

RUTGERS UNIVERSITY  
DEPARTMENT OF STATISTICS AND BIOSTATISTICS  
HILL CENTER #501, BUSCH CAMPUS, PISCATAWAY

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**Seminar**

**Speaker:** Lawrence Shepp  
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**Title:** A mathematical approach to managing diabetes

**Date:** Wednesday September 10, 2008

**Time:** 3:20 PM

**Place:** 552 Hill Center

**Abstract**

Closed-loop control of diabetes automates insulin delivery by an implanted insulin pump, using an algorithm which bases its decisions on continuous readings of blood sugar levels. An algorithm is effective if it lowers A1<sub>c</sub>, the percent of hemoglobin molecules (a proxy for collagen) which have been glycated, i.e., have absorbed a molecule of sugar, because damage occurs to diabetics when their collagen is glycated. Red blood cells contain the hemoglobin and have a mean lifetime of 120 days. Thus a blood sample can be used to obtain a new measurement of A1<sub>c</sub> every 120 days. We derive a formula for A1<sub>c</sub> by a direct mathematical method (which seems to give physical and medical insight) based directly on blood sugar levels, without the need for a blood sample. The new formula is useful in many ways, despite the fact that the data shows that it is less accurate in particular people (apparently the "slow glycaters"). Joint work with Cun-Hui Zhang et al.

Time permitting, I will indicate the proof that the expected number of real zeros of the polynomial of degree  $n$  with iid symmetric coefficients with tail behavior  $\frac{1}{(\log t)^a}$  with  $a > 1$ , is asymptotic to

$\left(\frac{a-1}{a-0.5}\right) \log n$  as  $n$  tends to infinity. This is a problem I have worked on for about 40 years and finally solved; it clears up some old questions but raises even more new ones.