



# Deer Antler

## Velvet Research in Australia and Overseas

**Based on travel reports from Canadian and  
Thailand Deer Conferences**

(The Thailand travel report was not available for  
this electronic version and is only available in  
the print version)

by D Walker, D White, R Roubin

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# Foreword

The First International Symposium on Antler Science and Product Technology was held in Canada between 9 and 12 April 2000. The Eighth World Congress on Clinical Nutrition was held in Thailand between 17 and 20 December 2000.

The Corporation supported two representatives from Australia to the Antler Science Symposium and one representative to the Clinical Nutrition Congress and their reports are enclosed.

The Antler Science Symposium provided participants with detailed information sessions including: Antler Biology and Growth Factors, Antler Removal, and Antler Chemistry and Bioactives.

The Symposium clearly showed the significant research on deer antler that continues to be undertaken around the world, including Australia, and provided strong support to the growing acceptance that deer antler cartilage is a substance with significant future medical application potential.

Besides the traditional uses, deer antler is already used as an additive for many commercial foods.

Animal welfare papers clearly demonstrated why electronic analgesia is not considered a suitable alternative to chemical analgesia for velvet removal.

Australian research presented at the Clinical Nutrition Congress in Thailand demonstrated that during the research, patients consuming velvet antler capsules showed no side effects to the velvet antler but did provide symptomatic relief in Osteoarthritis disease by positive changes within affected joints rather than by simply providing analgesia.

This report supports the investment in programs to encourage the production of quality assured Australian velvet antler supported by RIRDC and suggests long term opportunities to improve grower returns from the production of quality assured velvet antler.

This report, a new addition to RIRDCs diverse range of over 600 research publications, forms part of our Deer R&D program. It is funded jointly by the industry and the Federal Government.

Most of our publications are available for viewing, downloading or purchasing online through our website:

- downloads at [www.rirdc.gov.au/reports/Index.htm](http://www.rirdc.gov.au/reports/Index.htm)
- purchases at [www.rirdc.gov.au/eshop](http://www.rirdc.gov.au/eshop)

**Peter Core**  
Managing Director  
Rural Industries Research and Development Corporation



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# PART ONE

## The First International Symposium on Antler Science and Product Technology

9-12 April 2000  
Banff, Canada

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**A TRAVEL REPORT PRESENTED TO**

*Rural Industries Research & Development Corporation*

**THE 1<sup>ST</sup> INTERNATIONAL SYMPOSIUM ON ANTLER  
SCIENCE AND PRODUCT TECHNOLOGY**

9<sup>th</sup> to 12<sup>th</sup> April 2000

**BANFF CENTRE, BANFF, CANADA.**

**By David H Walker  
Managing Director  
Australian Deer Horn & Co Products Pty Ltd**



## ***Itinerary Outline***

Airflight to Los Angeles then to Vancouver.  
Rail from Vancouver to Jasper.  
Coach from Jasper to Banff.

Attended Symposium from 9<sup>th</sup> to 12<sup>th</sup> April, 2000.

Coach from Banff to Jasper.  
Rail from Jasper to Toronto.  
Airflight to Los Angeles via Dallas & Las Vegas.  
Los Angeles to Melbourne.

## ***Summary***

David Walker travelled to Banff, Canada, April 9<sup>th</sup> to 12<sup>th</sup> 2000 to attend the ASPT Symposium expecting to enjoy, learn and network with other deer industry people. That alone would have been considered sufficient to justify the expense of attendance but much more was to be the case.

Exceptional speakers covered many topics relating to deer antler useage and kept the audience vitally interested with fascinating details of the latest results of research conducted internationally, which can be used to promote the industries products.

Valuable international contacts for ADH & CP and the industry have been established and will be kept alive by both email and telephone.

## ***Recommendations to RIRDC***

From discussions with buyers, Australia needs to produce a grading chart / book of both Velvet and Co Products specifications.

These grading charts should be on easily cleaned material and contain measurements for weight, length and circumference of Velvet and Co Products. The grading book needs to allow for additional or subtraction of pages in the future depending on changes to harvesting standards from time to time.

It is the intention of ADH & CP to apply for funding to support the production of this grading chart / book in the near future.

## ***Primary Purpose of Travel***

- ◆ To attend the 1<sup>st</sup> International Symposium on Antler Science and Product Technology (ASPT).
- ◆ To meet with colleagues from other deer farming countries round the world to exchange knowledge.
- ◆ To gain the latest information and data from research conducted in countries around the world.

- ◆ To network with actual and potential deer horn buyers in those countries using our Australian products.
- ◆ To evaluate different methods of antler removal without the use of chemicals.
- ◆ To learn the latest methods and ways to value add Australian deer horn to achieve better returns for our growers.

### ***Findings from this Symposium***

- ◆ Many producers in USA and Canada value add their deer horn into capsules and market the capsules as a food supplement into their own domestic market with approval of the FDA.
- ◆ Many of the speakers verified and expanded on the benefits of using deer antler in extract and powder form in both humans and animals, i.e. for repair and replacement of bone degeneration, extra stamina particularly in the sporting area and nutraceutical uses: - immuno-stimulating; anti-fatigue; anti-stress, etc.
- ◆ We made useful contacts with the North American deer farmers in that we may be able to help lift prices on velvet supplied from the northern hemisphere out of season to our Australian production, thus when leading into our velvet season prices should remain firm.
- ◆ We spoke to several Korean buyers who had not used Australian product and were interested in securing velvet this coming season. They had known of New Zealand velvet but not heard that Australian product was 'clean and green', i.e. identifiable by colour tags to indicate chemical or non-chemical harvesting.

### ***Benefits to the Australian Deer Industry***

Prior to the ASPT in Banff, I met with Mr Ron Murpy, Manager of the Elk Products Board of USA.

The Elk Products Board operates along similar lines to Australian Deer Horn & Co Products (ADH & CP) in Australia whereby they collect and market frozen Elk Deer Horn for the US growers. The board in my view does not have the strength and participation of the US growers that we in Australia have through ADH & CP.

The US produces approximately 40 tonnes of deer velvet annually, with some processed as capsules and sold in the health food market throughout the US, with the balance sold either processed or frozen into the Korean market.

After the ASPT I attended and spoke at a meeting with Canadian Elk growers in Calgary, convened by Mr Pat Downey. The growers expressed an interest in setting up a pool similar to ADH & CP, collecting, grading and marketing their frozen velvet to receive better returns than at present selling to private buyers. Canada produces approximately 80 tonnes annually, and like the US, markets capsules domestically in the health food chain, with frozen sales to a processing company in Calgary and the balance to private buyers who market into Korea.

I believe that Australia should help the North America deer farmers wherever possible in order to strengthen the market. If Asian buyers are able to procure supplies of frozen deer horn in North America, below the New Zealand and Australian prices (which appears to be the case), then there is a potential to destabilize the world prices of raw product.

If the marketing of capsules, as a health food, is driven correctly there would not be sufficient green velvet produced in North America to supply that market.

However, if USA and Canada continue to increase production without this perceived market increase demand, then the extra production may put pressure on sales in Asian, mainly Korea for New Zealand and Australian product thus causing a downward trend in prices.

The objective of the ASPT Symposium was to provide a forum to exchange knowledge in Antler Science and Product Technology. The symposium attracted over 300 participants from 16 countries. Some 32 speakers delivered papers on many aspects of deer antler from humane harvesting techniques through to research undertaken on the benefits to animals and humans.

The Symposium brought together seven groups of people: - i.e. producers, processors, researchers, health services, government regulators, marketers and consumers.

For the purpose of this report extracts of some speakers papers have been reproduced as an example only to emphasis the interesting and informative presentations delivered to the delegates at the symposium. Of particular interest was antler removal techniques and the medicinal uses and efficacy of velvet products.

## ***Antler Removal***

P R Wilson<sup>1</sup>, D J Mellor<sup>1</sup>, K J Stafford<sup>1</sup>, & J C Haigh<sup>2</sup>

<sup>1</sup> *College of Science, Massey University, Palmerston North, New Zealand and* <sup>2</sup> *Western College of Veterinary Medicine, Saskatoon, Canada.*

Removal of antler from live deer has been a traditional practice in some Asian cultures for centuries. In the west however, velvet antler removal is a new form of animal utilization, evolving only since commercial deer farming began in the early 1970's. Velvet antler removal is now practiced in many deer farming countries and states but is prohibited in others. This introduces unique welfare, ethical and legal issues which have significant commercial implications to all sectors of deer industries, internationally.

L R Matthews<sup>1</sup>, & J M Suttie<sup>2</sup>.

<sup>1</sup> *AgResearch, Ruakura Agricultural Centre, Hamilton, New Zealand and* <sup>2</sup> *AgResearch, Invermay Agricultural centre, Mosgeil, New Zealand.*

There is a need, on animal welfare grounds, to provide sufficient analgesia for velvet antler removal. Market trends towards natural production systems have lead to research to develop alternative removal methods without the use of chemical methods while still providing analgesia. These methods fall into two categories, electronic and compression. Research has taken place on each system in New Zealand.

A commercial electronic analgesia (EA) device was tested on 26, 2- and 3-year old red deer stags in its standard format and after various modifications. The level of analgesia induced by EA was highly variable between animals and was not improved by the modifications. In no instance was complete analgesia induced. The current technology does not provide sufficient levels of analgesia to be considered as a suitable alternative to chemical analgesia for velvet removal. Compression analgesia using specially designed rubber rings is effective in inducing analgesia for velvet removal in spikers. A technique for velvet removal in adult (branched) antlers is being developed and is highly promising. At this time compression techniques are likely to provide cost effective ethical solutions for velvet removal without chemicals.

J C Haigh, M Woodbury, J Stookey, A L Schaefer, & P Wilson.  
*Western College of Veterinary Medicine, Saskatoon, Canada.*

The fact remains that the stress associated with prolonged holding of animals in chute systems is not desirable, and alternative methods of harvesting, that involve the minimum amount of handling, combined with the maximum analgesia and overall quality are needed.

A L Schaefer, & N J Cook.

*Lacombe Research Station, Agriculture and Agri-Food Canada, Lacombe, Alberta.*

The current study puts forth the hypothesis that with respect to velvet antler, stressors in the pre-harvest environment, such as capture and handling, can cause significant changes to the animals physiology which in turn can affect velvet antler yield and quality. Recent trials with twenty-three mature elk or wapiti stags in velvet for example suggest that the degree of stress perceived by the animal may affect antler yield. Salivary cortisol measurements were taken on these animals immediately post capture but pre antler removal. Conventional radio-immuno assay procedures were used to measure the cortisol levels in collected swabs. These measurements demonstrated that animals with a comparatively high cortisol or stress level also displayed approximately a 5% lower antler area or yield with same herd or contemporary animals. These results suggest that the further research and development of harvesting methods designed to reduce stress in elk during harvesting would be beneficial both in terms of animal welfare and economics.

## ***Medicinal Uses & Efficacy***

H H Sunwoo & J S Sim.

*Department of Agricultural, Food and Nutritional Science, University of Alberta, Canada.*

Traditional medical reports and clinical observations from the East convincingly show that velvet antler is biologically active to cure various diseases. However, little information is available on chemical and biological efficacy of antler products in the West due to the incomplete understanding of their uses and pharmacological properties. To make antler products acceptable as nutraceuticals and functional foods in the West, chemical and biological properties of velvet antlers have to be clearly determined.

Antlers are made of chemical components consisting of sugars, fatty acids, amino acids, and nucleotides as essential molecules, which become macromolecules such as polysaccharides, lipids, proteins and nucleic acids, respectively. For their physico-chemical properties, each of these macromolecules is responsible for not only antler growth and development, but also biomedical and nutraceutical uses of antlers. Therefore, understanding chemical and molecular characteristics of antlers is crucially important to elucidate the clinical and medicinal efficacies of antlers, which have been claimed by oriental medicine for many years.

G R Mundy & S E Harris.

*University of Texas Health Science Center, San Antonio, TX USA.*

Antler growth is the most rapid and dramatic bone growth known. Growth occurs by the process of endochondral bone formation, with the sequence of events which are seen in growing long bones during fracture repair and during the osteoinductive process following subcutaneous injection of demineralized bone matrix. During the process of bone formation in spring, osteoblasts and antler tissue lay down bone trabeculae at an enormous rate and bone growth is achieved by appositional ossification on preexisting trabeculae. We used predominantly extracts of antler tissue to identify novel growth regulatory peptides, but in addition we used conditioned media from cultured cells obtained from the trabeculae of antler tissue and developed a cDNA expression library from these cells. The cells we obtained grew from trabecular surfaces of growing antler bone and have tremendous growth potential. Since it seemed very likely that the growing antler tissue would be a source of local paracrine bone stimulating factors, we used antler tissue to identify growth regulatory peptides for bone cells using a checkerboard matrix approach. From these antler extracts, we have identified deer IGF-1 and IGF-2, deer BMP-2 and BMP-4, and deer acidic and basic fibroblast growth factors. However, in addition, we have identified novel members of these factors. Characterization of these growth factors and responsiveness in cells should provide insights into normal physiological bone remodelling and fracture repair, since it is likely that these factors are expressed in less abundant amounts in human bone tissue and similar control mechanisms are likely relevant.

I Ongaro.

*Department of Oral Biology, University of Alberta, Edmonton, Canada.*

The objective of this study was to investigate the micro-structural properties of elk velvet antler (EVA) cartilage and ossifying bone from the perspective of a potential bone grafting material. Synthetic materials have no resemblance to natural bone matrix, while EVA matrix has many characteristics consistent with human alveolar bone. Modified EVA matrix may have a potential as a bone grafting material.

C J Balok & T Langham.

*Cedar Animal Medical Center, Gallup, New Mexico USA.*

A two year ongoing study was conducted to determine the efficacy and safety of velvet antler treatments in animals. Dogs ranging in size from 2 kg to 70 kg were selected based on their

presenting signs and case history. The primary condition treated was chronic arthritis and muscular injuries or conditions. Bone and soft tissue healing was observed. Other conditions treated were poor hair coat and skin conditions, and aged or geriatric pets. Also studied were reproductive impotence in stallion, ringbone and chronic navicular disease in the equine. More than 70% of the cases observed showed a positive response to treatment with velvet antler after cessation of other drugs currently in use. A positive response was one in which the owner noticed marked changes in the presenting signs. Increased vitality, increased appetite, improved attitude and decreased pain were the major qualitative changes noted. Increased healing in severe bone fractures, and soft tissue injuries in the equine were also noticed, along with improved performance. From this study on over 150 animals it was concluded that velvet antler greatly improved arthritic conditions in the canine and equine patient, and accelerated soft tissue and bone healing and improved the reproductive performance in the stallion. No major side effects or toxicities were noted with the dosages used.

G R Mundy.

*University of Texas Health Science Center, San Antonio, TX USA.*

Osteoporosis is a major public health problem, affecting 10 million women in the US and possibly three times that number worldwide. It is estimated that 30 million American women are currently at risk for osteoporosis. Osteoporosis is increasing markedly in prevalence in Asia, and estimates are that it will be more common there than elsewhere in the world by the middle of the next century. Current treatments for osteoporosis are based on maintaining bone mass constant by inhibiting bone resorption. However, patients with established osteoporosis have lost more than 50% of their bone in critical mass substantially and restore disrupted trabecular bone microarchitecture which is common in established osteoporosis.

To develop rational and effective treatments for established osteoporosis, it is necessary to have more detailed knowledge of the molecular events that control bone formation. Antler physiology provides a unique possibility of gaining insights into these mechanisms. Antler growth represents an extreme example of bone formation, possibly the most rapid in the animal kingdom. During antler growth, antler cells express a wide range of growth regulatory peptides that are incorporated into the antler bone matrix. We have extracted antler tissue in a search for such peptides and identified a number of growth factor families that are present in normal human and bovine bone, including bone morphogenetic proteins (BMPs) and fibroblast growth factors (FGFs). Members of these families have powerful anabolic effects on bone. FGFs stimulate bone formation systematically, restore trabecular bone microarchitecture, and enhance fracture repair. BMPs have powerful local effects on bone formation, but are not satisfactory as systemic therapeutic agents because of their pharmacokinetics. However, in an alternative approach to identifying an anabolic agent for osteoporosis, we have characterized the BMP2 gene promoter in deer, murine and human tissue, and have used it as a screening tool to identify small compounds that enhance BMP2 transcription by bone cells and subsequent bone formation systematically. Such compounds have been identified that stimulate bone formation in vivo in rodent models of osteoporosis. It is hoped that approaches such as this may provide the long sought after anabolic agent for the treatment of patients with established osteoporosis.

K H Shin.

*Natural Products Research Institute, Seoul National University, Seoul 110-460, Korea.*

Dr K H Shin of the Seoul National University, Korea, evaluated immuno-stimulating, anti-fatigue, anti-stress and anti-thrombotic effects, of both water and ethanol extracts of antlers from red deer bred in New Zealand. Daily oral administrations of ethanol extracts from antlers to mice significantly enhanced carbon clearance response in a dose dependent manner, which indicates activation of the immune system. Both water and ethanol extracts of antlers, when administered orally for 5 consecutive days in mice, caused a marked prolongation of forced swimming performance in a dose dependent manner which reflects the anti-fatigue activity of antlers.

J S Sim & H H Sunwoo.

*Department of Agricultural, food and Nutritional Science, University of Alberta, Canada.*

Antlers have been used for medicinal purposes in the Orient for many centuries but with the continuing growth of the antler industry, producers heavily depend on the development and diversification of antler products as both functional foods and pharmaceutical agents.

If biologically active ingredients in antlers are identified, characterized, extracted and mass-produced, antlers could be a useful component of new food products, which could modulate physiology of our body and protect us against disease. Our research has characterized the chemical composition and physical properties of velvet antlers, and developed procedures for extracting and purifying glycosaminoglycan-rich fractions consisting of chondroitin sulphate as a major glycosaminoglycan. And keratan sulfate, dermatan sulfate, heparan sulfate and hyaluronic acid as minor components. Further characterization of glycosaminoglycan-rich antler (GAGRA) showed potent growth-promoting effects both *in vivo* and *in vitro*. Feeding GAGRA to growing rats stimulates bone development by increasing femur length, thickness and ash contents. A simple and economical procedure to extract glycosaminoglycan-rich antler (GAGRA) product from fresh velvet antlers has been developed and now is available for a commercial exploitation.

Dr J S Sim referred to the fact that we are in the 4<sup>th</sup> Agricultural Revolution; Domestication – Mechanical – Chemical - Bioinformatic and that we farm the ultimate medicinal animal. Deer antler is now used as an additive in many other foods besides the traditional uses of capsules, slices, powder, extracts, tincture, ointment, e.g.. yoghurt, wine, lollies, icecream, pet food etc.

## ***Antler Science and Product Technology Book***

The whole Symposium proceedings will be published in book form entitled ASPT Book. This valuable resource may then be utilized beyond the participants of the Symposium. The book will contain 6 chapters and summary including :

1. Antler Biology.
2. Antler Chemistry.
3. Antler Harvest and Quality.
4. Antler Clinical/Medical Efficacy.
5. Antler Nutraceuticals and Marketing.
6. Short Communications.
7. Panel Discussion and Summary.

A copy of the Symposium proceedings has been ordered for use by the Australian industry.

For further up to date information please contact:

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## **REPORT ON Sub-Program 2.4 Deer**

### **1ST INTERNATIONAL SYMPOSIUM ON ANTLER SCIENCE & PRODUCT TECHNOLOGY UNIVERSITY OF ALBERTA CANADA 8-12 April 2000**

One of the most successful and informative International deer conferences held to date with over 260 delegates attending from Canada, USA, NZ, Norway, Korea, Nigeria, Czech Republic, Russia, Australia, Germany, Japan, Greenland, Nepal, Morocco.

Attendance representation: Researchers 40%; Deer Farmers 50%; Processors 10%. compared to speaker representation of 98% researchers which was an imbalance not to have given a total overview of the world's velvet industry.

The Symposium attracted 43 commercial sponsors from 5 countries and approx. 20 commercial stands displaying products and services.

Session I covered Antler Biology and Growth Factors, what regulates antler growth and development and its potential use in bone repair. A most informative representation was made by Dr. J.S. Price from the Bone and Mineral Centre in the UK, one of the many non-deer industry researchers attending.

Session II covered Antler removal and I will leave it Mr. D.H. Walker to summarise. In this session Dr. S.J. Kang from the Food and Drug Administration of Korea stated that Australian velvet rated No.1 in the world for quality followed by New Zealand No.2 and Canada No.3.

Session III covered Antler Chemistry and Bioactives and its use in medicines, nutraceuticals and functional foods. This session clearly indicated the lack of clinical evidence to back the presentations being given by most researchers and some of these researchers were brought to task in question time to substantiate their hypotheses of activity of certain antler extracts and processing methods.

It was clearly demonstrated that medical science will not accept research "findings" which cannot be substantiated. The same can be said for substantiating processing methods. Samples should be randomised from several hundred antlers and from a specific region of each antler. To present evidence of one antler only without giving any evidence that all samples were of the same grade and number of days of growth and similar diet is unacceptable science. Both New Zealand and Canadian researchers were taken to task over inconclusive and unsubstantiated findings being presented.

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J. Suttie from NZ presented results of analyses of NZ processed antler. His results were staggering as he demonstrated that one third of antler processed in NZ shows no biological activity, another one third showed low active.

These results compared to Australian results which demonstrated high levels of activity in all models tested. These results demonstrate that processing skills in Australia are far superior to that of NZ processors.

Australian researcher Prof. P. Ghosh and R. Reubens clearly indicated a sound scientific approach backed by scientific evidence of effectiveness.

The session on Antler Clinical and Medical Efficacy was also most informative but again researchers were brought to task for failing to establish credible scientific backing for clinical trials without an analysis of product to be administered. There were no animal models to support claims, no toxicology. Once again Australian researchers shone out in their approach to setting up clinical trials at Sir Charles Gardner Hospital, Perth.

Also in this session Prof. P. Ghosh from Australia presented an outline of the joint research project with the University of Sydney and ADP Pharmaceuticals Pty Ltd describing a novel gene detected in deer antler cartilage. It is proposed that this novel gene can be transected with human chondrocytes then transplanted back into human defective cartilage to promote and enhance the matrix regeneration and repair. The ramification of this finding may take the deer industry some time to absorb.

Another speaker in this session, Dr. G. Mundy, University of Texas and a leading bone researcher, described other speakers as not all talking about the same product because of such varied results and speculative research findings. His work with deer antler cartilage has been in treating osteoporosis and calcium deficiency in menopausal women but to date his findings were inconclusive. However he has undertaken to test products processed by ADP in Australia.

The following session on Antler Nutraceuticals lost its way when one speaker strapped on a set of toy antlers and could not afterwards be taken seriously.

It would be difficult to establish deer antler as a functional food when Australian researchers have clearly demonstrated activity in animal models at 5.0mg/kg of body weight. This correlates to 350mg. for 70kg. body weight for a human with arthritis. It would be difficult to add this small dosage to a food substance without overdosing or underdosing the human patient.

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## **Summary:**

We still hold the opinion that deer antler cartilage is a complex tissue and a therapeutic substance with enormous medical application in the future.

The Symposium also established Australian privately funded antler cartilage researchers to be world leaders in the medical application of antler and gene technology.

Further research findings will be presented to the 5th World congress of the Osteoarthritis Research Society International to be held in Barcelona, Spain in October 2000.

Also, the first results of human double-blind clinical trials using "Cervusen®", a deer antler cartilage preparation treating Osteoarthritis, will be presented at the 8th World Congress on Clinical Nutrition in Thailand, 17-20 December 2000.



Dennis W. White  
Rebecca Reubens

# PART TWO

## Eighth World Congress on Clinical Nutrition

17-20 December 2000  
Thailand

<b>Travel Report</b> ( <i>by Dennis White, ADP Pharmaceuticals</i> )	15
<b>Abstract of Research Paper Presented at Conference:</b> Rationale for the Use of Antler Cartilage Products and Genes Obtained from their Cells to Treat Arthritis and Repair Cartilage Defects Following Joint Injury ( <i>by Peter Ghosh, Rebecca Roubin and Margaret Smith</i> )	17
<b>Order Form for book 'Antler Science and Product Technology'</b> (includes the full research paper mentioned above)	20

**TRAVEL REPORT  
8TH WORLD CONGRESS ON  
CLINICAL NUTRITION  
THAILAND**

17-20 DECEMBER 2000

**A Report for the Rural Industries Research  
and Development Corporation**

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March 2001

## **1. OBJECTIVES**

This was an opportunity to present the world's first clinical data on the treatment of a specific human disease using deer antler cartilage (DAC) taken orally.

## **2. BACKGROUND**

The clinical properties of DAC have been the subject of privately funded research at the Institute of Bone & Joint Research Laboratories, (University of Sydney) attached to the Royal North Shore Hospital of Sydney for the past eight years.

Results of this research prompted the conduct of double-blind clinical trials on patients suffering from osteo-arthritis. This was carried out at the Goetcher Research Unit, Sir Charles Gardner Hospital, Perth.

## **3. RESEARCH**

See attached.

## **4. OUTCOMES**

A total of four papers were presented on DAC research from Canada, USA, New Zealand and Australia.

The clinical research from Australia presented by Rheumatologist Dr. J. Eddelman of the Goetcher Research Unit based at Sir Charles Gardner Hospital, Perth, attracted great interest since there are very few natural products which have reached this stage of clinical efficacy.

## **5. PUBLICATIONS**

A full draft of the presentation has been accepted for publication by APLAR, a leading world journal of Rheumatology. This will be published by May 2001.

Additionally a revised version will be published by the University of Alberta, Canada.

## **6. ACKNOWLEDGEMENTS**

Travel costs to this Conference by Dr. J. Eddelman were jointly funded by RIRDC and ADP Pharmaceuticals Pty Ltd.

**Rationale for the Use of Antler Cartilage Products and Genes  
Obtained from their Cells to Treat Arthritis and  
Repair Cartilage Defects Following Joint Injury**

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**Running head: Antler Cartilage Anti-arthritis Activity**

**Rationale for the use of antler cartilage products and genes obtained from their cells to treat arthritis and repair cartilage defects following joint injury**

Ghosh, P., Roubin, R. and Smith, M. M.

Institute of Bone and Joint Research, University of Sydney (Department of Surgery) at the Royal North Shore Hospital, St. Leonards, NSW, 2065, Australia

**ABSTRACT:**

This study was undertaken to evaluate the anti-arthritic and anti-inflammatory activities of deer antler cartilage (DAC) using a modified adjuvant-induced arthritis (AIA) model in the rat. DAC was also extracted to isolate messenger RNA (mRNA) to determine if it was different to mRNA for human type II collagen.

Arthritis and air pouch inflammation in Wistar rats was initiated by subdermal injection of the arthritogen *Mycobacterium tuberculosis* (Mtb) into the tailbase on day 0 followed by a second Mtb injection on day 10 into preformed saline-filled dorsal air-pouches. DAC was administered orally by gastric lavage at doses of 0 (n = 25), 0.05 (n = 10), 0.2 (n = 10), 1.0 (n = 10) or 5.0mg/kg (n = 10) five times per week to groups of rats over the entire study



period. Animals were sacrificed on day 17 and pouch fluid volume, total and differential white cell numbers, nitrite ion (the metabolite of nitric oxide (NO) radical), hyaluronan and prostaglandin E<sub>2</sub> (PGE<sub>2</sub>) content determined. The knee joints from these animals were also examined histologically.

The results of this study showed that DAC at doses between 2 - 5mg/kg significantly reduced tail and paw swelling relative to non-drug-treated controls. Pouch-fluid PGE<sub>2</sub>, NO and hyaluronan levels were also reduced but total fluid volume and white cell numbers were unchanged. Loss of proteoglycans, cartilage fibrillation and subchondral bone changes in joints of DAC-treated animals were decreased relative to controls as determined histologically. Using a human type II collagen riboprobe and Northern blot analysis DAC were shown to express normal type II collagen mRNA together with a novel-related gene product of 7.0kb.

**Keywords:** Deer, Antler, Cartilage, Arthritis, Models, Type II collagen, Glycosaminoglycan, Genes

# Antler Science and Product Technology

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Edited by Drs. JS Sim, HJ Sunwoo, RJ Hudson and BT Jeon, University of Alberta, Canada

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