## Direct Interaction between Amphotericin B and Ergosterol in Lipid Bilayers as Revealed by $^2$H NMR Spectroscopy

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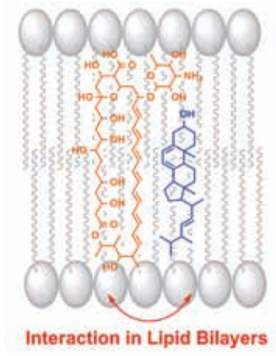
Amphotericin B (AmB) is a widely-prescribed drug for treatment of systemic fungal infections, and its clinical importance has unchanged for lack of better alternatives. Although AmB is thought to exert its antifungal activity by forming trans-membrane ion-channels together with ergosterol that is an abundant sterol in fungal cell membranes, no previous study has directly proven the AmB-ergosterol interaction. Here we prepared deuterated sterols and AmB, and measured their $^2$H NMR spectra in lipid bilayers, which demonstrated that ergosterol has significant interaction with AmB, while cholesterol rich in mammalian membranes does not. This is the first direct observation of molecular interaction between ergosterol and AmB in lipid bilayers.




## Algebraic Shifting and Graded Betti Numbers

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**Corollary.** *Let the base field be arbitrary. Let $\Delta$ be a simplicial complex and $\Delta^{\mathrm{lex}}$ the unique lexsegment simplicial complex with the same $f$-vector as $\Delta$. Then*

$$\beta_{ii+j}(I_\Delta) \leq \beta_{ii+j}(I_{\Delta^{\mathrm{lex}}})$$

*for all $i$ and $j$.*

Commutative algebra is one of the most traditional research areas of modern mathematics in Japan. The current trend of commutative algebra is the study on its computational and combinatorial aspects. This article is fit for the trend and discusses an outstanding unsolved problem concerning the behaviors of graded Betti numbers under shifting operations of simplicial complexes. By creating new algebraic techniques on generic initial ideals as well as by using clever tricks on classical combinatorics, the authors succeeded in proving affirmatively a long-pending conjecture on Betti number inequalities arising from exterior shifting and combinatorial shifting.

## Dynamic Stokes Shift of 9,9' -Bianthryl in Ionic Liquids: A Temperature Dependence Study

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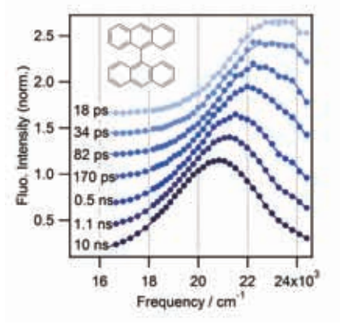
***The Journal of Physical Chemistry C***, **113**, 11868–11876 (2009)

Temperature dependent time-resolved fluorescence spectroscopy of 9,9'-bianthryl (BA) in imidazolium ionic liquids (IL) was carried out. BA in ILs undergoes ultrafast intramolecular charge transfer (CT) reaction followed by solvation process (red-shift of the emission spectrum) in the CT state. The time constant of the red-shift becomes comparable or longer than the lifetime of the CT state in highly viscous ILs and the ground state is recovered prior to the completion of the solvation process. Therefore, steady state fluorescence spectrum of BA in viscous ILs shifts to shorter wavelengths (blue-shift) with decreasing temperature due to emission from the unrelaxed CT state.




## H-NS Modulates Multidrug Resistance of *Salmonella enterica* Serovar Typhimurium by Repressing Multidrug Efflux Genes *acrEF*

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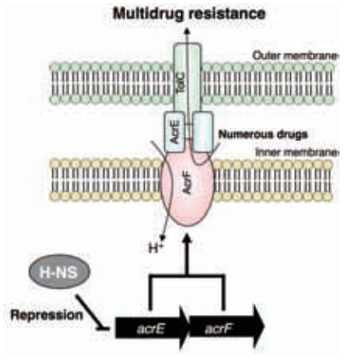
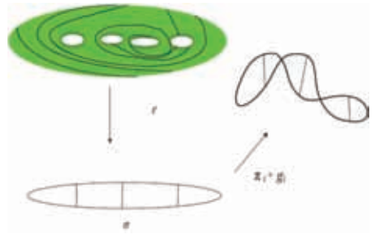
***Antimicrobial Agents and Chemotherapy***, **53**, 3541-3543 (2009)

Bacterial multidrug efflux pumps confer resistance to a wide range of antibiotics, dyes, and biocides. We have shown that *Salmonella* has nine functional drug efflux pumps. However, few data are available on the regulation of *Salmonella* multidrug efflux genes. Screening of *Salmonella* mutants for the ability to increase β-lactam resistance has led to the identification of a mutation in *hns*, which codes for the histone-like nucleoid structuring protein (H-NS). In this study, we report that H-NS modulates multidrug resistance through repression of the genes that encode the AcrEF multidrug efflux pump in *Salmonella enterica* serovar Typhimurium.







## Constructing geometrically infinite groups on boundaries of deformation spaces

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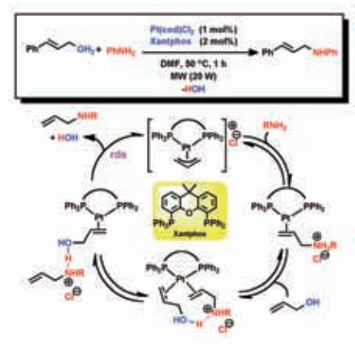
It was conjectured in 1980's by Bers, Sullivan and Thurston that every finitely generated Kleinian group would be an algebraic limit of a minimally parabolic geometrically finite groups. We have solved this conjecture affirmatively in a series of two papers. The present paper is the first part of this series. Here we have shown that for a give system of arational laminations in the Masur domain on the boundary of a convex cocompact hyperbolic 3-manifold, there exists a limit group on the boundary of the deformation space in which the system is the union of unrealisable laminations.




## Platinum-Catalyzed Direct Amination of Allylic Alcohols under Mild Conditions: Ligand and Microwave Effects, Substrate Scope, and Mechanistic Study

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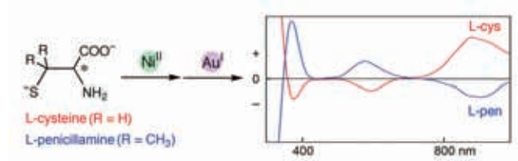
***Journal of the American Chemical Society***, **131 (40)**, 14317–14328 (2009)

Direct catalytic amination of allylic alcohols, in which water is the sole coproduct, is achieved. By using platinum catalysts supported by large bite-anlge diphosphine ligands such as Xantphos and DPEphos, various monoallylamines such as the biologically active compounds Naftifine and Flunarizine are synthesized in good to high yield without need for an activator. Furthermore, several catalytic intermediates including Pt(xantphos)$Cl_2$, Pt($\eta^2$-$C_3H_5OH$)(xantphos), and [Pt($\eta^3$-allyl)(xantphos)]OTf are isolated and characterized. Based on these experimental results, the activation of the OH group of allylic alcohols by the HCl salts of amines plays an key step in the catalytic cycle.




## A Multinuclear Coordination System of L-Cysteine and L-Penicillamine That Induce Opposite Chiralities at Metal Centers

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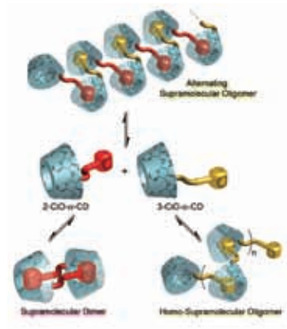
***Angewandte Chemie International Edition***, **48**, 8469-8472 (2009)

In nature, penicillamine exists in D-form that is opposite to L-form of cysteine, although the only difference between penicillamine and cysteine is the presence/absence of methyl groups on β-carbon atom. Herein, we evidenced based on spectroscopic and crystallographic studies that L-cysteine and L-penicillamine form the same $Au^{I}_3M_2$ (M = $Ni^{II}$, $Co^{III}$) pentanuclear structures with opposite chiral configurations about octahedral metal centers, thus exhibiting CD spectra enantiomeric to each other. This remarkable phenomenon was explained in terms of intramolecular hydrogen-bonding and steric interactions, which may provide insight into why D-penicillamine behaves like L-cysteine in nature.




## Social Self-Sorting: Alternating Supramolecular Oligomer Consisting of Isomers

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Bio-materials, such as microtubules and hemoglobin, are composed of two kinds of building blocks. These molecules exhibit a high affinity with each other and, hence, form complexes referred to as social self-sorting. In many cases, mixtures of isomers lead to the formation of homo-supramolecular assemblies, called narcissistic self-sorting. In the process, molecules show a high affinity for themselves. Social self-sorting is comparatively rare because two hetero units often form a thermodynamically-unfavorable structure. Herein, we observed the formation of homo-supramolecular complexes by isomers of cinnamoyl α-CD (CiO-α-CD), and the formation of an alternating supramolecular oligomer by the mixture of isomers in such a way that represents a social self-sorting system.