998-34-67 **Alexey Kuznetsov*** (alexey@bu.edu), Mathematics Department, CAS, 111 Cummington st., Boston, MA 02215, Boston, MA 02215, **Mads Kaern** (mkaern@bu.edu), Biomedical Engineering Department, ENG, 44 Cummington st., Boston, MA 02215, Boston, MA 02215, and **Nancy Kopell** (nk@bu.edu), Mathematics Department, CAS, 111 Cummington st., Boston, MA 02215, Boston, MA 02215. *Synchronization and suppression of oscillations in an ensemble of genetic relaxation oscillators.*

Oscillatory behavior has been observed in different natural and engineered gene regulatory networks. Previous work has demonstrated non-synchronous, erratic oscillations in a population of cells containing artificial genetic oscillators in which the individual oscillators are uncoupled from each other. Here, we present the analysis of a robust, hysteresis-based genetic relaxation oscillator, population of which can be synchronized. The oscillator is constructed by connecting two subsystems that have previously been implemented experimentally. The first subsystem is a robust genetic bistable element, and the second one is an intercell communication mechanism involved in quorum-sensing. The latter subsystem drives the toggle switch through a hysteresis loop in single cells and acts as a diffusive coupling between individual cellular oscillators in a cell population. We demonstrate the possibility of both population synchronization and suppression of oscillations, depending on diffusion strength and other parameters of the system. We propose an optimal choice of the parameters; we also find small variations in the architecture of the gene regulatory network that substantially expand the oscillatory region and improve the likelihood of observing oscillations experimentally. (Received January 30, 2004)