1048-13-172 **Alicia Dickenstein** (alidick@dm.uba.ar), **Laura Felicia Matusevich** (laura@math.tamu.edu) and **Ezra Miller*** (ezra@math.duke.edu). *Combinatorics of binomial primary decomposition.*

An explicit lattice point realization is provided for primary components of an arbitrary binomial ideal in characteristic zero, in terms of congruences on finitely generated commutative monoids. The decomposition is derived from a characteristic-free combinatorial description of certain primary components of binomial ideals in affine semigroup rings, namely those associated to faces of the semigroup.

The relevance to biochemical networks occurs via complex-balancing mass action systems. Each strictly positive initial concentration for a given such system lies in the stoichiometric compatibility class of a unique complex-balancing state, which Horn's Global Attractor Conjecture posits should be a global attractor for the interior of its invariant polyhedron. Approaching this conjecture by definition involves dynamics near the boundary. On the other hand, the space of complex-balancing steady states for a mass action system ("toric dynamical system") is the positive zero set of a certain binomial ideal. Although this ideal can be chosen prime for the purpose of restricting to the interior, the natural ideal produced by the dynamics has components at the boundary. Binomial primary decomposition provides a potential tool for analyzing the boundary components. (Received February 09, 2009)