

NEWSLETTER – JANUARY 2006

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1. THE BIOMOUTH RESEARCH GROUP (BY OLIVER RÖHRLE)

One of the many positive things about the Biomouth Symposium in Auckland last December was the general feeling that we should strengthen our collaborations and exploit the diversity of the people interested in or involved in mastication, jaw mechanics, food development, dentistry, or other related areas. There also was the general notion that a more formal research group should be founded - the Biomouth Research Group. As a first step, an introductory Charter for the Biomouth Research Group has been set up by Jules, Mike, Peter, John, Andrew, and me. A copy of the charter is attached at the end of this newsletter.

The Biomouth Research Group Charter asks for two officers, the president and secretary. Until our first set of nominations and election, which I suggest will be done via email along with the call for contributions to the next newsletter, Jules Kieser will act as provisional president and Oliver Rohrle as provisional secretary. Unless I hear from someone raising objections to how we conduct the nomination process and elections (via email), I assume that everyone will be happy to send me their nominations and votes via email (more to come later).

I also reserved for the Biomouth Research group a web address: <http://www.biomouth.org>. Currently, there is just some general text about the Biomouth group from my personal website. However, our web administrator has promised me to set up soon a template which we can use and modify as we like. Once the template is uploaded, I will send out an email for ideas for content, hyperlinks, and suggestions to improve the website itself.

Further, we pledged at the Symposium, that we would be more pro-active about joint publications. I have received some suggestions of outlines for joint papers or projects. Two interesting ideas have been included further below in the newsletter.

2. IDEAS, DISCUSSIONS, AND PROJECTS FOR THE BIOMOUTH RESEARCH GROUP

Hans Lennros, DDS in Sweden, emailed me the following interesting idea:

I am professionally interested in the relationship between jaw movements, physical characteristics of food, and sensory perception of hardness. The mechanical factors of food that cause biting adaptation and the recursive effects of modified biting on the mechanical phenomena of food are largely unknown and I believe that a dynamic mathematical modelling is a workable method to aid and assist in the understanding of the biomechanics of the masticatory apparatus.

Now, as biting is an action that results from interplay between food properties and the masticatory system what is bruxism? And what causes it?

A number of different hypotheses have been suggested. Also the relationship between parafunctional tooth contacts and the incidence of temporomandibular disorders (TMD) have been discussed a lot. However, the area is still riddled with confusion.

Do you think of investigating this further could become a part of the Biomouth project?

Peter Xu, Massey University (NZ) had the following suggestion:

There is an idea I would put forward for potential project proposal.

So far we've been studying for biomechanical model or robotic device of the masticatory system. With them we can understand the mandibular movements, chewing forces, muscular activities, in relation to food properties, food particle size distribution, and/or masticatory efficiency of denture. These studies are concerned basically with two problems: 1. given driving force (or muscular activities) understand the jaw motion, and 2. given jaw motion find the muscular activities required. However, there is something missing out here - central nervous commands of mastication. For chewing a food, why this command of muscular activities is generated in central nervous system and how the masticatory command is described objectively/mathematically, based on what sensory information human chews this way, how the chewing commands are related to the type of foods. This is a sensory-motor interaction problem.

There is a hypothesis that people chew in a force feedforward control manner for the purpose of a rhythmic jaw movement. But why this? If this holds, how this is described mathematically? we should have interest to understand the deep knowledge about sensory-motor commands of mastication. If we take our jaw modelling (either mathematical or robotic) as a low-machine level, we may further study the high-level of mastication commands under which the masticatory system (its models) is instructed and then operated.

I am wondering if this is a project like "Mathematical Modelling and Artificial Intelligence of the Sensory-Motor Interaction in Human Masticatory System". We at Massey have started to work on it from AI perspective.

Just a thought to inspire some new inputs.

3. WHAT'S HAPPENING AT THE MASSEY UNIVERSITY, ALBANY

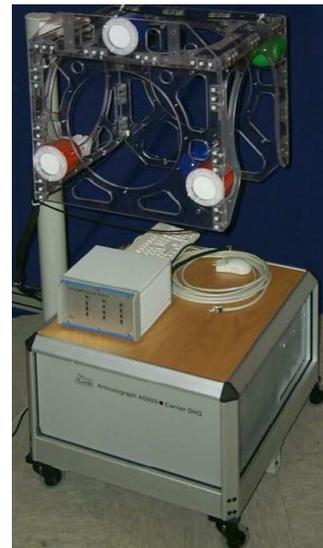
Christine Lawrence is currently analysing data she collected last year for two studies. This first is an extension of previous work where she has been looking at the effect of portion size on the particle size distribution of the bolus. The second study is looking at the selection and breakdown of food in the mouth, i.e., how the particle size distribution of the bolus changes throughout a chewing sequence and beyond. Christine also used a trained panel to describe textural properties of her foods and has found relationships between the panels sensory scores and masticatory properties - this work will be presented by Christine at the New Zealand Institute of Food Science and Technology conference, 19-21 June 2007, Wellington and Pangborn Sensory Symposium, August 2007, Minneapolis. Kylie will also present the portion size work at the 10th European Nutrition Conference, 11-13th July 2007, Paris.

Shiji Nair has almost completed her Post Graduate Diploma in Technology and is currently finishing the analysis of her data and writing her dissertation. Shiji has been looking at the effect of a non-starch polysaccharide on the structure, texture and digestibility of bread. She has been investigating whether the particle size distribution of the food bolus changes with the addition of these dietary fibres and whether this can be related to in-vitro measures of digestion. This work will be presented at the New Zealand Institute of Food Science and Technology conference, 19-21 June 2007, Wellington.

Walter Xie has been reading hundreds of mastication papers and is currently writing a review paper. This paper will focus on the measurement of masticatory parameters, experimental design and the types of data that are presented in journal articles.

Kylie Foster has been invited to present at a workshop "The physical properties of food and the evolution of primate feeding systems" in Paris, July 2007. The workshop will be held as part of the 8th International Congress of Vertebrate Morphology, Paris, 16-21 July 2007. This will be a presentation of the work from her post-doctorate. Kylie has also been invited to visit Martin Wickham, Institute of Food Research, Colney, Norwich and present the mastication work that we have been doing at Massey University. Kylie has submitted a standard Marsden proposal with Callum Ross (University of Chicago), Anthony Herrel (University of Antwerp), Peter Lucas (George Washington University), Jules Keiser (University of Otago) and Brett Gartrell (Massey University) looking at feeding performance and cranial design in tuatara. Kylie will also present a review on food properties, mastication and digestion at New Zealand Institute of Food Science and Technology conference, 19-21 June 2007, Wellington.

The 3D Articulograph (AG500) was installed in December and demonstrated at the Biomouth Symposium. The articulograph will be used for tracking jaw movement (three dimensions, two angles). It will also be possible to synchronise electromyographic signals and sound recordings with the system. The system is currently being calibrated and preliminary data will be collected in February. Once the calibrations are completed, the articulograph will be available for use. EMG and sound recordings are likely to be incorporated into the system at a later date. Please contact Kylie Foster (09 4140800 x 41142, K.Foster@massey.ac.nz) if you would like to use the articulograph.



4. “THE HUMAN CHIN” – (BY MIKE SWAIN, IONUT ICHIN, JULES KIESER)

Mike Swain, Ionut Ichim, and Jules Kieser have just had this accepted in Medical Hypotheses.

“A mechanobiological hypothesis for the development of the human chin”

Abstract: One of the most fundamental yet unanswered questions of human evolution is that of the development of the chin. Whereas it is known that the chin, or mentum osseum, is a unique anatomical feature of modern humans that emerged during the Middle and Late Pleistocene, its origin and biomechanical significance are the subjects of intense controversy. Theories range from the suggestion that the chin evolved as a result of progressive reduction of the dental arch, which left it as a protrusion, to the hypothesis that it provided resistance to mandibular bending during mastication. Until now however, no accepted functional explanation of the human chin has emerged. Here we develop the hypothesis that the actions of the tongue and non-masticatory orofacial muscles may have played a significant role on the development of the human chin. We report numerical simulations of the forces and resultant stresses developed in hypothetical chinned and non-chinned mandibles. Using empirical data and estimates of the forces generated by the human tongue during speech, our hypothesis suggests that the chin might in fact have developed as a result of the actions of the tongue and perioral muscles, rather than as a buttress to withstand masticatory induced stress. This provides a new perspective on the generation of the chin and importantly, suggests that its appearance may be causally related to the development of human language.

5. AMENDMENT TO THE BIOMOUTH SYMPOSIUM PROCEEDINGS

When Oliver sent out the Proceedings for the Biomouth Symposium, the following abstract for a poster presentation was accidentally omitted. My apologise.

“Chewing Knowledge - Representation and Discovery”

D. Xie¹, K. D. Foster², W. L. Xu¹, J. E. Bronlund¹,

¹Institute of Technology and Engineering, Massey University, New Zealand.

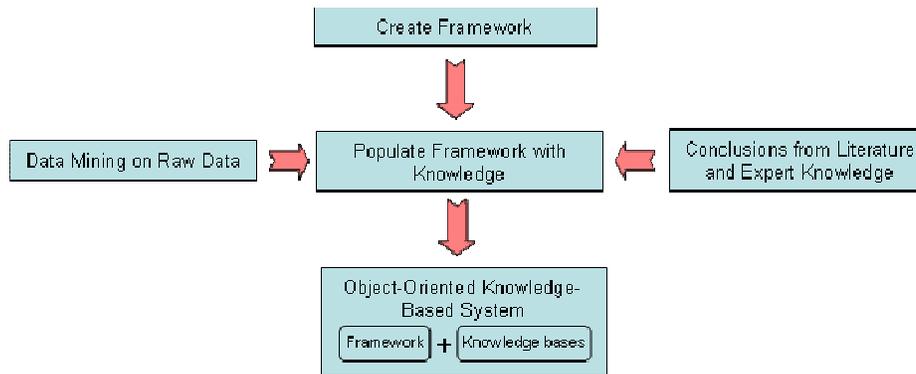
²Institute of Food, Nutrition and Human Health, Massey University, New Zealand.

Human mastication is a rhythmic movement characterised by each individual. It is a complex process that has been shown to adapt to both food properties and individual characteristics but is still not completely understood. In order to completely understand mastication, relationships need to be found between food properties, subject characteristics (e.g. dental status, chewing side, age) and masticatory parameters (e.g. muscle activities, jaw movements, bolus properties, saliva properties) and rules or functions established. Some rules found using controlled experimental conditions (subjects, foods, masticatory parameters measured) are available in the existing literature. However, it can be difficult to compare results from different research groups as measurements and methodologies are usually inconsistent or the data may be confidential or unpublished.

Figure 1 presents the process for creating an object-oriented knowledge-based system. This system involves a framework of mastication related objects for which relationships between objects can be placed. The object-oriented knowledge-based system contains two parts:

- i. a framework to illustrate all recognized masticatory parameters and factors affecting mastication, and

ii. a knowledge-based system which shows the relations or rules that exist between these parameters and factors.



6. THE BIOMOUTH RESEARCH GROUP CHARTER

BIOMOUTH RESEARCH GROUP

- Charter -

I. NAME:

The name of this research group shall be the Biomouth Research Group

II. STATEMENT OF PURPOSE:

The purpose of this organisation shall be to:

1. Foster communication and collaboration between existing research groups within New Zealand that are involved or interested in mastication, jaw mechanics, food development, dentistry, or other related areas.
2. Raise our profile and showcase our research locally and internationally.
3. Seek collaboration with overseas laboratories.
4. Actively seek research funding for collaborative Biomouth projects.

III. MEMBERSHIP.

1. There shall be no membership fee.
2. Everyone shall be entitled to apply for an official membership through:
 - a. Contacting an existing member
 - b. The Biomouth Research Group's official website, <http://www.biomouth.org>.
3. Only official members of the Biomouth Research Group may hold office and vote in elections for the organization's officers.

IV. EVENTS AND MEETINGS.

1. The Biomouth Research Group shall meet once per year.
2. The Biomouth Research Group shall host conferences, symposia, debates, speakers, and discussion meetings according to the statement of purpose.
3. The Biomouth Research Group shall acknowledge outstanding papers and posters at conferences organised by themselves with “Best Contributed Talk” and “Best Poster” awards.

V. OFFICERS.

The Biomouth Research Group shall have 2 officers:

1. The President of the Biomouth Research Group
 - a. Shall have a good understanding of the overall areas of research related to mastication.
 - b. Shall be the official spokesperson for the organization.
 - c. Shall publicly adhere to and abide by the statement of purpose of the organization.
2. The Secretary of the Biomouth Research Group
 - a. Shall have a good understanding of the overall areas of research related to mastication.
 - b. Shall be the administrator of the membership lists.
 - c. Shall be in charge of collecting, assembling, and emailing a quarterly Biomouth newsletter.
3. Failure of any officer to uphold the duties of their office are grounds for removal from office.
4. An officer may be removed from office by 2/3 of the votes of registered members of Biomouth Research Group.

VI. CRITERIA FOR HOLDING OFFICE.

1. All individuals holding office must be registered Biomouth Research group members.
2. The election shall take place with the December Biomouth newsletter every 2 years and shall be elected by a majority vote of the registered members
3. In the case of a resignation of an officer from office, a special election meeting may be held to fill the office until the next election.
4. All officers hold their position until the next elections.
5. There are no limitations on the number of terms of office an individual may hold.

VII. CRITERIA FOR CHANGING THE CHARTER.

1. The charter shall be changed after a special ballot results in either of the following:

- a. One officer and 50% of the votes are in favour of a change.
- b. Two-thirds of the votes are in favour of a change.

After agreeing at the Biomouth Symposium in Auckland (14-15.12.2006) to formally establish the NZB Research Group, this Charter shall take effect on the 1.1.2007. The founding members are:

- Prof. Jules Kieser, University of Otago
- Prof. Mike Swain, University of Otago
- Prof. Peter Xu, Massey University
- A/Prof. John Bronlund, Massey University
- Prof. Andrew Pullan, Massey University
- Dr. Oliver Röhrle, University of Auckland