VetLife™ MALAYSIA

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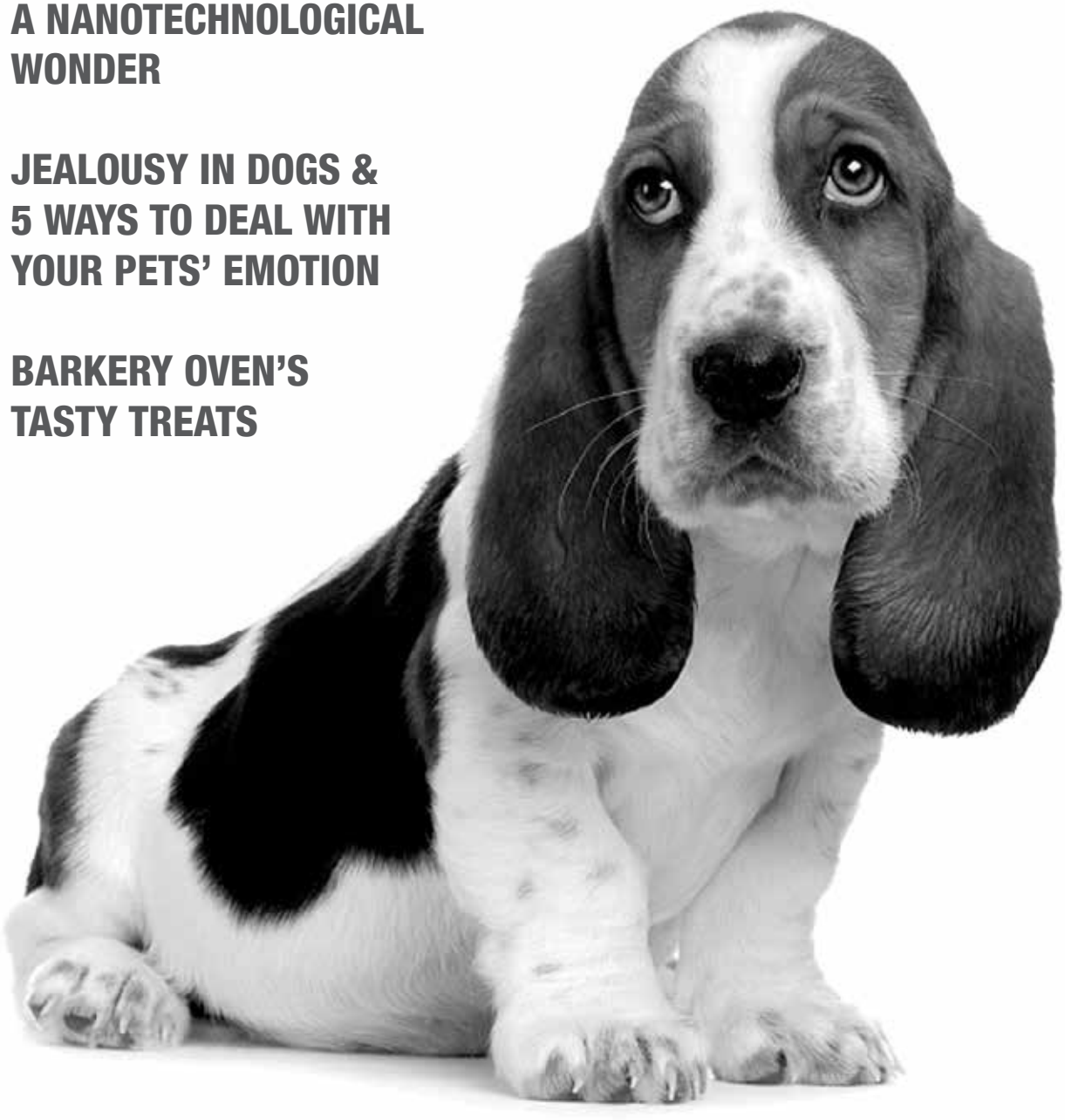
THE COW:
A NANOTECHNOLOGICAL WONDER

JEALOUSY IN DOGS & 5 WAYS TO DEAL WITH YOUR PETS' EMOTION

BARKERY OVEN'S TASTY TREATS



Editor's Note

Welcome to Issue 1 where we will be launching at Dogathon 12th October 2014, UPM. We will be having a booth there from 6am to 2pm, so be sure to see us there!

The introductory issue last month had good response and we have good feedback from readers. We hope to see much more readers this month. We are very happy to answer any queries about the sponsors and their products or services.

Recently, an orthopaedic workshop conducted by MSAVA at HUKM, has inspired us to believe that we can all improve our skills and be equipped at a high level. Although we still have a good journey ahead of us, we have to believe that step by step our practice of veterinary medicine and surgery, of the average clinic, will be on par or better than those in developed nations. To this end, we need to continually seek superior knowledge and skills. Standard operating procedures should also be that of international standards.

Hopefully, workshops of this calibre will continue to have large appeal. Participation by all vets should be welcomed and encouraged. We will work together to make sure more of these workshops are held in the coming months.

For humankind and animal health,
Dr Dev Arumugam
Editor-in-Chief

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Would you like to have a handbag that can change its size depending on how many things you carry with you? A bag that would not bulge, but uniformly, in all directions, would shrink or get larger? And would you like to save money off dowels, because you would not need them anymore because when you put in the screw it is thin, and when there is no force applied anymore, it would become thicker and stabilize itself?

Well, such amazing material properties are possible, and we can learn how to make them from cows, yes, you heard right, cows, chameleon tongues, cat teeth and membranes in the cytoskeleton of red blood cells.

NANOTECHNOLOGY OF THE COW

by **Ille C. Gebeshuber**

Normal materials that we encounter in our daily lives get thinner when stretched. (See the video of my shirt, when I stretch the garment in one direction, it becomes thinner in the perpendicular dimension - refer **Video 1**). This is a normal material reaction, and we say in engineering terms that such materials have a positive Poisson ratio.

Video 1 : Most engineering materials, when stretched, become thinner in the perpendicular direction. One example is garment material. Thanks to Naveen Kailas for making the video.

Watch me!
Our digital magazine comes embedded with videos that you can watch on the go!

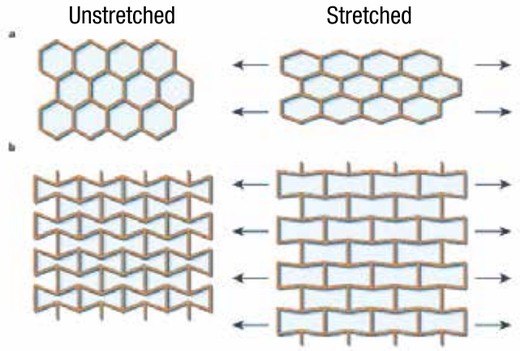

Photo 2: If you stretch a normal material (like the one in the top of the image), it becomes thinner in the direction perpendicular to the stretching. Most materials react like this.

However if you stretch an auxetic material, such as the teats on cow udders, or cat teeth, they stay the same width or even get thicker in the other direction (see bottom of the image)!

Auxetic materials, on the other hand, have a weird and strange behavior: they become thicker when stretched (refer Photo 2)! Their Poisson ratio is negative or zero (in that case, they stay the same width). Ray H. Baughman writes in his 2003 article “Auxetic materials: Avoiding the shrink” in the scientific journal Nature, which is the most reputable science journal in the world, “The behaviour of some auxetic materials seems more fitting for Alice’s Wonderland than for the real world. After an initial elongation, stretching the porous polytetrafluoroethylene used as artificial arteries generates up to an 11-fold higher relative expansion in one lateral direction”.

Photo 3: Laura and Alma, two milk cows from a farm in Carinthia, Austria.

To investigate this amazing property, we decided to visit a cow stable in Carinthia, Austria, Europe. With the help of my dear mother-in-law, Maria Macqueen, we contacted a farmer and told her that we would like to do some engineering in her cow stable. A bit puzzled, she invited us over. We met great people and two wonderful cows, Laura and Alma (see Photo 3). Using eyeliner, I drew one grid on the udder, and one on the teat (see Photo 4 & Video 5). Stretching the teat showed no thinning of the material perpendicular to the applied force! So, we decided to proceed with our related research and are excited about what is yet to be found out!

Photo 4 (left) & Video 5 (right): The grid on Laura's udder. The markings on my hand are from testing the best "pen" to use: in the competition between lipliner and eyeliner the eyeliner won, and was used to draw the grid on the cow udder.

Further aspects of the cow, which might yield important new information for materials science are the horn, the muzzle, the rumen and the horn shoe. One of my Austrian PhD students, Mag. Theresia Meschik, is currently working on this (see Photo 6). Watch out on Facebook and in research articles for exciting new developments.

Nanoscience and nanotechnology are the science and technology of the very very small: the width of one human hair (width, not length!) is about 100 000 nanometers, and in this science of the small we deal with functional units that are just a couple of tens to up to some hundred nanometers in size. Organisms have many such small entities that they rely on (e.g., biomolecules) and many biological materials, tissues, structures and organs base their functionality on nanoscale units, which are in many cases built up hierarchically, with added functionality added on each layer, from the nano to the micro to the macro scale (one micrometer is 1000 nanometers, one millimeter is 1000 micrometers, one millimeter is 1 000 000 – on million – nanometers). Bone for example has seven levels of hierarchy. Man made engineering materials are still far away from such amazing hierarchical setup, which is why conventional engineering still relies on various, in many cases toxic and unsustainable materials to build its devices, whereas natural structures with wonderful functionality can be built from simple, benign materials.

the cow: a nanotechnological wonder.
lessons for biomimetics and materials

nano-, micro and macroscale structures and related functions of cow-specific tissues

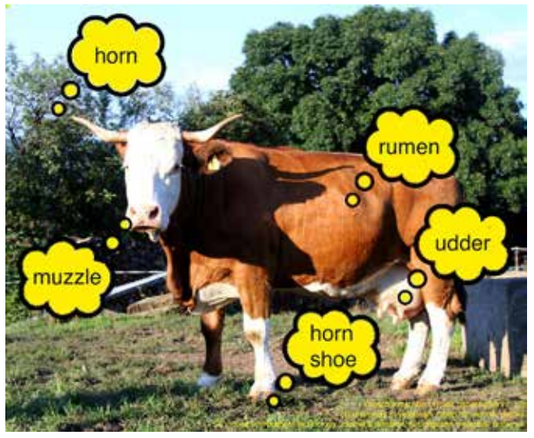

Photo 5: There is a lot that engineers (with the help of biologists and veterinary scientists) can learn from cows. Poster presented at the 2013 Nanoposter competition of Nanopaprika – The International NanoScience Community.

If you want to join our research in the area of biomimetics, i.e., learning from materials, structures and processes in living nature for new, possibly disruptive applications in materials science and engineering, do contact me.

Having lived and worked in South East Asia for several years now, I have broadened my horizon by getting to know and understand completely new ways of thinking, doing research, and dealing with problems. We are always looking for MSc and PhD students, as well as national and international research collaborators.

On rainforest expeditions with PhD students from Europe and Malaysia from fields such as economics, engineering, biology, the veterinary sciences, physics and the applied as well as the fine arts and collaborators from around the globe we have established an interdisciplinary sound basis to unveil the unique wisdom and potential of the largest sustainable system we know, living nature, and what we can learn from it regarding successful addressing of major global challenges such as climate change and sustainable development, major changes in biodiversity, supply with clean water for everybody and health problems due to resistant microorganisms.

References

Baughman, Ray H. (2003) “Auxetic materials: Avoiding the shrink” Nature 425, 667

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Jacobs, Jennifer (2014) “Natural Solutions to Global Problems”, TheEdge Malaysia, September 8, 2014, SME Pullout Inaugural Issue, Center Spread, p. S7. (Article featuring my approach to science)

New ways of teaching, of disseminating and accessing knowledge, of doing engineering and shaping our approaches towards a better, healthy and good way of living, that would not compromise future generations, are the focus of our research. Our work is based on biomimetics and a deep understanding of trends and developments.

By the way, the farmers were so happy their cow served as research subject for an engineering project that they did not want me to clean off the eyeliner from the udder and teat, and they proudly showed their marked scientific cow to all their friends. :)

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