basil-Jones <i>et al.</i> 2012).....	49

	Page
Figure 3.13: Plot of intensity versus q for a SAXS pattern of leather (Basil-Jones <i>et al.</i> 2012).....	49
Figure 3.14: Diagram of data treatments used to calculate; 1. collagen d spacing, 2. amount of crystalline collagen, and 3. collagen fibril orientation a) graph of intensity versus q showing the location of Bragg peaks, b) graph of summed intensity versus q , c) graph of log summed intensity versus $\log q$ used to determine the baseline, d) graph of intensity above the baseline versus q used to determine the amount of collagen, e) graph of log summed intensity versus $\log q$ used to determine the baseline at 180° , f) graph of log summed intensity versus $\log q$ used to determine the baseline at 90° , g) graph of intensity versus azimuthal angle, and h) graph of intensity above the baseline versus azimuthal angle used to determine OI.	53
Figure 4.1: Amount of fibrillar collagen through the thickness of ovine leather cross-sections (averages of 12 samples each) cut a) parallel to the backbone, and b) perpendicular to the backbone. Weak leather - solid circles, and strong leather – open circles (Basil-Jones <i>et al.</i> 2011).....	57
Figure 4.2: Amount of collagen determined from the intensity of the sixth-order collagen d spacing peak (at around $0.059\text{--}0.060 \text{ \AA}^{-1}$) versus tear strength for a) ovine leather; b) bovine leather (Basil-Jones <i>et al.</i> 2011).	58
Figure 4.3: Amount of collagen, determined from the intensity of the sixth-order collagen d spacing peak (at around $0.059\text{--}0.060 \text{ \AA}^{-1}$), in the corium - open circle, and the grain - closed circle, versus tear strength for both ovine and bovine samples.....	59
Figure 4.4: Orientation index versus tear strength for OSP samples of leather for a) ovine cross-sections cut parallel to backbone; b) bovine cross-sections cut parallel to backbone; c) flat ovine samples, grain- closed circle and corium - open circle;; d) flat bovine samples, grain - closed circle and corium - open circle;; e) ovine cross-sections cut perpendicular to backbone; f) bovine cross-sections cut perpendicular to backbone. A higher OI indicates a greater degree of fibre alignment (Basil-Jones <i>et al.</i> 2011).	61
Figure 4.5: Average orientation index across the thickness of ovine leather measured a) all samples cut parallel to the backbone (Basil-Jones <i>et al.</i> 2011); b) all samples cut perpendicular to the backbone; c) weak - closed circle and strong - open circle, cut parallel to the backbone; and d) weak - closed circle and strong – open circle, cut perpendicular to the backbone. Graphs are of an average of 28 leather samples for all samples and 14 leather samples for weak and strong samples.	63
Figure 4.6: Orientation index versus tear strength for the averages of each of the leather types measured through cross-sections cut parallel to the backbone. Error bars are one standard deviation (Basil-Jones <i>et al.</i> 2011).	64
Figure 4.7: Representative SEM images of cross-sections of leather observed parallel to the backbone for a) weak ovine; b) strong ovine and c) strong bovine. Scale bars $10 \mu\text{m}$ (Basil-Jones <i>et al.</i> 2011).....	66
Figure 4.8: d spacing versus tear strength for a) ovine cross-sections cut parallel to backbone; b) bovine cross-sections cut parallel to backbone; c) flat ovine samples, grain- closed circle and corium - open circle, ; d) flat bovine samples, grain - closed circle and corium - open circle, ; e) ovine cross-sections cut perpendicular to backbone; f) bovine cross-sections cut perpendicular to backbone (Basil-Jones <i>et al.</i> 2011).	68

	Page
Figure 4.9: Variation in d spacing through representative samples of weak ovine – open triangle, strong ovine - closed circle, and bovine - closed square, leathers (Basil-Jones <i>et al.</i> 2011).....	69
Figure 4.10: SEM image of a cross-section of strong ovine leather. Scale bar 1 mm.	70
Figure 4.11: Sketch of fibre orientation in a) leather highly aligned in two directions and b) leather with no proffered alignment. The orientation change is exaggerated to better illustrate the difference (Basil-Jones <i>et al.</i> 2011)	71
Figure 4.12: Diagram illustrating the relationship between collagen fibre alignment and OI in leather. a) Cross-section with high negative OI, b) cross-section with low OI, c) cross-section with high OI, d) flat sample with high negative OI, e) flat sample with low OI, and f) flat sample with high OI. Black arrows indicate the direction of applied stress in tear strength measurements. Dotted lines represent probable lines of failure. Red arrows indicate the direction of the backbone.....	72
Figure 5.1: Thickness of leather taken from different positions on the ovine skin.....	77
Figure 5.2: a) absolute tear strength and b) normalised tear strength of leather taken from different positions on the ovine skin.	79
Figure 5.3: Normalised tear strength of position versus the average normalised tear strength of the entire skin for; a) neck, b) belly, c) OSP and d) butt	81
Figure 5.4: Perpendicular versus parallel tear strengths for neck - closed circle; belly - open circle; OSP - closed triangle; and butt - closed square, positions.....	82
Figure 5.5: SEM image of a cross-section of ovine leather showing the approximate location of the grain-corium junction. Scale bar 1 mm.	83
Figure 5.6: Profiles of amount of crystalline collagen across sample thicknesses a) cut parallel to the backbone from the: neck - closed circle; belly - open circle; OSP - triangle, and b) cut perpendicular to the backbone from the: butt - closed square; OSP- open square.	84
Figure 5.7: Average amount of crystalline collagen versus tear strength for neck – closed circle, belly - open circle, OSP - closed triangle, and butt - open triangle.....	85
Figure 5.8: Profiles of d spacing across sample thicknesses a) cut parallel to the backbone from the: neck - closed circle; belly - open circle; OSP - triangle; and b) cut perpendicular to the backbone from the: butt - closed square; OSP - open square.	85
Figure 5.9: Average d spacing versus tear strength for samples a) cut parallel to the backbone from the: neck - closed circle; belly - open circle; OSP – triangle; and b) cut perpendicular to the backbone from the: belly - closed square; OSP - open square... ..	86
Figure 5.10: Average d spacing versus tear strength for neck - closed circle; belly - open circle; OSP - closed triangle; and butt - open triangle, for: a) cross-sections cut parallel to the backbone, b) cross-sections cut perpendicular to the backbone, c) flat samples of the grain, and d) flat samples of the corium.	89

	Page
Figure 5.11: Profiles of orientation index across sample thicknesses a) cut parallel to the backbone from the: neck - closed circle; belly - open circle; OSP – triangle; and b) cut perpendicular to the backbone from the: butt - closed square; OSP - open square.....	90
Figure 5.12: Average orientation index versus tear strength, with lines of best fit for each sample set, for cross-sectional ovine leather samples a) cut parallel to the backbone from the: neck - closed circle; belly - open circle; OSP – triangle; and b) cut perpendicular to the backbone from the: butt - closed square; OSP - open square.....	90
Figure 5.13: Average orientation index versus tear strength from: neck - closed circle; belly - open circle; OSP - closed triangle; and butt - open triangle; for a) cross-sections cut parallel to the backbone, b) cross-sections cut perpendicular to the backbone, c) flat samples of the grain, and d) flat samples of the corium.	92
Figure 6.1: Orientation index at various stages of processing.	99
Figure 6.2: <i>d</i> spacing at various stages of processing.	101
Figure 6.3: <i>d</i> spacing of fibrillar collagen versus the pH of processing fluid at various stages of processing.	102
Figure 6.4: Thickness at various stages of processing.....	102
Figure 6.5: Measured a) absolute tear strength and b) normalised tear strength at various process stages.....	104
Figure 6.6: Orientation index versus relative tear strength of processing stages.....	105
Figure 7.1: Graphs of stress versus strain for a) weak ovine, b) strong ovine and c) strong bovine (Basil-Jones <i>et al.</i> 2012).	112
Figure 7.2: Graphs of stress versus strain for a) weak ovine grain, b) weak ovine corium, c) strong ovine grain and d) strong ovine corium... ..	113
Figure 7.3: <i>d</i> spacing and orientation index versus strain measured edge on parallel to the backbone. <i>d</i> spacing - open circle; OI - closed circle. a) weak ovine, 19 N/mm tear strength; b) stronger ovine, 39 N/mm; c) strong bovine, 71 N/mm (Basil-Jones <i>et al.</i> 2012).	114
Figure 7.4: <i>d</i> spacing and orientation index versus strain measured for flat samples. <i>d</i> spacing - open circle; OI - closed circle. a) weak ovine (21 N/mm tear strength) grain; b) weak ovine, corium; c) stronger ovine (44 N/mm) grain; d) stronger ovine, corium (Basil-Jones <i>et al.</i> 2012).	115
Figure 7.5: <i>d</i> spacing and orientation index versus stress measured edge on parallel to the backbone. <i>d</i> spacing - open circle; OI - closed circle a) weak ovine, 19 N/mm tear strength; b) stronger ovine, 39 N/mm; c)strong bovine, 71 N/mm (Basil-Jones <i>et al.</i> 2012).....	116
Figure 7.6: <i>d</i> spacing and orientation index versus stress measured flat parallel to the backbone. <i>d</i> spacing - open circle; OI - closed circle. a) weak ovine (21 N/mm tear strength) grain; b) weak ovine, corium; c) stronger ovine (44 N/mm) grain; d) stronger ovine, corium (Basil-Jones <i>et al.</i> 2012).....	117
Figure 7.7: <i>d</i> spacing profiles through the thickness of the leather and change in <i>d</i> spacing as a consequence of increasing strain, for cross-sectional samples cut parallel to the backbone. a) weak ovine, 19 N/mm tear strength; b) stronger ovine, 39 N/mm; c) second strong ovine leather with a tear strength of 42 N/mm; d) strong bovine, 71 N/mm (Basil-Jones <i>et al.</i> 2012).....	119

	Page
Figure 7.8: Orientation index through the thickness of the leather versus strain and change in orientation as a consequence of increasing strain for cross-sectional samples cut parallel to the backbone. a) weak ovine, 19 N/mm tear strength; b) stronger ovine, 39 N/mm; c) second strong ovine leather with a tear strength of 42 N/mm; d) strong bovine, 71 N/mm (Basil-Jones <i>et al.</i> 2012).	121
Figure 8.1: Graph of stress versus strain for a sample of OFM.	128
Figure 8.2: <i>d</i> spacing and orientation versus a) strain and b) stress for a sample of OFM. <i>d</i> spacing: open circle; OI: closed circle.	129
Figure 10.1: Example of a SAXS image for a leather sample with a high level of preferred orientation (orientation index was calculated to be 0.81)	151
Figure 10.2: Example of a SAXS image for a leather sample with a medium level of preferred orientation (orientation index was calculated to be 0.50).	152
Figure 10.3: Example of a SAXS image for a leather sample with a low level of preferred orientation (orientation index was calculated to be 0.19). ..	153
Figure 10.4: An example of the data recorded by the load cell during stretching of leather while mounted in the SAXS X-ray beam....	154
Figure 10.5: Example of reproducibility of <i>d</i> period measurement in adjacent regions on one sample. Solid line, 5s exposure, 0.05 mm sampling; Dashed lines, 1s exposure, 0.25 mm sampling.	154
Figure 10.6: Representative SEM image of a cross-section of weak ovine leather observed parallel to the backbone. Scale bar 50 μm	155
Figure 10.7: Representative SEM image of a cross-section of strong ovine leather observed parallel to the backbone. Scale bar 50 μm	156
Figure 10.8: Representative SEM image of a cross-section of bovine leather observed parallel to the backbone. Scale bar 30 μm	157
Figure 10.9: Amount of collagen determined from the intensity of the primary collagen <i>d</i> spacing peak (at around 0.059–0.060 \AA^{-1}) versus absolute tear strength for both ovine - closed circle, and bovine - open circle, samples. .	158
Figure 10.10: Orientation index versus absolute tear strength for OSP samples of leather. a) Ovine cross-section cut parallel to backbone; b) bovine cross-section cut parallel to backbone; c) ovine, flat, grain - closed circle, corium - open circle, ; d) bovine, flat, grain - closed circle, corium - open circle, ; e) ovine cross-section cut perpendicular to backbone; f) bovine cross-section cut perpendicular to backbone.	159
Figure 10.11: <i>d</i> spacing versus absolute tear strength for OSP samples of leather. a) Ovine cross-section cut parallel to backbone; b) bovine cross-section cut parallel to backbone; c) ovine, flat, grain - closed circle, corium - open circle, ; d) bovine, flat, grain - closed circle, corium - open circle, ; e) ovine cross-section cut perpendicular to backbone; f) bovine cross-section cut perpendicular to backbone. Trend lines indicate significant relationships. ..	160
Figure 10.12: Amount of collagen determined from the intensity of the primary collagen <i>d</i> spacing peak (at around 0.059–0.060 \AA^{-1}) versus tensile strength.	161
Figure 10.13: Orientation index versus tensile strength for OSP samples of leather. a) Ovine cross-section cut parallel to backbone; b) ovine, flat, grain - closed circle, corium - open circle, and c) ovine cross-section cut perpendicular to backbone....	162

	Page
Figure 10.14: <i>d</i> spacing versus tensile strength for OSP samples of leather. a) Ovine cross-section cut parallel to backbone; b) ovine, flat, grain - closed circle, corium - open circle, and c) ovine cross-section cut perpendicular to backbone.....	163
Figure 10.15: Amount of collagen determined from the intensity of the primary collagen <i>d</i> spacing peak (at around 0.059–0.060 Å ⁻¹) versus tensile extension.....	164
Figure 10.16: Orientation index versus tensile extension for OSP samples of leather. a) Ovine cross-section cut parallel to backbone; b) ovine, flat, grain - closed circle, corium - open circle, and c) ovine cross-section cut perpendicular to backbone....	164
Figure 10.17: <i>d</i> spacing versus tensile extension for OSP samples of leather. a) Ovine cross-section cut parallel to backbone; b) ovine, flat, grain - closed circle, corium - open circle, and c) ovine cross-section cut perpendicular to backbone..	165
Figure 10.18: Stretching results for sample Ov198 with a tear strength of 20 N/mm a) stress versus strain; b) <i>d</i> spacing and orientation versus strain. <i>d</i> spacing: open circle; orientation: closed circle;; c) <i>d</i> spacing and orientation versus stress measured. <i>d</i> spacing: open circle; orientation: closed circle;; d) <i>d</i> spacing through the thickness of the leather and change in <i>d</i> spacing as a consequence of increasing strain; e) orientation through the thickness of the leather versus strain and change in orientation as a consequence of increasing strain.	167
Figure 10.19: Stretching results for sample Ov199 with a tear strength of 20 N/mm a) stress versus strain; b) <i>d</i> spacing and orientation versus strain. <i>d</i> spacing: open circle; orientation: closed circle;; c) <i>d</i> spacing and orientation versus stress measured. <i>d</i> spacing: open circle; orientation: closed circle;; d) <i>d</i> spacing through the thickness of the leather and change in <i>d</i> spacing as a consequence of increasing strain; e) orientation through the thickness of the leather versus strain and change in orientation as a consequence of increasing strain.	168
Figure 10.20: Stretching results for sample Ov200 with a tear strength of 19 N/mm a) stress versus strain; b) <i>d</i> spacing and orientation versus strain. <i>d</i> spacing: open circle; orientation: closed circle;; c) <i>d</i> spacing and orientation versus stress measured. <i>d</i> spacing: open circle; orientation: closed circle;; d) <i>d</i> spacing through the thickness of the leather and change in <i>d</i> spacing as a consequence of increasing strain; e) orientation through the thickness of the leather versus strain and change in orientation as a consequence of increasing strain.	169
Figure 10.21: Stretching results for sample Ov201 with a tear strength of 39 N/mm a) stress versus strain; b) <i>d</i> spacing and orientation versus strain. <i>d</i> spacing: open circle; orientation: closed circle;; c) <i>d</i> spacing and orientation versus stress measured. <i>d</i> spacing: open circle; orientation: closed circle;; d) <i>d</i> spacing through the thickness of the leather and change in <i>d</i> spacing as a consequence of increasing strain; e) orientation through the thickness of the leather versus strain and change in orientation as a consequence of increasing strain.	170

- Figure 10.22: Stretching results for sample Ov202 with a tear strength of 43 N/mm a) stress versus strain; b) d spacing and orientation versus strain. d spacing: open circle; orientation: closed circle;; c) d spacing and orientation versus stress measured. d spacing: open circle; orientation: closed circle;; d) d spacing through the thickness of the leather and change in d spacing as a consequence of increasing strain; e) orientation through the thickness of the leather versus strain and change in orientation as a consequence of increasing strain. 171
- Figure 10.23: Stretching results for sample Ov206 with a tear strength of 18 N/mm a) stress versus strain; b) d spacing and orientation versus strain. d spacing: open circle; orientation: closed circle;; c) d spacing and orientation versus stress measured. d spacing: open circle; orientation: closed circle;; d) d spacing through the thickness of the leather and change in d spacing as a consequence of increasing strain; e) orientation through the thickness of the leather versus strain and change in orientation as a consequence of increasing strain. 172
- Figure 10.24: Stretching results for sample Ov207 with a tear strength of 21 N/mm a) stress versus strain; b) d spacing and orientation versus strain. d spacing: open circle; orientation: closed circle;; c) d spacing and orientation versus stress measured. d spacing: open circle; orientation: closed circle;; d) d spacing through the thickness of the leather and change in d spacing as a consequence of increasing strain; e) orientation through the thickness of the leather versus strain and change in orientation as a consequence of increasing strain. 173
- Figure 10.25: Stretching results for sample Ov212 with a tear strength of 44 N/mm a) stress versus strain; b) d spacing and orientation versus strain. d spacing: open circle; orientation: closed circle;; c) d spacing and orientation versus stress measured. d spacing: open circle; orientation: closed circle;; d) d spacing through the thickness of the leather and change in d spacing as a consequence of increasing strain; e) orientation through the thickness of the leather versus strain and change in orientation as a consequence of increasing strain. 174
- Figure 10.26: Stretching results for sample Ov216 with a tear strength of 43 N/mm a) stress versus strain; b) d spacing and orientation versus strain. d spacing: open circle; orientation: closed circle;; c) d spacing and orientation versus stress measured. d spacing: open circle; orientation: closed circle;; d) d spacing through the thickness of the leather and change in d spacing as a consequence of increasing strain; e) orientation through the thickness of the leather versus strain and change in orientation as a consequence of increasing strain. 175
- Figure 10.27: Stretching results for sample Bo881 with a tear strength of 63 N/mm a) stress versus strain; b) d spacing versus strain; c) d spacing versus stress measured; d) d spacing through the thickness of the leather and change in d spacing as a consequence of increasing strain. ... 176
- Figure 10.28: Stretching results for sample Bo887 with a tear strength of 57 N/mm a) stress versus strain; b) d spacing versus strain; c) d spacing versus stress measured; d) d spacing through the thickness of the leather and change in d spacing as a consequence of increasing strain.... 177

	Page
Figure 10.29: Stretching results for sample Bo887 with a tear strength of 57 N/mm a) stress versus strain; b) d spacing versus strain; c) d spacing versus stress measured; d) d spacing through the thickness of the leather and change in d spacing as a consequence of increasing strain.....	178
Figure 10.30: Stretching results for flat grain sample Ov801 with a tear strength of 20 N/mm a) stress versus strain; b) d spacing and orientation versus strain. d spacing: open circle; orientation: closed circle;; c) d spacing and orientation versus stress measured. d spacing: open circle; orientation: closed circle.	179
Figure 10.31: Stretching results for flat corium sample Ov802 with a tear strength of 20 N/mm a) stress versus strain; b) d spacing and orientation versus strain. d spacing: open circle; orientation: closed circle;; c) d spacing and orientation versus stress measured. d spacing: open circle; orientation: closed circle.	180
Figure 10.32: Stretching results for flat grain sample Ov804 with a tear strength of 20 N/mm a) stress versus strain; b) d spacing versus strain; c) d spacing versus stress measured.....	181
Figure 10.33: Stretching results for flat corium sample Ov805 with a tear strength of 20 N/mm a) stress versus strain; b) d spacing versus strain; c) d spacing versus stress measured.....	182
Figure 10.34: Stretching results for flat grain sample Ov855 with a tear strength of 43 N/mm a) stress versus strain; b) d spacing strain; c) d spacing versus stress measured.....	183
Figure 10.35: Stretching results for flat corium sample Ov856 with a tear strength of 43 N/mm a) stress versus strain; b) d spacing versus strain; c) d spacing versus stress measured.....	184
Figure 10.36: Stretching results for flat grain sample Ov867 with a tear strength of 17 N/mm a) stress versus strain; b) d spacing versus strain; c) d spacing versus stress measured.....	185
Figure 10.37: Stretching results for flat corium sample Ov868 with a tear strength of 17 N/mm a) stress versus strain; b) d spacing versus strain; c) d spacing versus stress measured.....	186
Figure 10.38: Stretching results for OFM a) stress versus strain; b) d spacing and orientation versus strain. d spacing: open circle; orientation: closed circle, and c) d spacing and orientation versus stress measured. d spacing: open circle; orientation: closed circle	187
Figure 10.39: Stretching results for OFM a) stress versus strain; b) d spacing and orientation versus strain. d spacing: open circle; orientation: closed circle, and c) d spacing and orientation versus stress measured. d spacing: open circle; orientation: closed circle	188

LIST OF TABLES

	Page
Table 5.1: The statistical significance of differences between the thicknesses of leather samples from different positions on the skin as determined by Tukey test. ..	78
Table 5.2: The statistical significance of differences between the tear strength's of leather samples from different positions of the skin as determined by Tukey tests. Bottom left side absolute tear strength and top right side normalised tear strength.	80
Table 5.3: Parameters for fitted regression lines of normalised tear strength of each position versus the average normalised tear strength of a skin data for each position sampled.	80
Table 5.4: Parameters for fitted regression lines of perpendicular versus parallel tear strength data for each position sampled ..	82
Table 5.5: The statistical significance of differences between the d spacing's of leather samples from different positions on the skin as determined by Tukey test. ..	87
Table 5.6: The statistical significance of differences between the variation in d spacing across profiles of leather samples from different positions on the skin as determined by Tukey test.	88
Table 5.7: Parameters for fitted regression lines of orientation index versus tear strength data for each position sampled.	91
Table 5.8: The statistical significance of differences between the orientation indexes of leather samples from different positions on the skin as determined by Dunn's method.	91
Table 6.1: The significance of differences between the orientation indexes of partially processed leather samples as determined by the Holm-Sidak Method.	100
Table 6.2: The significance of differences between the d spacing's of partially processed leather samples as determined by Tukey Test.	101
Table 6.3: The significance of differences between the thicknesses of partially processed leather samples as determined by Tukey Test.	103
Table 6.4: The significance of differences between the tear strength's of partially processed leather samples as determined by Tukey Tests. Bottom left side absolute tear strength and top right side normalised tear strength.	104
Table 10.1: Sample information for cross-sections of ovine leather cut from the OSP parallel to the backbone.	137
Table 10.2: Sample information for cross-sections of bovine leather cut from the OSP parallel to the backbone.	138
Table 10.3: Sample information for flat samples of the grain of ovine leather cut from the OSP parallel to the backbone.	139
Table 10.4: Sample information for flat samples of the grain of bovine leather cut from the OSP parallel to the backbone.	140

	Page
Table 10.5: Sample information for flat samples of the corium of ovine leather cut from the OSP parallel to the backbone....	141
Table 10.6: Sample information for flat samples of the corium of bovine leather cut from the OSP parallel to the backbone....	142
Table 10.7: Sample information for cross-sections of ovine leather cut from the OSP perpendicular to the backbone. .	143
Table 10.8: Sample information for cross-sections of bovine leather cut from the OSP perpendicular to the backbone. .	144
Table 10.9: Sample information for cross-sections of ovine leather cut from the neck parallel to the backbone.....	145
Table 10.10: Sample information for cross-sections of ovine leather cut from the belly parallel to the backbone.....	146
Table 10.11: Sample information for cross-sections of ovine leather cut from the butt perpendicular to the backbone. .	147
Table 10.12: Sample information for cross-sections of ovine leather cut from the OSP parallel to the backbone.....	148
Table 10.13: Sample information for cross-sections of ovine leather cut from the OSP perpendicular to the backbone. .	149
Table 10.14: Sample information for cross-sections of ovine partially processed leather cut from the butt perpendicular to the backbone. ...	150
Table 10.15: Sample information for samples of leather cut from the OSP parallel to the backbone used for stretching experiments.	150
Table 10.16: Information on stretched cross-sectional samples cut from the OSP parallel to the backbone.	166
Table 10.17: Information on stretched flat samples cut from the OSP parallel to the backbone.....	166

LIST OF PUBLICATIONS

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Basil-Jones, M. M., Edmonds, R. L., Allsop, T. F., Cooper, S. M., Holmes, G., Norris, G. E., Cookson, D. J., Kirby, N., Haverkamp, R. G. (2010) Leather Structure Determination by Small Angle X-ray Scattering (SAXS): Cross Sections of Ovine and Bovine Leather.

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