RESEARCH REPORT

1. Name: Sébastien ABRY	（ID No.: SP05201 ）

2. Current affiliation: Ecole Normale Supérieure de Lyon

3. Research fields and specialties:

    Humanities   Social Sciences   Mathematical and Physical Sciences

    X Chemistry   Engineering Sciences   Biological Sciences

    Agricultural Sciences   Medical, Dental and Pharmaceutical Sciences

    Interdisciplinary and Frontier Sciences

4. Host institution: Graduate School of Environment and Information Sciences at Yokohama National University

5. Host researcher: Pr. Hideaki YOSHITAKE

6. Description of your current research

In biological systems, the oxidation of many substrates is selectively carried out by enzyme, whose hydrophobic active center contains generally at least one metal atom. The objective of my thesis consists in the creation of "bio-inspired" heterogeneous catalysts for selective oxidation reactions. Their design is based on copper enzymes such as *Tyrosinase* taken as bio-models. The molecular confinement and the hydrophobic nature of the metal site environment are created i) using inorganic materials with narrow pore size distribution in the nanometer scale range, ii) grafting hydrophobic functions and also chelating functions to bind copper inside the pores. MCM-41 type mesoporous silicas were selected for several reasons. This material possesses a large specific surface area (1000 $m^2.g^{-1}$) allowing to reach high site concentration and is handled easily in various spectroscopic experiments, including solid state NMR. The hexagonal array of pores allows a fine monitoring of the support integrity during all the synthesis steps. The narrow pore size distribution tunable in the 2-4 nm range will define a homogeneous confinement effect. Moreover, the silanol groups of the surface of the pores allow the grafting of different functions: hydrophobic or polar and/or chelating.

Our strategy for controlling the distribution of the grafted chelating and hydrophobic functions is based on the so-called "molecular patterning approach" developed by our research group. This approach takes advantage of the presence of the templating surfactant, localized inside the nanopores of as-made MCM-41, which is used as surface protection during the first grafting. Since these surfactant molecules (quaternary ammonium) are localized at the surface neutralizing SiO- groups and, being in mutual electrostatic repulsion, they are distributed according to a regular array at the surface. Then, the synthetic strategy here is to keep them into the as-made silica during the grafting

of the first function and to displace them before the grafting of the second function. The quaternary ammonium plays the role of a stencil allowing that leads to the patterning during the first grafting. This strategy has been tested using trimethylsilyl (TMS) functions for hydrophobization, and chloropropyldimethylsilyl (CPDMS) as a tether for other functions to create by chemical derivatization. Characterization of the so-obtained materials shows that both the two functions are grafted on the surface but the proportion is not still yet controlled. The substitution of Cl by amino groups to generate Lewis basicity and complexing properties toward metal ions such as copper is obviously the next step. Using diethylamine, the reaction gives only 17% yield. This has to be optimized using other amines and/or changing synthesis conditions.

7. Research implementation and results under the program

(As much as possible, describe the contents and results of your research in a manner that is easily understandable to a non-specialist in your field.):

Title of your research plan: Study of distance between bromopropyl chains on surface using molecular diamine probes.

Description of the research activities:

The first part of my research work in Japan has consisted in finding the softest conditions needed to obtain a quantitative substitution of Br atom of bromohexane by different amines. These conditions are later employed for the derivatization of bromopropyl chains on the surface of mesoporous solids to get monoamino-complexing or polyamino-chelating functions. Several tests were done changing solvent and temperature. Each reaction test was followed by ^{1}H and ^{13}C NMR spectroscopies. The retained condition was 7 days in toluene at 60°C for primary amine and 7 days in toluene at 35°C for secondary amines.

The second part of my work in Japan has consisted in applying this conditions to the reaction between two different solids containing bromopropyl chains (Figure 1: LUS-1 and LUS-2) and three amines (N-propylamine, dimethylethylenediamine and dimethylpropyldiamine).
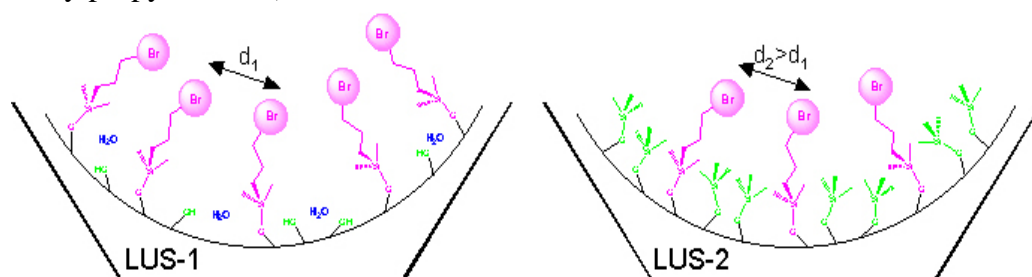

Figure 1.

The LUS-1 only has bromopropyl chains while LUS-2 has trimethylsilyl and bromopropyl chains. The distance between two viciny bromopropyl chains in LUS-2

is expected to be higher than in LUS-1.

Amines were used as chemical probes to characterize the distance and the number of nearby bromopropyl chains together with several analyses (in Japan: argentometric titration and scan electronic microscopy EDS-SEM, in France: solid NMR, elemental analysis and maybe EXAFS). Because analysis is difficult in material chemistry, we need to wait for all the above analyses before confirming any results.

8. Please add your comments (if any):

I would like to thank Pr. Yoshitake, my lab-mates, my new friends in Japan and everyone involved in this JSPS Summer Program. This two months allowed me to discover a lot of things, from the lab to the daily life. This was an unforgettable experiment and it will be a pleasure to come again in Japan.

9. Advisor's remarks (if any):

He has been sincerely engaged in his study. Two months are not enough to complete a "unit" of experiments. Both in Japan and France, we will continue to analyze the products he synthetized and find the optimum condition of synthesis.

RESEARCH REPORT

1. Name: Sebastien Boucksom	（ID No.: SP05202 ）

2. Current affiliation:

Institut de Mathematiques de Jussieu, Paris.

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3. Research fields and specialties:

    Humanities   Social Sciences   x   Mathematical and Physical Sciences

    Chemistry   Engineering Sciences   Biological Sciences

     Agricultural Sciences   Medical, Dental and Pharmaceutical Sciences

    Interdisciplinary and Frontier Sciences

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4. Host institution:

Graduate School of Mathematical Sciences, University of Tokyo

5. Host researcher:

Dr. Shigeharu Takayama

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6. Description of your current research

  My current research is concerned with positivity properties of divisors on algebraic varieties, in the context of classification theory of higher dimensional complex varieties. Algebraic varieties are geometric objects defined by polynomial equations, and divisors are defined by one more equation, taking into account multiplicities. The positivity of such a divisor on an algebraic varietyroughly corresponds to the amount of freedom the divisor has to be deformed on the variety with a polynomial dependence on new parameters. Now it turns out that an algebraic variety is always endowed with a canonical divisor, which appropriately enough bears this name, and classification theory aims at distinguishing between algebraic varities according to the positivity properties of their canonical divisor. More precisely, two algebraic varities are said to be birational if a rational change of variables sends one to the other, and the canonical divisor is preserved under such equivalence.   The goal is then to find a good model, which we understand well, in each birational class of varieties whose canonical divisor has a given positivity property. Several important conjectures in higher dimensional classification theory specify that canonical divisors satisfy very special properties among general divisors, in particular that it admits a Zariski decomposition. A divisor is said to admit a Zariski decomposition if after passing to some birational model, it can be split into a part which can be deformed and one which is completely rigid on the variety, and my current research aims at understanding ahen such decompositions actually exist, having of course in mind the special case of canonical divisors. In a recent joint work with C. Favre and M. Jonnsson, we have introduced a different point of view on Zariski decompositions, by working directly on the voute etoilee of a given algebraic variety, which is the limit space of all

possible blow-ups of the variety. Any divisor on the variety admits a Zariski decomposition on this limit space, and the goal is to understand when this decomposition already exists at a finite level. We've developed a number of tools for that, translating the problem into convex function theory on the rather wild space of all valuations of the variety, which looks like a fractal tree when the dimension equals 2. The research project initially proposed was to try and apply these new techniques to the canonical divisor, and study in particular the rationality properties of the corresponding function on valuation space.

7. Research implementation and results under the program

   (As much as possible, describe the contents and results of your research in a manner that is easily understandable to a non-specialist in your field.):

   Title of your research plan:

   Singular Kahler-Einstein metrics on manifolds of general type.

   Description of the research activities:

   Most of my research activity in Todai has been devoted to further developing convex function theory on the valuation space, with the help of numerous discussions with S.Takayama. Much time has been spent to explain him the basis of the new theory under construction, and conversely to learn from his indepth knowledge of Mori theory and pluricanonical systems. In particular, one recent and exciting theorem of Takayama's on extension of pluri-log canonical forms seems to be very promising in trying to argue inductively to tackle the openness conjecture, which is the major goal of the valuation space theory.

   I've given two seminar talks while in Japan, one in Todai which was a great opportunity to exchange with the most interesting audience I met there, and one in Nagoya, where I've spent one week for joint research on Monge-Ampere masses and Bergmann kernels with D. Popovici and had interesting mathematical dicussions with Pr. Ohsawa who invited me.

   However we have been compelled to give up the analytic part of the initial project, because of the very recent announcement by Y.T.Siu, probably the world's leading expert on the subject, of substantial progress on the question, which may soon lead to a full solution of the problem of finite generation of the canonical ring, known to be equivalent to the existence of Zariski decompositions for canonical divisors. But since this question on partial differential equations was just one part of the overall project, this didn't prevent us from achieving significant progress on several problems that arose in the course of discussions with Takayam, also forming by our rich exchanges sound basis for further research, which shall be done next year in the context of a one-year JPSPS post-doctoral fellowship.

RESEARCH REPORT

1. Name: Boué Stéphanie	SP05203

2. Current affiliation:

EMBL, Meyorhofstr. 1, D- 69117 Heidelberg, Germany – Bork Group

3. Research fields and specialties:

    Humanities   Social Sciences   Mathematical and Physical Sciences

    Chemistry   Engineering Sciences   X Biological Sciences

    Agricultural Sciences   Medical, Dental and Pharmaceutical Sciences

    Interdisciplinary and Frontier Sciences

4. Host institution: Bioinformatics center – Kyoto University

5. Host researcher: Prof. Kanehisa

6. Description of your current research

The goal of my PhD thesis is to investigate transcripts generated in different tissues, at different time points in development or life in order to pinpoint the changes and understand the histological and/or functional differences. One way to explore the transcriptional diversity in cells is to build whole genome microarrays (or use commercial ones), and to hybridize cellular samples on it. Up to now I worked with mouse arrays with 52 different tissues/organs to observe transcription in space, and fly arrays following transcription during embryogenesis.

7. Research implementation and results under the program

  (As much as possible, describe the contents and results of your research in a manner that is easily understandable to a non-specialist in your field.):

  Title of your research plan:

Reanalysis of gene expression changes in glomerulonephritis measured by microarrays in rat models

Description of the research activities:

Glomerulonephritis is a painless inflammation of the glomerulus in the kidney, often due to the buildup of immune complexes, and which can lead to high blood pressure and the progressive loss of kidney function. Gene expression of rat models of the disease has been investigated using microarray technology[1]. These data first analyzed two years ago have been reanalyzed using the latest gene annotations and using the Bioconductor package[2]. 29 genes are found to be overexpressed (at least 2 fold) in the disease-model compared to the wild type and 14 to be underexpressed. Among them there are osteopontin, glutamate cysteine ligase, or epidermal growth factor known to be involved in kidney diseases. Genes that could be mapped to KEGG[3] maps, thanks to the KEGG API, link the disease to focal adhesion, amino acid metabolism and MAPK pathway. No significant expression change has been found in the ill rats treated with predsinolone compared to the ill ones. No new serious candidate for therapy could be found.

1. Yamada *et al.* Inhibition or protein kinase CK2 prevents the progression of glomerulonephritis. (2005) *PNAS* **102** (21) 7736-7741
2. Gentleman *et al.* Bioconductor: open software development for computational biology and bioinformatics. (2004) *Genome Biology* **5**(10) R80
3. Kanehisa, M. *et al.* The KEGG resources for deciphering the genome. Nucleic Acids Res., 23,D277-D280 (2004)

RESEARCH REPORT

1. Name: BUSNEL Jean-Marc	（ID No.: SP05204 ）

2. Current affiliation:

ESPCI, 10 rue Vauquelin, 75005, Paris, France

3. Research fields and specialties:

    Humanities   Social Sciences   Mathematical and Physical Sciences

    X Chemistry   Engineering Sciences   X   Biological Sciences

    Agricultural Sciences   Medical, Dental and Pharmaceutical Sciences

    Interdisciplinary and Frontier Sciences

4. Host institution: University of Hyogo

5. Host researcher: Shigeru TERABE

6. Description of your current research

The project of my thesis can be included in the proteomics field that is the analysis of proteins contained in complex sample. Our main interest is focused on allergen sources: we would like to detect, characterise and identify the molecular allergens contained in a complex allergen source such as food or plant pollen. So far, the best approach is to analyse a complex protein mixture in a 2 dimension gel electrophoresis and detect the allergens by an immuno-detection on a blot of the gel performed with allergic patient's sera. This technique is very dependant on skilful manpower, is time consuming and poorly reproducible and finally very expensive. Our project is to develop a single multidimensional chip able to separate rapidly and fully automatically, following two complementary basic electrophoretic principles, complex protein mixtures, such as food extract and finally to identify the allergens contained in the studied mixture. We propose to separate the analytes first by Capillary Iso-Electric Focusing (CIEF) into an ordered stack of proteins separated following their isoelectric points (pI). Then, these proteins will be further separated by Carrier Ampholytes Based Capillary Electrophoresis (CABCE), a new electro-driven separation method that we are now developing in Paris. This technique is able to separate very quickly proteins under high electric field strength due to the low conductivity of the background electrolytes (BGE) used without involving any heating of the capillary contents by Joule effect. Moreover, these BGE, based on carrier ampholytes are presenting a rather important loading capacity contrary to other low conductivity buffers, such as some amino-acids which have been used in the past. This parameter appears highly important when looking at the coupling of CABCE with CIEF, which is presenting a high concentrating power of the analytes.

7. Research implementation and results under the program

Title of your research plan:

Stacking phenomenon in CABCE and hyphenation of CABCE with Mass Spectrometry

Description of the research activities:

The CABCE method is a new method that has to be studied and characterized from a theoretical point of view. The rather high loading capacity of this method which has been bring to the fore in Paris, prior to my stay in Japan, is a surprising property for such low conductivity background electrolytes. Nevertheless, this property is a really important feature that makes possible to work with concentrated samples without decreasing dramatically the performances of the analysis. This property is strongly linked to the Kohlrausch Regulation Function (KRF) of a background electrolyte. The values of this function have previously been shown to present a rather high value in the carrier ampholytes based background electrolytes.

The KRF, which regulates with the Ohm's laws, the transport of the ionic constituents of a solution in a capillary during an electrophoretic process, rules also another important process in electrophoresis, the stacking phenomenon.

Stacking is really important because it allows to preconcentrate online with the electrophoretic separation diluted samples. Moreover, when considering real samples, the low concentration of the compounds of interest is an often encountered problem.

Taking advantage of the great knowledge of Professor Terabe and co-workers in the field of the preconcentration techniques in capillary electrophoresis, I explored during my stay in Japan the stacking capabilities of the carrier ampholytes based background electrolytes. It has been shown that the field enhanced sample injection, a very useful online preconcentration technique in capillary electrophoresis can be easily implemented in CABCE. This allowed to enhance the sensitivity detection of different kinds of compounds, small organic molecules or even peptides, approximately a thousand times.

Thanks to the instruments available in the laboratory of Professor Terabe, the coupling between CABCE and a highly sensitive mass spectrometry has also been explored. And contrary to what is observed in CIEF, the relatively low volatility of the carrier ampholytes is not as awkward in CABCE. Indeed, the carrier ampholytes that are buffering at a pH close to their isoelectric point are presenting a very low electrophoretic mobility. This feature combined to the use of coated capillaries which are presenting a very low electroosmotic flow allowed to couple CABCE to mass spectrometry for the analysis of protein tryptic digests with a rather good sensitivity.

A part of the results obtained during my stay in Japan thanks to the JSPS summer program fellowship will be the subject to a scientific publication which is presently under preparation.

Moreover, the results obtained in the laboratory of Professor Terabe will be really helpful in the future for optimizing the conditions of protein separations by CABCE.

RESEARCH REPORT

1. Name: Marion Cranney	（ID No.: SP05205　）

2. Current affiliation: Laboratoire de PhotoPhysique Moleculaire

3. Research fields and specialties:

    Humanities   Social Sciences   XMathematical and Physical Sciences

    Chemistry   Engineering Sciences   Biological Sciences

    Agricultural Sciences   Medical, Dental and Pharmaceutical Sciences

    Interdisciplinary and Frontier Sciences

4. Host institution: National Institute for Materials Sciences

5. Host researcher: Pr. Tsuyoshi Hasegawa

6. Description of your current research

My present research concerns Nanoscience. It took place at the Laboratoire de PhotoPhysique Moleculaire in Orsay (France) in the "Nanophysics, Photochemistry of surfaces and Modelisation" group.

The goal of my group's research is to build molecular nanomachines (machines made by an assembly of molecules), whose working is fully controlled through electronic or optical excitations. We have then to study first organic molecules adsorbed on surfaces which have some interesting properties like motion on the surface, intramolecular motion or light emission and we have to understand how to activate in a controlled and reproducible way those properties.

For this purpose I use a Scanning Tunneling Microscope in ultra-high vacuum working at room temperature (RT-STM) or at low temperature (LT-STM), in order to manipulate and to excite with electric pulses individual organic molecules adsorbed on semi-conductor surfaces. The STM, which is a near-field microscope with a very high resolution, measures the tunneling current between the microscope probe and the surface, which is related to the topography of the surface and to its electronic properties.

I studied during one year the electric excitation of biphenyl (a very simple and small molecule) on silicon Si(100) with a RT-STM. This molecule has the interesting property to move on the surface about a fixed axis between two positions. This switching motion from one position to the other one can be activated in a controlled way through electronic excitation.

I recently began to study bigger and more complex molecules, like hexaphenyl or CMTE. Both of these molecules have the very interesting property of emitting light.

7. Research implementation and results under the program

(As much as possible, describe the contents and results of your research in a manner that is easily understandable to a non-specialist in your field.):

Title of your research plan:
Study of optical properties of nanostructures of hexaphenyl molecules adsorbed on various substrates by light emission spectroscopy based on SNOM and STM

Description of the research activities:

Pr. Hasegawa at NIMS in Tsukuba (Japan) has proposed that I study the optical properties of nanostructures of hexaphenyl molecules adsorbed on various substrates under the supervision of Dr. Tsuruoka.

As written before, hexaphenyl molecules have the very interesting property of emitting light in the blue region. Moreover under certain deposition conditions they can form by self-assembly fibers of several hundred of micrometer length and several nanometers width and height. These fibers can be used as nano-waveguide in optronic devices.

I prepared in France the samples (hexaphenyl on silicon, graphite and diamond) and I studied them with STM and SEM before coming to Japan. That was the first time I deposited these molecules on these samples and tried to get fiber structures. The STM is not the best instrument to study self-assembly of nanostructures, because the area is too small to get a good general view.

I studied these samples in Japan with a specially designed combined SNOM-STM apparatus equipped with UV-laser and photodetection system. The SNOM (Scanning Near-Field Optical Microscope) is another near-field microscope which provides the topography of the surface (measured with shear-force feedback mode) and a picture of the emitted light in the same time and of the same area. It was used in illumination mode : the probe was a tip made of optical fiber, which illuminated in near-field mode the surface, and the light emitted from the sample was collected by an objective lens under the substrate (in case of transparent substrates) or by a mirror mounted around the probe (for opaque substrates).

The results are not as good as the hope I had : due to very bad deposition methods, hexaphenyl didn't form any fiber structures on the surface but form mainly aggregates, amorphous or crystallized, and the density of these aggregates and their shape were very inhomogeneous on all surfaces. That's why it was very difficult to find good areas in order to make SNOM pictures. But we have found that some hexaphenyl aggregates emitted light (but some didn't, maybe because of differences in crystallinity) with very narrow peaks and with a high efficiency.
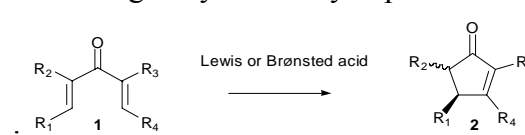
After the improvement of deposition methods and growth conditions of nanostructures of hexaphenyl on these surfaces, I hope to come back at NIMS in order to end up these studies and maybe more (post-doc?)…

8. Please add your comments (if any):

It was a lot a fun to stay these 2 months in Japan and to have a small experience of living in Japan. The only problem was my capacity of speaking Japanese…

I was very pleased as well to work in this group, where people were so nice with me and where I learned a lot about science (of course!), about japanese ways of working (nights in the lab!!!), japanese every-day life and gastronomy (oshii!).

RESEARCH REPORT

1. Name: Frederic Douelle	（ID No.: SP 05206 ）

2. Current affiliation: University of Edinburgh

3. Research fields and specialties:

      Humanities   Social Sciences   Mathematical and Physical Sciences

      X Chemistry   Engineering Sciences   Biological Sciences

      Agricultural Sciences   Medical, Dental and Pharmaceutical Sciences

      Interdisciplinary and Frontier Sciences

4. Host institution: ISIR Osaka University

5. Host researcher: Professor Hiroaki Sasai

6. Description of your current research

- <u>Background</u>

The Nazarov cyclisation of dienones to produce 2-cyclopentenones has become one of the most powerful methods for cyclopentannulation in recent years **Scheme 1**. Since its discovery in 1941, the reaction has been subject to a steady stream of innovations such that the contemporary procedure delivers good yields of cyclopentenones under mild conditions.

Scheme 1: The Nazarov cyclisation

We have been discovered[1] a new reagent-free protocol for Nazarov cyclisation that involves simple heating of dienones. Nazarov cyclisation produces highly substituted cyclopentenones in good to excellent yields. In addition to the economic and environmental benefits of conducting reagent-free carbon-carbon bond formation, the neutral reaction conditions may enable the extension of Nazarov methodology to acid-sensitive substrates that have been previously inaccessible. Somewhat surprisingly, only few catalytic asymmetric variant are reported, therefore our next objective is to investigate in this regard.

7. Research implementation and results under the program

  (As much as possible, describe the contents and results of your research in a manner
   that is easily understandable to a non-specialist in your field.):

Survey of Catalytic Asymmetric Nazarov Cyclisation

- Introduction

    The research project is divided in three mains parts which are first the design and synthesis of starting substrates (**Scheme 2**). Secondly, the investigations of the optimised catalytic metal systems that allow the highest diastereoisomeric excess (**Scheme 3**). And finally to test the enantioselectivity with various chiral ligands (**Scheme 4**) under optimised conditions.

- Design of suitable starting substrates

    Based on preliminary Priti s results, the use of substrate **1** (**Scheme 2**) did not give any decent yield. It is thought that substitution in ά position of the carbonyl is essential to enhance the reactivity. Thus we have designed and synthesised[2] the starting dienones **2**, **3** and **4** with electron withdrawing, electron donating and alkyl groups to scope their electronic effects under Nazarov ring closure.
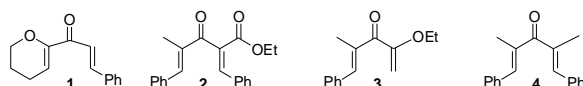
Scheme 2: Nazarov substrates

- Survey of optimized catalytic system for each substrate

    Aggarwal and co-workers[3] reported that the use of copper as metal was efficiently coordinated the two carbonyl of the substrate **2** and therefore high diastereoisomeric excess could be expected. Indeed the use of catalytic amount of Cu(OTf) under mild conditions yielded quantitative diastereisomeric product **5**. Based on Tius and co-workers investigation[4], The Lewis acid character of Palladium as coordination metal was a good starting point to check the ring closure viability of ethoxy-substrate **3** and alkyl substrate **4**. Pd(OAc)$_2$ and PdCl$_2$(CH$_3$CN)$_2$ as catalytic systems and substrate **3** were attempted under various solvent, temperature and time. As expected, 20 mole% of Pd(OAc)$_2$ and substrate **3** gave expected diastereoisomeric product **6** in almost quantitative yield. The reaction between 1 mole% of PdCl$_2$(CH$_3$CN)$_2$ and substrate **3** yielded the diastereoisomeric product **7** quantitatively too. Substrate **4** low reactivity in presence of either Pd(OAc)$_2$ or PdCl$_2$(CH$_3$CN)$_2$ did not show any trace of product **8**.
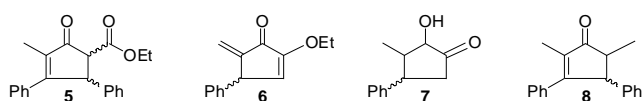
Scheme 3: Nazarov expected products

- Asymmetric reactions survey

Under optimised catalytic conditions discussed above substrate **2** was separately mixed with different ratios of ligands **9**, **11**, **12** and **13** at different temperature. Surprisingly final analysis was showed starting substrate **2** essentially. For some unclear behaviors, the additions of ligands prevent any form of ring closure. Ligands **9**, **10**, **11**, **12** and **13** were separately tested with substrate **3** and either $Pd(OAc)_2$ or $PdCl_2(CH_3CN)_2$ catalytic system. The reactions are still undergoing.
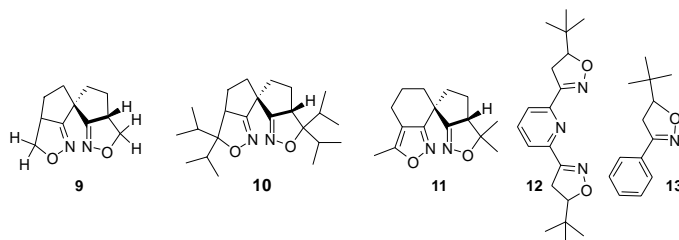
Scheme 4: Chiral ligands

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[1] Douelle, F.; Tal, L.; Greaney, M. F., *Chem. Commun.,* **2005**, 660. [2, 5] Supporting information available from dref0072000@yahoo.fr.   [3] Aggarwal, V.; Belfield, J. *org. Lett.*, **2003**, 5, 5075. [4] Tius, M.; Leclerc, E. *J. org. Lett.*, **2003**, 5, 4927.

8. Please add your comments (if any):

At the time I have been starting the JSPS program, I had a strong interest upon the Nazarov cyclisation methodologies. After discussion with Priti, a PhD student from my host research group, we decided to start focusing on the catalytic asymmetric version of it. The reason why I changed the direction of my research (compared with the former proposal) is that a durable collaboration between Prity s deep experiences in asymmetric reaction and my understanding of Nazarov reaction is raised.

RESEARCH REPORT

1. Name: Nicolas DUGUET	（ID No.: SP05207）

2. Current affiliation: Institut de Recherche en Chimie Organique Fine (IRCOF)

UMR 6014 CNRS, University of Rouen, France

3. Research fields and specialties:

      Humanities   Social Sciences   Mathematical and Physical Sciences

  X Chemistry   Engineering Sciences   Biological Sciences

      Agricultural Sciences   Medical, Dental and Pharmaceutical Sciences

      Interdisciplinary and Frontier Sciences

4. Host institution: Graduate School of Pharmaceutical Sciences, Kyoto University

5. Host researcher: Professor TOMIOKA Kiyoshi

6. Description of your current research:

I am preparing a Ph.D. thesis in organic chemistry, more precisely, in the field of asymmetric synthesis. The Rouen group has been interested in the "chiralization" of organolithium because few examples of efficient asymmetric induction have been reported in the literature. Our research has been focused on the applications of mixed aggregates between chiral lithium amides and alkyllithiums in the asymmetric nucleophilic addition reaction (Scheme 1).
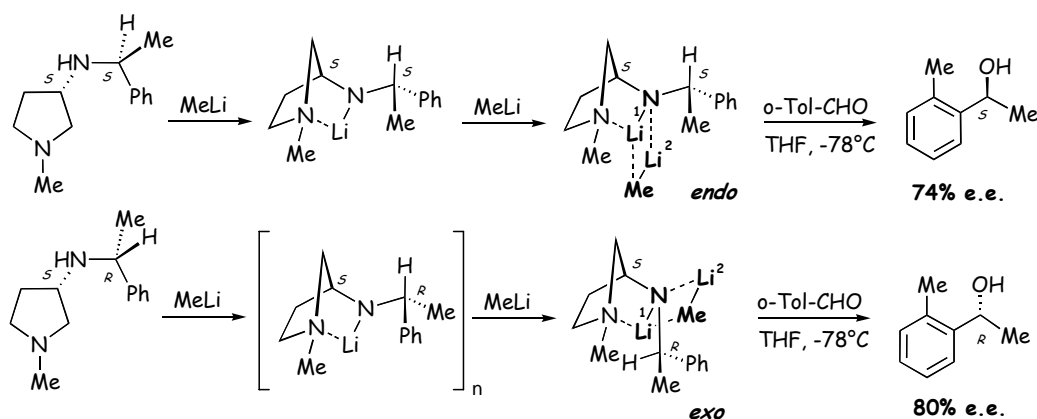
Scheme 1

More recently, we planned to explore the potential of our system in conjugate addition which is one of the field of research of the group led by Professor Kiyoshi Tomioka, who is now known as one of the leading experts in asymmetric catalysis for conjugate addition of organometallic reagents on electrophically activated alkenes (Scheme 2).
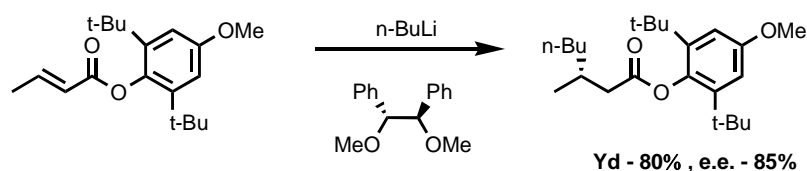
Scheme 2

## 7. Research implementation and results under the program

Title of your research plan:

Use of mixed aggregates of chiral 3-aminopyrrolidine lithium amide and lithium ester enolate in conjugate addition

Description of the research activities:

Labwork:

During my short stay, I explored the aggregation and the application of mixed systems associating a lithium ester enolate and our chiral lithium amides in conjugate addition reaction. These kind of complexes are very sensitive to reaction conditions, such as, temperature, solvent and ratio between all components of the reaction. That is the reason why I checked all these parameters and I found (up to now) that the best reaction conditions were as shown below (Scheme 3):
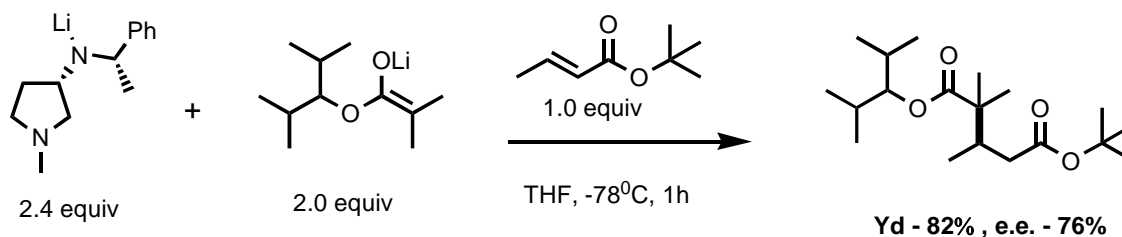
Scheme 3

Seminar:

On June 28 I presented my research at a seminar organized each week. It included all members of the lab and there was an exceptional opportunity to discuss my research results with Japanese specialists.

Conclusion:

This program gave me a unique chance to benefit from the expertise of a well-known Japanese laboratory. I obtained interesting results that could be exploited in the future in the frame of my Ph.D.

8. Comments:

I would like to thank the JSPS and the CNRS for enabling me to take part in this program. My special thanks go to Professor Kiyoshi Tomioka, my advisor, for accepting me to join his group of research within the Graduate School of Pharmaceutical Sciences. I warmly thank Rie Sayuwatari who arranged everything for me for this program. I also thank all members of the lab for their time and help.
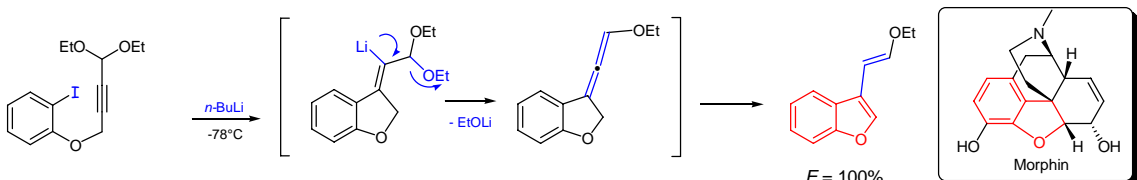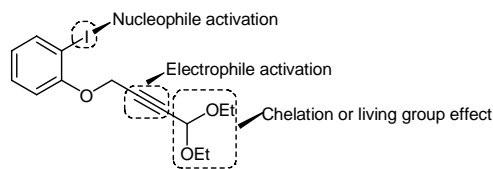
9. Advisor's remarks :

I found Mr Nicolas DUGUET is an independent and talented young PhD student during his stay in our lab.

The opportunity is, I believe, very much fruitful for us and Mr Nicolas DUGUET

I thank to JSPS for giving us this wonderful summer time.

Kiyoshi Tomioka, Professor of Organic Chemistry

RESEARCH REPORT

1. Name: Anne-Lise GIRARD	（ID No.: SP05208　）

2. Current affiliation:

UMR 6014 CNRS / IRCOF / Rouen University / France

3. Research fields and specialties:

    Humanities   Social Sciences   Mathematical and Physical Sciences

    X Chemistry   Engineering Sciences   Biological Sciences

    Agricultural Sciences   Medical, Dental and Pharmaceutical Sciences

    Interdisciplinary and Frontier Sciences

4. Host institution: Faculty of engineering / Tsushima / Okayama University

5. Host researcher: Pr. Kazuhiko Takai

6. Description of your current research

The Rouen group has discovered a new convenient process to obtain quicky a complex molecule from a simple starting material. However this reaction seems limited by the application of the subtrates concerned.

The laboratory decided to explore this reaction on other substrates and to develop this anionic methodology, potentially useful to build the skeleton of natural products with biological activities as alkaloids.

In order to understand the driving force of this reaction and to apply to an other substrate, different parts of the molecule are studied and modified.

7. Research implementation and results under the program

(As much as possible, describe the contents and results of your research in a manner that is easily understandable to a non-specialist in your field.):

Title of your research plan:

Intramolecular cyclization by activation of triple bond with metal-complex

Description of the research activities:

During my research activities, I worked with special transition metal catalysts thanks organometallic complexes. The metals used need a specific material and hard method of work. The first and major part of my work was to learn these process of work with simple system before to use my molecules.

Three different metals have been used. The first was the tantalum as an activator of triple bond by insertion of alkyne with a low valent tantalum complex. I have learn to isolate this type of described tantalum-alkyne complex with shlenk technique. Concerning my substrate prepared in France, the objective was to activate an intramolecular cyclization.
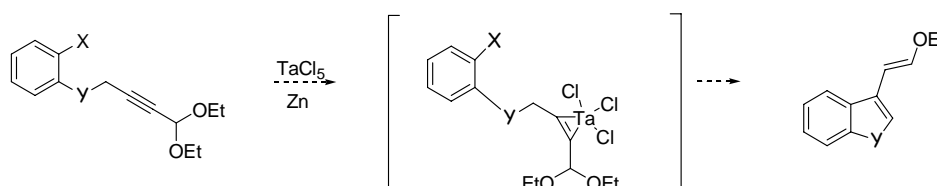

However, parasite reactions occured due to the acetal part of the molecule. An other substrate has been prepared and an other metal catalyst was tested.

Zirconocene alkenyl species were considered with the Negishi's reagent. This zirconocene-butene complex was generated in situ successfully and the ligand exchange occured on a described molecule.
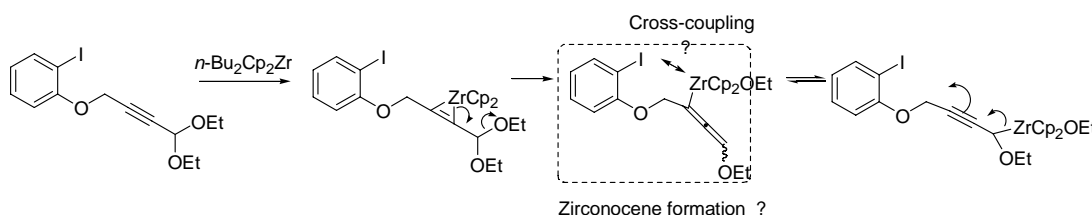
However, with the subtrate prepared, again reactivity's problem of the propargylic substituted positions on the molecule.

A platinium catalysed diboration on this same internal alkyne was also tested. The objective was double : remove the problem of elimination with one boron and use the second to engage a cross coupling with the aryl part of the molecule to provide an intramolecular cyclization.
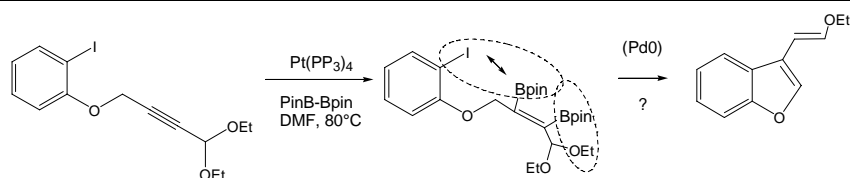
Once more, a problem of reactivity of my substrate occured. Other experimental conditions and other catalyst as palladium was also tested without success.

To conclude on these results, the substrate studied is very specific and functionalised if we compare to the internal alkynes described in the litterature. The acetal part seems the most problem with all these different catalysts. This part of the molecule is maybe the first work to change. Other similar substrates and catalysts can be tested for conclude on this study.

8. Please add your comments (if any):

I m very enjoy by this complete training on utilization of hard shlenk techniques under argon inert atmosphere without any trace of air and water. There was also very interesting to build this project before to arrive in Japan and during the program according to the results obtained. This project was a real challenge due to the innovation concerned if the result should has been successful and also a real project possible for a long term on many years.

9. Advisor's remarks (if any):

This program is very short and maybe it's better to well build the possibity of the project before.

The subject need also to be a short subject adapted to the time offered by the program.

RESEARCH REPORT

1. Name:　Kranitz Mai-lan	（ID No.: SP05209）

2. Current affiliation: Edinburgh University

3. Research fields and specialties:

  Humanities   Social Sciences   Mathematical and Physical Sciences

   Chemistry   Engineering Sciences   X Biological Sciences

    Agricultural Sciences   Medical, Dental and Pharmaceutical Sciences

4. Host institution: Kyoto university

5. Host researcher: Dr Hiroaki Setoguchi

6. Description of your current research

New Caledonia is located in the Pacific Ocean. Though it is only 19 000sqkm,
it has an incredibly rich flora and one of the highest conifers endemism rate in the world
(43 species all endemics, 7% of the world conifers). The Araucaria genus is one of the best
example with 13 species (on the 19 still existing) all endemics.
Furthermore, Araucaria species are undergoing several threats due to fragmented habitats,
mining exploitation and fire. 11 out of 13　of them are on the Conifer Red List of the
UICN (Global Red List of Conifers, Farjon et al. 1999.)
My aims are to establish a phylogeny of the species in an attempt to estimate the evolution
rate of the genus in New Caledonia and have a time estimation of its splitting from the rest
of the genus.
Having encountered countless species determination problems a species delimitation study
will also be run. This is a very important issue as no conservation plan can be achieved on
an uncertain ground.

I) The *Araucaria* phylogeny
The problems:
To tackle this question, the hypotheses concerning the arrival of the genus in New
Caledonia and the events that may have led to such a high diversity on such a small Island
were tested. Two main hypotheses remained:
•The genus diversified 37 MYA after the arrival of a important amount of ultramafic soil
(oceanic crust very rich in heavy metals) on the main Island of New Caledonia.
•The radiation is more recent and due to glaciations, and temperatures and sea level
variations.

Methods:

Previous studies have tried to assess the phylogenetic relationship of the genus Araucaria but New Caledonian species relationships still remain undetermined. In order to resolve this phylogeny, different approaches were used in this study: Chloroplast DNA sequencing and nuclear DNA sequencing.

II) The species delimitation

The problems:

The "*Flore de Nouvelle-Calédonie*" was produced in 1972 and has become quite obsolete due to the addition of new herbarium specimens, to some inadequacies in the locality references and some frequent overlap or uncertainty in the species descriptions. Finally, questions concerning the taxonomic status of some species have arisen.

Methods:

In order to ensure that the units of analysis reflect natural biological units, and also contribute towards programs concerned with their conservation, both molecular data and herbarium study were used. Two field trips were done in order to get an important range of species material and field observations (tree height, shape, habitats, bark colour and texture, foliage variations). The herbarium material was completed by loans from several Herbaria. The molecular study is focusing on the use of DNA sequencing and microsatellite analysis to assess whether taxa described by morphology match those described by molecular tools.

For more informations on the species and their locality please refer to the following website: http://rbg-web2.rbge.org.uk/Araucaria/

7. Research implementation and results under the program

(As much as possible, describe the contents and results of your research in a manner that is easily understandable to a non-specialist in your field.):

Title of your research plan:

Estimation of the genetic divergence between *Araucaria laubenfelsii*, *A. montana* and *A. rulei* using nuclear microsatellite.

Description of the research activities:

The *Araucaria* of New Caledonia represent a classic example of the problems for conservation caused by taxonomic uncertainty. One of the most important cases concerns *Araucaria montana* and *Araucaria laubenfelsii*. Even though *Araucaria montana* is globally rare (it is restricted to New Caledonia) it is at least relatively abundant on the island. *A. laubenfelsii* in contrast, is much rarer and is thought to occur in < 10 populations. However, difficulties in distinguishing these two species means that there is uncertainty over exactly where *A. laubenfelsii* occurs, and hence uncertainty as to the threats the species is facing, and the most appropriate strategies for its conservation.

In this study, I propose using genetic markers to aid in species delimitation and identification. Genetic markers provide a suite of polymorphic characters which are environmentally and developmentally stable and can hence provide an objective set of information on the genetic similarities and distances among a set of populations belonging to one or more taxa.

Approach

The approach I proposed is to use nuclear microsatellites to screen samples from a range of populations representing the morphological diversity in these two putative species. The resulting data is used to establish whether one or two groups are present (e.g. if there is just a single polymorphic species, or whether *A. montana* and *A. laubenfelsii* are indeed distinct, and if so which populations belong to which species). Nuclear microsatellites are usually time consuming to isolate, but this project builds up previous work and use microsatellites that were isolated from a related species and are known to work in all New Caledonian *Araucaria*. The project also draws on extensive DNA collections of *Araucaria* samples held at the Royal Botanic Garden Edinburgh.

Results

In the allotted time of two months, four out of the five initially isolated primers were scanned for four populations of *Araucaria montana, A. laubenfelsii* and *A. rulei.* Eight individuals per population were randomly chosen out of the DNA material available in the Royal Botanic Garden of Edinburgh.

The allele combination of the four microsatellite didn't yield any important variation in between the three species. Only one out of the four microsatellite gave some limited resolution. The allelic frequencies of AS167 revealed some discrepancies between the species but the limited time allowed did not permit to investigate the result any further.

The presence of important similarities between all 3 species genomes suggests either a recent evolution of each species, either a current overlap in the species units. Still, this results reflect the morphological overlap existing between the species. However, this work is only restricted to a limited number of samples and more individuals should be investigated as well as a higher number of markers.

8. Please add your comments (if any):

The existence of technical problems during the past two months (non-availability of the fragment analysis machine, break down of the fragment analysis machine's laser, modifications of the PCR conditions) did not allow time for the investigation of other microsatellite markers, nor permit deeper analysis of the results.

RESEARCH REPORT

1. Name: Olivier LAMOTTE	（ID No.: SP05210 ）

2. Current affiliation: ROSES-CNRS University of Paris 1 Pantheon Sorbonne

3. Research fields and specialties: Humanities   X Social Sciences   Mathematical and Physical Sciences Chemistry   Engineering Sciences   Biological Sciences Agricultural Sciences   Medical, Dental and Pharmaceutical Sciences Interdisciplinary and Frontier Sciences

4. Host institution: Yokohama National University 5. Host researcher: Prof. Kozo KIYOTA

6. Description of your current research

These last several years there has been a proliferation of Regional Trade Agreements (RTA) worldwide aimed to eliminate tariff and non-tariff barriers to trade. One can expect several effects from the implementation of free trade agreements: increase of the trade intensity between the members, enlargement of the market potential, economies of scale for the firms, enhancement of the economic reforms in the interior market of the members, improvement of the dialogue and of non-economic cooperation but also trade diversion from non-members and a competition shock for less competitive sectors. The benefits and costs of such a process are numerous and need therefore to be evaluated. My current research focuses on the trade effects of RTA.

To measure these effects, I use the gravity equation, which is the empirical 'workhorse' in international trade to study the ex post effects of RTA on bilateral merchandise trade flows. The size of the trade flows is explained by three factors: the potential supply of the exporting country, the potential demand of the importing country, the commercial flow resistance between the partners. Panel-data econometric techniques are used to estimate empirically the effects of RTA.

7. Research implementation and results under the program

  (As much as possible, describe the contents and results of your research in a manner
    that is easily understandable to a non-specialist in your field.):

Title of your research plan:

The impact of regional trade agreements: a sectoral assessment

Description of the research activities:

Background of the research

Although there are dozens, sometimes contradictory, empirical evaluations of major
RTA, very few works take into account that they may have different sectoral effects.
Almost all studies estimate the equation on aggregated trade flows, identifying therefore
an average effect weighted by the proportion of each category of products in the exports
or the imports. However, one can assume that the effects of RTA differ among sectors
for several reasons. Firstly, because consumers' tastes differ across countries and the
demand will not react in the same manner for all products. Secondly, because tariff
barriers to trade are not the same across sectors before and after the entry in force of
RTA. Sensitive products are often subject to higher tariffs and most of the time excluded
from the scope of free trade agreements or applied a special regime. Thirdly, the
existence of non-tariff barriers such as technical, sanitary or environmental norms can
limit the effects of trade liberalization and they are usually concentrated on certain
categories of products: food, medicines etc. In order to overcome this bias I run
estimations on commodity-level data. My research was organized in three major steps:
construction of a database, econometric estimations, analysis and discussion of the
results with Japanese researchers. The research led to the writing of a brief draft paper
that will be presented at conferences and submitted to a refereed journal for publication.

Econometric specification and database

The estimated equation is the following:

$$ln(Trade_{ijt}) = \beta_0 + \beta_1 ln(GDP_{it}) + \beta_2 ln(GDP_{jt}) + \beta_3 ln(Distance_{ij})$$
$$+ \beta_4(C_{ijt}) + \beta_5(RTA_{ijt}) + e_{ijt}$$

$(Trade_{ijt})$ data are exports expressed in USD and disaggregated at the ISIC rev2 4-digits
level. They are taken from Trade and Production database, 1976-1999, Nicita and
Olarreaga (2001), The World Bank.

(GDP_{it}) & (GDP_{jt}) data are expressed in current dollars and come from the World
Development Indicators of the World Bank.

$(Distance_{ij})$ is measured as the geodesic distance in kilometers between capital cities
and come from the CEPII.

(C_{ij}) is a vector of covariates that approximate countries historical, geographical and
cultural proximity.

(RTA$_{ijt}$) is a vector of dummy variables that takes 1 if both i and j are members of a RTA. We included dummies for the European Union (EU), the ASEAN free trade agreement (AFTA), the North American Free Trade Agreement (NAFTA), the Mercado Comun del Sur (MERCOSUR) and one for all other RTA.

e_{ijt} is the error term.

In order to provide consistent estimates the regressions are conducted with panel data econometric techniques: country and year fixed effects, within estimator, instrumental variables, Heckman two-step procedure.

Preliminary results

Several interesting results could be drawn from the empirical study:

-As expected the effects of RTA differs considerably among sectors; the trade arrangements considerably increase trade in some sectors whereas they have no significant effects on some others.

-The patterns of sectoral effects are also different between major RTA; one noticeable pattern is that of the AFTA. Its impact on trade was the highest for manufactured metal products, machinery and equipment.

-Trade diversion (reduction of trade between members of a RTA and non-members) could be observed mainly for the AFTA and for the MERCOSUR.

8. Please add your comments (if any): I would like to express my gratitude to JSPS, CNRS and Yokohama National University for enabling me to take part in this program. My special thanks go to Prof. Kozo Kiyota, my advisor, for his insightful comments and advices and for taking care of me throughout the program.

RESEARCH REPORT

1. Name: Texier Benjamin　　　　　　　　　　　（ID No.: SP05211　　）
2. Current affiliation: Indiana University, Bloomington, USA
3. Research fields and specialties: Mathematics 　　　Humanities　　　　　　Social Sciences　　　　Mathematical and Physical Sciences 　　　Chemistry　　　　　　Engineering Sciences　　　　Biological Sciences 　　　Agricultural Sciences　　　　　Medical, Dental and Pharmaceutical Sciences 　　　Interdisciplinary and Frontier Sciences
4. Host institution: Kyoto University 5. Host researcher: Professor Kazuo Aoki
6. Description of your current research I am currently working on a) stability issues for large-amplitude, high-frequency solutions of systems of hyperbolic differential equations, specifically, equations describing laser-plasma interactions, and b) stability issues for traveling waves arising in combustion models.
7. Research implementation and results under the program 　(As much as possible, describe the contents and results of your research in a manner that is easily understandable to a non-specialist in your field.): 　Title of your research plan: Laser-plasma interactions: fluid models and kinetic models   　Description of the research activities: 　My research activities in Kyoto with Professor Aoki revolved around the comparison of kinetic and fluid models for the description of laser-plasma interactions. I noticed similarities between the formal computations of the Kyoto school of Sone, Aoki, Takata et al., describing rarefied gas dynamics through kinetic models, and the WKB expansions of the Bordeaux school of Joly, Colin, Lannes et al., describing high-frequency waves through fluid models, precisely:

1. The Zakharov model describing Langmuir turbulence gives an example of a "ghost effect" (in the terminology of Sone) in a fluid-dynamical framework.

2. Transparency equalities (null conditions), as exhibited by Joly, Metivier and Rauch for Maxwell-Bloch-type equations, seem to be present in the formal Hilbert expansions of Aoki and Sone, when temperatures variations are large compared to the Knudsen number.

These remarks yield interesting questions:

a) From a mathematical point of view, ghost effects arise when the equations are not written in normal form. In the spirit of my recent work on the Zakharov equations, can one find the normal form of the equations in a kinetic context, for instance for rotating Couette flows ?

b) Is there a common algebraic structure in the WKB expansions for hyperbolic systems for large-amplitude solutions in the presence of transparenct and in the Hilbert expansions for large variations of temperature ?

Professor Aoki and I agreed to further investigate these points together in a near future.

8. Please add your comments (if any):

There are a many good restaurants, and a few nice temples in Kyoto.

RESEARCH REPORT

1. Name: TUNG Tony	（ID No.: SP05212 ）

2. Current affiliation: ENST Paris - France

3. Research fields and specialties:

    Humanities   Social Sciences   Mathematical and Physical Sciences

    Chemistry   X Engineering Sciences   Biological Sciences

    Agricultural Sciences   Medical, Dental and Pharmaceutical Sciences

    Interdisciplinary and Frontier Sciences

4. Host institution: Kyoto University, Matsuyama laboratory

5. Host researcher: Prof. Takashi Matsuyama

6. Description of your current research

The strong development of numerical technologies has lead to efficient 3D acquisition of real objects and rendering of 3D methods. Nowadays 3D object databases appear in various areas for leisure (games, multimedia) as well as for scientific applications (medical, industrial part catalogues, cultural heritage, etc.). Large database can be nowadays quickly populated using 3D mesh acquisition and reconstruction tools which have become easy to use, and with new ergonomic 3D design tools which have become very popular. As database size is growing, tools to retrieve information become more and more important. 3D object indexing appears to be a useful and very promising way to manage this new kind of data. Database indexing consists on defining a method able to perform comparisons between the database elements. Similarity retrieval is one of the main application: using a research "key", a subset of elements with the most similar keys are extracted from the database.

Our research focuses on a 3D shape matching method for 3D mesh models applied to content-based search in database of 3D objects. The approach is based on the multiresolution Reeb graph (MRG) proposed by [Hilaga et al, 01]. MRG provides a rich representation of shapes able in particular to embed the object topology. In our framework, we consider 3D mesh models of various geometrical complexity, of different resolution, and when available with color texture map. The original approach, mainly based on the 3D object topology, is not accurate enough to obtain satisfying matching. Therefore we propose to reinforce the topological consistency conditions of the matching and to merge within the graph geometrical and visual information to improve matching and calculation of shape similarity between models. Besides, all these new attributes can be freely weighted to fit the user requirements for object retrieval. We obtain a flexible multiresolutional and multicriteria representation that we called augmented multiresolution Reeb graph (aMRG). The approach has been tested and compared with other methods. It reveals very efficient for the retrieval and the classification of similar 3D shapes.

7. Research implementation and results under the program

  (As much as possible, describe the contents and results of your research in a manner that is easily understandable to a non-specialist in your field.):

   Title of your research plan:

   Shape tracking in 3D video using augmented multiresolution Reeb graph.

   Description of the research activities:

   3D video is the ultimate image media recording dynamic visual events in the real world as is; it records time varying 3D object shape with high fidelity surface properties (i.e. color and texture). Its applications cover wide varieties of personal and social human activities: entertainment (e.g. 3D game and 3D TV), education (e.g. 3D animal picture books), sports (e.g. sport performance analysis), medicine (e.g. 3D surgery monitoring), culture (e.g. 3D archive of traditional dances) and so on. Matsuyama laboratory proposes: 1. a PC cluster system for real-time reconstruction of dynamic 3D object action from multi-view video images, 2. a deformable 3D mesh model for reconstructing the accurate dynamic 3D object shape, and 3. an algorithm of rendering natural-looking texture on the 3D object surface from the multi-view video images. Experimental results with quantitative performance evaluations demonstrate the effectiveness of these methods in generating high fidelity 3D video from multi-view video images.

   During my stay at the Matsuyama laboratory we decided to apply the augmented multiresolution Reeb graph (aMRG) technique on the 3D models generated by the 3D video. Figure a. presents some frames of a 3D video sequence and Figure b. presents the corresponding Reeb graphs at resolution r=5.
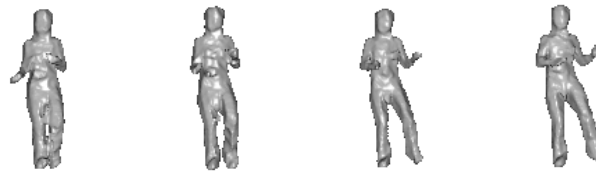

Figure a. - 3D models from the 3D video.
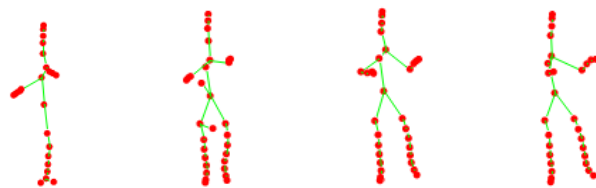
Figure b. - Reeb graphs at resolution r=5 of the 3D models.

   Afterwards it is possible to apply the aMRG matching procedure, using the additive attributes of the aMRG, to perform shape matching. We have observed that in a 3D video sequence we can find the similar poses based on the topology of the 3D models. In particular, Matsuyama laboratory works with dancing ladies 3D video (cf. Figure c.).
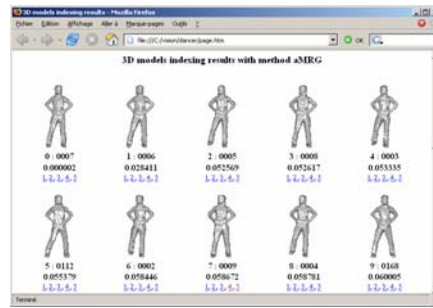
Figure c. - Example of pose retrieval.

The next step has consisted in extending the topological matching of the graphs to geometrical matching so that two 3D models taken from two consecutive frames will always be linked. As a consequence it would be possible to perform tracking of body parts, even if the topology changes. Using the information of the similarity calculation between aMRG at t-1 and t, we extend the topological matching between the aMRG at t and t+1 using geometrical based links (it is also possible to use the aMRG attributes). Figure d. presents the preliminary results.

Figure d. Topology conservation between two graphs during a sequence.

In conclusion, we have proposed an approach to track matched nodes during a 3D video sequence, especially when the topology change. The obtained results are promising but still require some more tests and parameter optimisation.

8. Please add your comments (if any): I had a really good experience during my stay at the Matsuyama laboratory. The laboratory staffs are lovely people and I really enjoyed working with them. Moreover Matsuyama laboratory pursues very interesting and high level research in the field of 3D.

RESEARCH REPORT

1. Name:　Etienne Boisnier	（ID No.: SP05213）

2. Current affiliation: Imperial College, London.

3. Research fields and specialties:

Humanities　　　　Social Sciences　　　Mathematical and Physical Sciences

Chemistry　　　　　Engineering Sciences　　　XBiological Sciences

Agricultural Sciences　　　　Medical, Dental and Pharmaceutical Sciences

Interdisciplinary and Frontier Sciences

4. Host institution: Ocean Research Institute, University of Tokyo, Tokyo.

5. Host researcher: Dr. Teruhisa Komatsu, Associate Professor at ORI.

6. Description of your current research

My current research consisted in exploring the different ways of defining, measuring and preserving marine biodiversity. By marine biodiversity I mean above all coastal fish population diversity.

I applied traditional terrestrial biodiversity measuring tools (statistical but also conceptual) to marine environment in order to bring into light some problems that appear due to the specificity of the marine environment. It led to redefine not only biodiversity itself but also the way of assessing it.

I am really interested in developing a new suitable management framework capable of preserving more efficiently, and at the lowest cost possible, coastal marine biodiversity. Artificial reefs are one important pillar of this framework.

7. Research implementation and results under the program

 (As much as possible, describe the contents and results of your research in a manner that is easily understandable to a non-specialist in your field.):

 Title of your research plan:

 Using artificial reefs as a conservation tool: a Japanese case-study.

 Description of the research activities:

 My research consisted in exploring the conservation potential of an artificial reef located off Okayama (Okayama Prefecture, Japan). Indeed, even if Japan possesses a huge number of artificial reefs, it remains really difficult, mainly due to the lack of studies, to determine to what extent artificial reefs could be suitably used as a conservation tool to preserve some endangered species and more generally to preserve marine biodiversity.

 I used from data from one artificial reef (made with oyster shell and steel) over a long-term period (more than 8 years) and examined not only the evolution of the fish assemblage composition itself but also checked the importance of environmental parameters such as water temperature, water turbidity or light intensity.

 The main purpose of the research was, using data analysis results, to be capable of modelling fish assemblage evolution over time and then to be able to make prediction for future outcomes. The idea was to create guidance for the owner of this reef, really sensitive to marine biodiversity problems, in order to manage the reef in the most efficient way.

 Because some endangered species (2 species recorded in the IUCN Red list of Threatened Species) occurred along the reef studied, it was possible to analyse the type of assemblage that led to this appearance.

 The main results are the following:

 1/ Reef population composition is linked not only to seasonal cycles but also to long-term cycles that interact continuously.

 2/ Individual number and species number evolution are disconnected until the reef carrying capacity is reached and there is a strong and clear link between species richness and threatened species appearance along the reef.

 3/ Endangered species occurrence patterns are different depending on the species. In other words, species preservation through this artificial reef has to be targeted.