

**Progress Report**

**A. Quantum Chemical Database**

**B. Chemical Prototype Projects**

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## Agenda

- VARUNA
- Collaboration with Heather Carlson?
- VARUNA for Proteins



## Porting Varuna to MySQL

- MySQL version of Varuna is now available
  - With ~4500 datasets available
- Web-Interface is being generated (will be available end of July)

## Interfacing Current Version of Varuna with other DB's

- Import & Export through VOTables have been implemented
- Web-Interface is being generated (will be available end of July)



## Possible Joint Project with Heather Carlson (MACE)

- Connect to Bind MOAD and add value by
  - Augmenting the experimental data with computed structures and energies
- Not clear yet if this is a viable path
- Due to heavy traveling, we were so far unable to sit down about this
- Will likely drive up to Michigan for a 1-1 talk about this in July/August



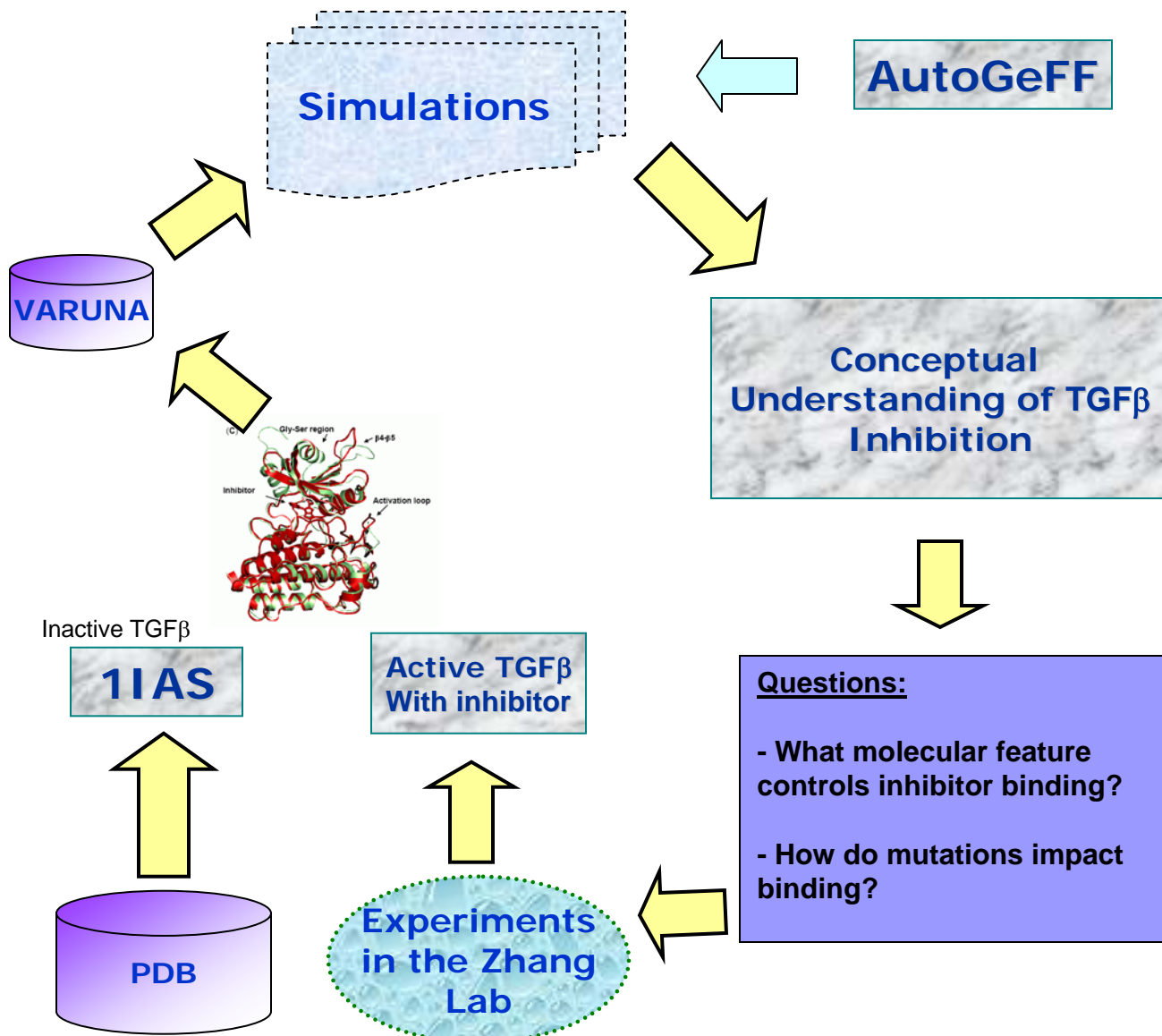
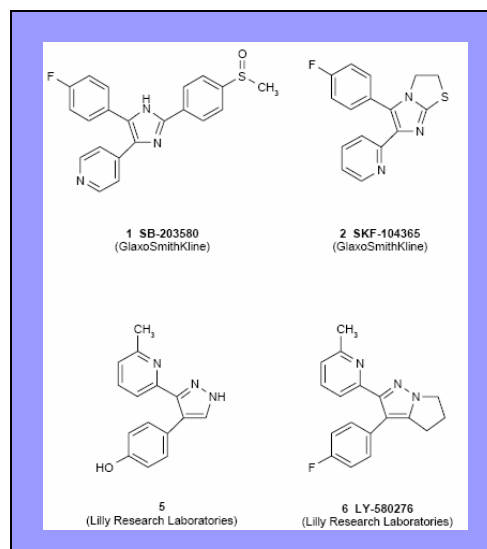
## AutoGeFF, Varuna and Workflows

- Metalloproteins are extremely important in biochemical processes
- Understanding their chemistry is difficult
- To add value to the small molecule DB's (PubChem, etc.), we must somehow connect them to PDB's, BindMOAD, etc.
- By extending Varuna's functionality to handling, storing Metalloproteins, we could provide a connection

# Prototype-Project: Controlling the TGF $\beta$ pathway

Collaboration with Faming Zhang

## in-house Molecules in Varuna



### Questions:

- What molecular feature controls inhibitor binding?
- How do mutations impact binding?



## Automatic Generator of ForceFields (AutoGeFF)

- Develop a Stand-Alone Software (in C) that can take ANY
  - drug-like molecule (from PubChem, for example)
  - metal complexes
  - metalloenzymes (from PDB, for example)
  - unnatural or functionalized amino acids, nucleobases (from in-house db)for which molecular mechanics force fields are not available and automatically generate FF's based on
  - High level Quantum Simulations (using Varuna as a Webservice)for Sophisticated Molecular Mechanics Simulations
- First Step: Coding of a specialized Prototype that can reproduce our manually derived novel force fields for Cu-A $\beta$  Alzheimer's Disease as a Proof-Of-Principles Study.
- Patrick Lorton (CS senior with a few years of Oracle employment history), and Marco Fioroni have been working on this project.
- Prototype is expected to be ready in July/August

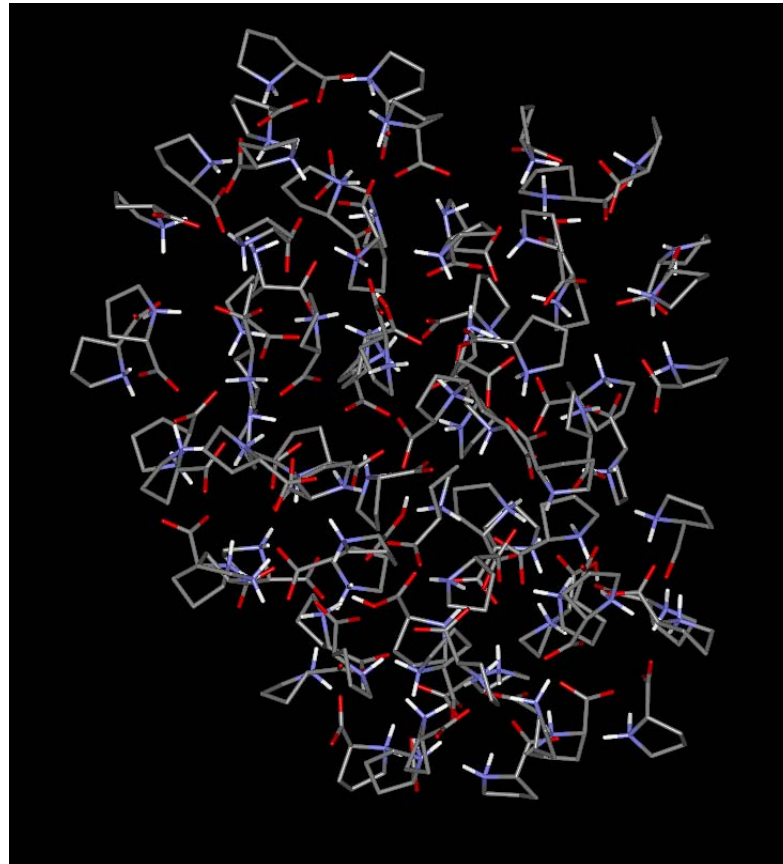


## Publications acknowledging the NIH grant

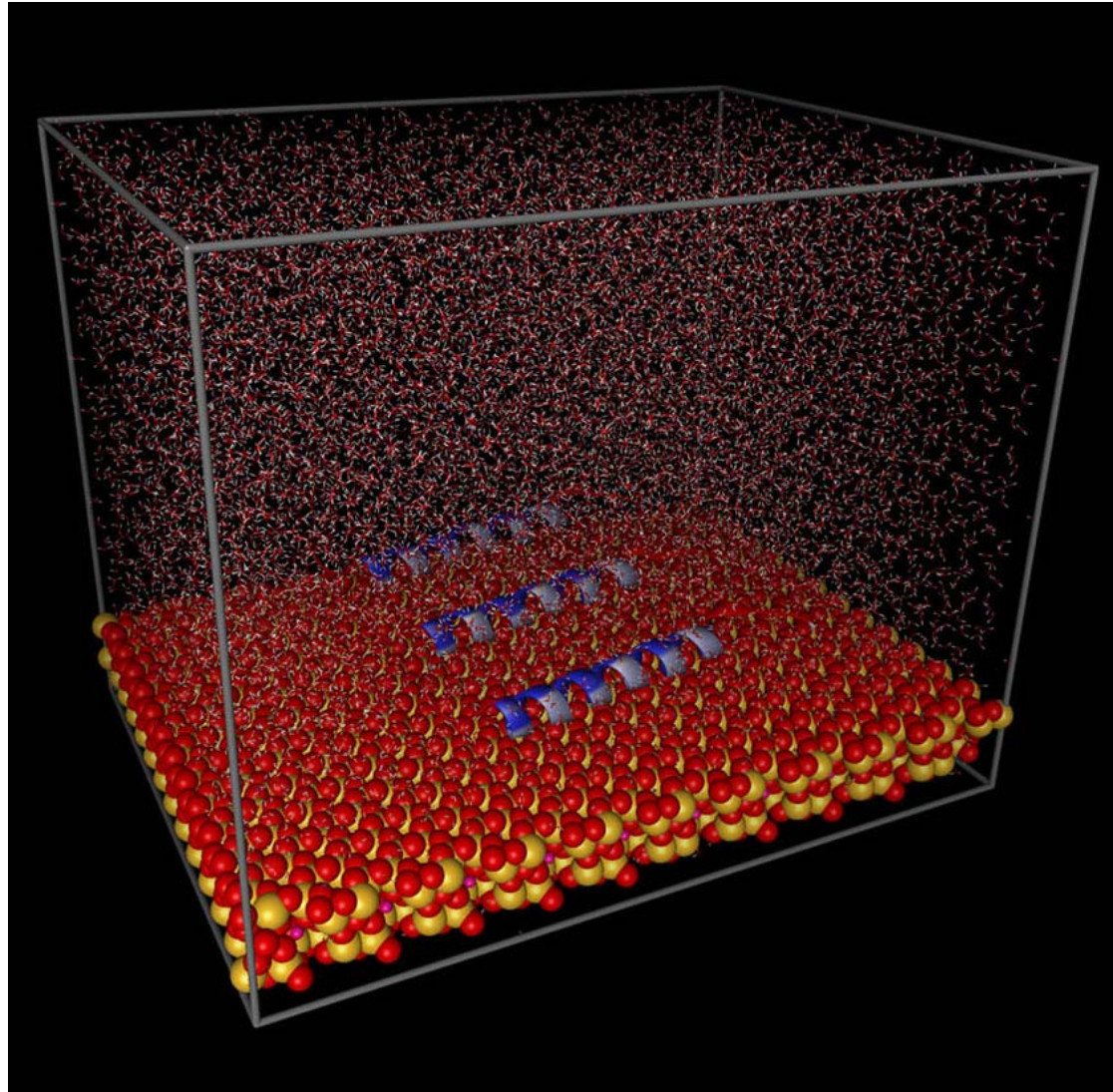
- “Intermolecular C-H Activation Promoted by a Titanium Alkylidyne” B. C. Bailey, H. Fan, E. W. Baum, J. C. Huffman, M.-H. Baik, D. J. Mindiola *J. Am. Chem. Soc.* **2005**, 127, 16016-16017
- “Cis,cis-[(bpy)2RuVO]2O4+ Catalyzes Water Oxidation formally via in situ Generation of radicaloid RuIV-O(dot)” X. Yang and M.-H. Baik *J. Am. Chem. Soc.* **2006**, 128, 7476-7485
- “A Co2N2 Diamond Core Resting State of Cobalt(I): An Intermediate in the Activation of Atmospheric Nitrogen” A. R. Fout, F. Basuli, H. Fan, J. C. Hoffman, M.-H. Baik and D. J. Mindiola *Angew. Chem. Int. Ed. Eng.* **2006**, 45, 3291-3295
- “Room Temperature Ring-Opening Metathesis of Pyridines by a Transient Ti≡C Linkage” B. C. Bailey, H. Fan, J. C. Huffman, M.-H. Baik and D. J. Mindiola *J. Am. Chem. Soc.* **2006**, 128, 6798-6799
- “Studies of the Generation and Pericyclic Behavior of Cyclic Pentadienyl Carbanions. Alkylation Reactions As An Efficient Route to Functionalized cis-Bicyclo[3.3.0]octenes” D. R. Williams, J. T. Reeves, P. P. Nag, W. H. Pitcock, Jr. and M.-H. Baik *J. Am. Chem. Soc.* **2006**, accepted
- “Chirally Directed Formation of Nanometer Scale Proline Clusters” S. Myung, M. Fioroni, R. R. Julian, S. L. Koeniger, M.-H. Baik, D. E. Clemmer, *J. Am. Chem. Soc.* **2006**, in press
- “Direct Nitric Oxide Detection In Aqueous Solution by Copper(II) Fluorescein Complexes” M. H. Lim, B. A. Wong, W. H. Pitcock, D. Mokshagundam, M.-H. Baik, S. J. Lippard, *J. Am. Chem. Soc.* **2006**, submitted
- INVITED PAPER to honor the Bob Grubbs and Dick Schrock for the occasion of their winning the Nobel Prize 2006  
Why is the 14e-Ruthenacyclobutene Intermediate of the Grubbs catalyst energetically more stable than its 16e-olefin adduct precursor?  
H. Wang, M. Vieweger, C. H. Suresh, M.-H. Baik  
*J. Organometallic Chem.* **2006**, due in June

## New Areas and New Collaborations

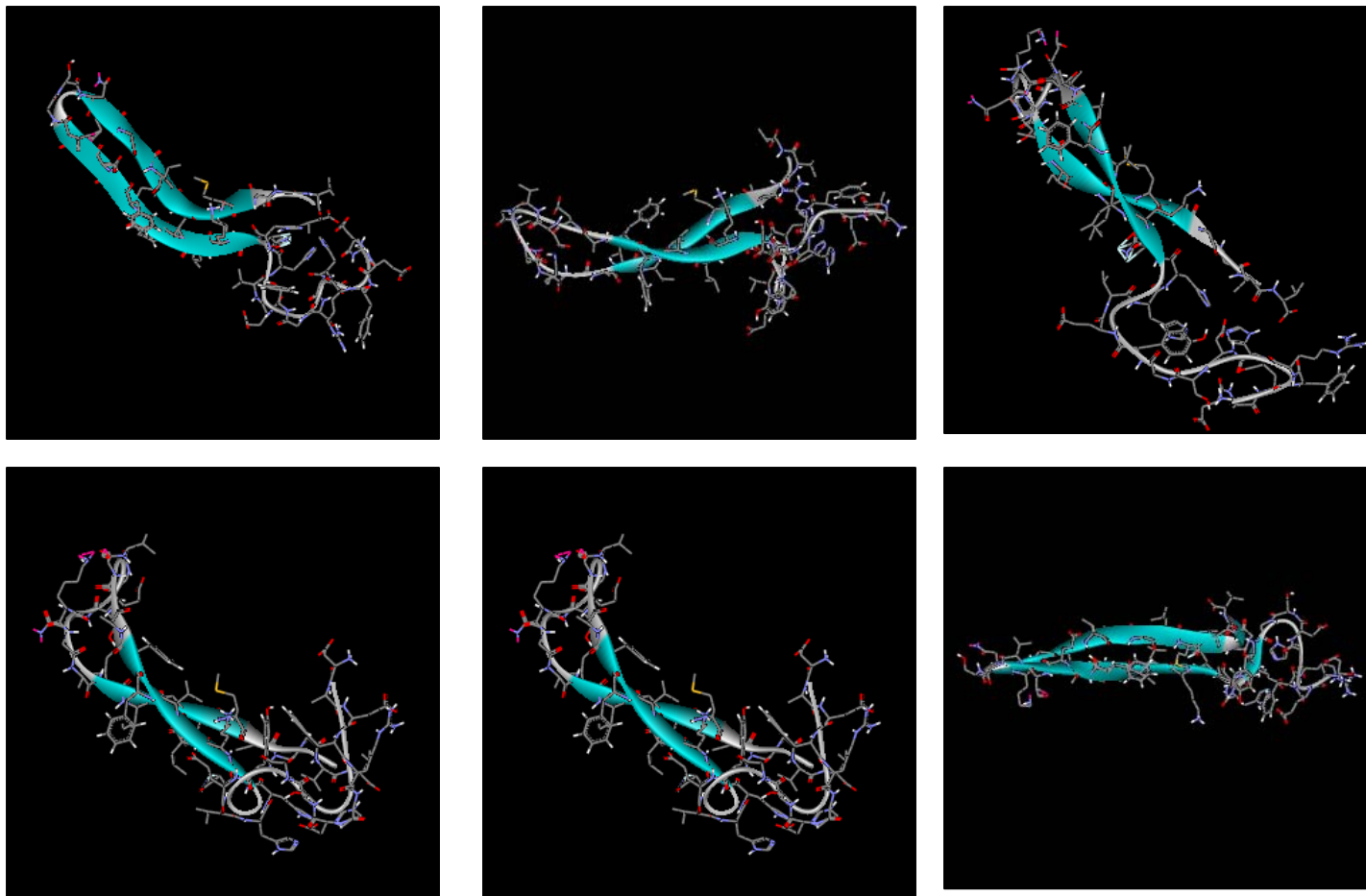
- David Clemmer
  - The Self-Assembly and Chirally Directed Formation of nanometer Scale Proline Clusters: A Mechanism for Enantio-selective formation of Life?



New Collaboration with Prof. Martin Jarrold: Structures of small peptides on a Mica Surface



# Breakthrough in Alzheimer's Research!



**Publication for JACS in preparation!**