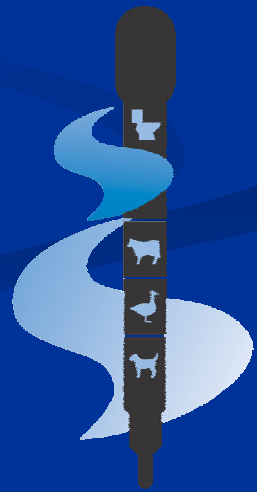
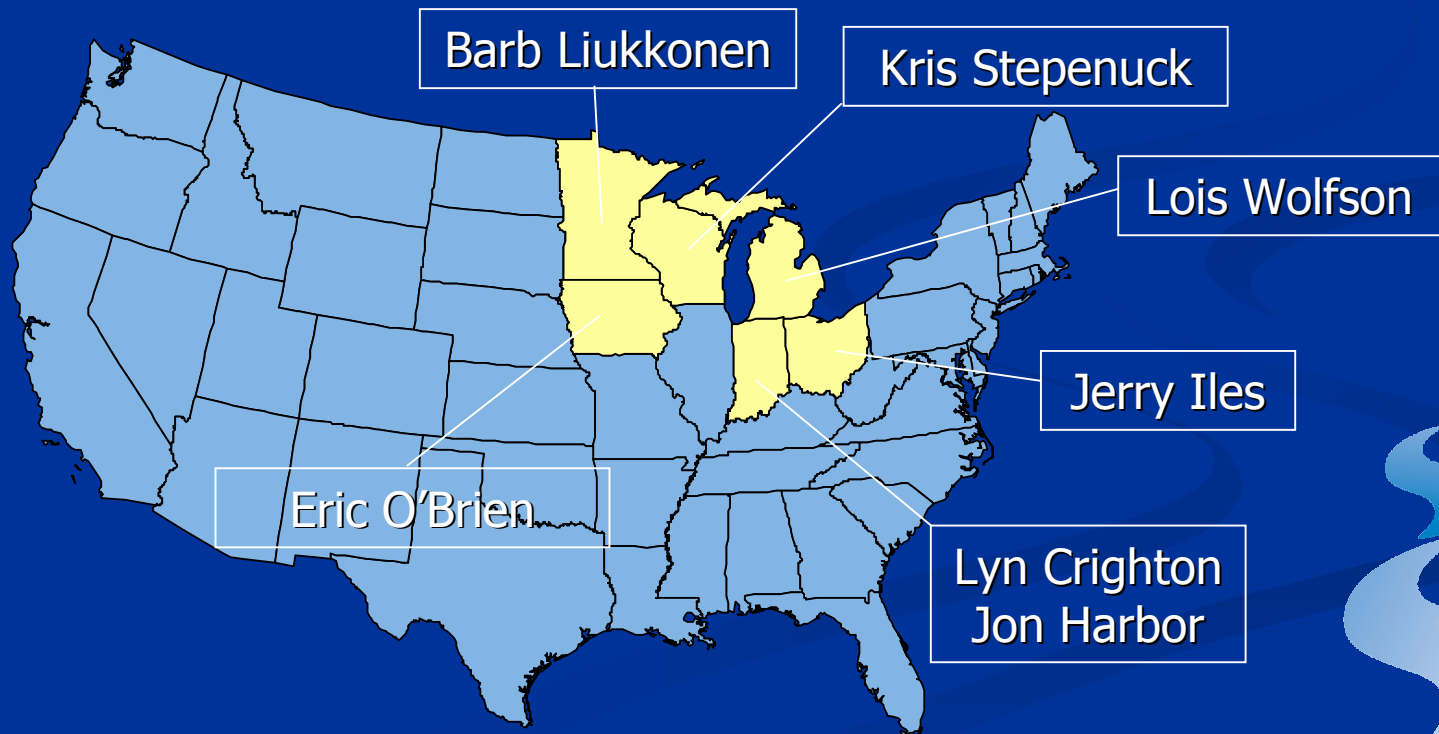


# Volunteer Monitoring of *E. coli* in Upper Midwest Streams: A Comparison of Methods and Preferences

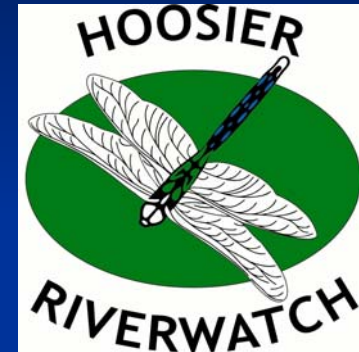
## The Hunt for Red *E. coli*



CSREES

EDUCATION • INNOVATION  
USDA  
RESEARCH • EXTENSION

# Project Partners

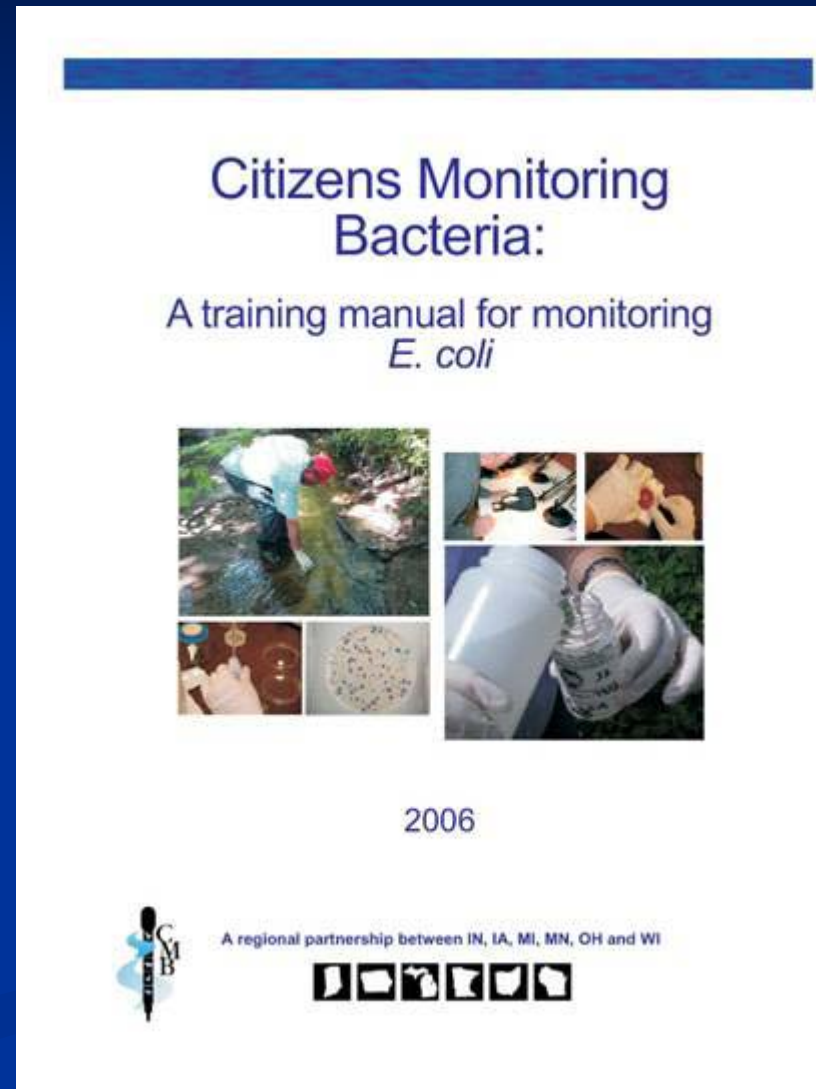


*Water Action Volunteers*



# Project Goals

- Determine the accuracy and reliability of *E. coli* home lab methods when used by volunteers
- Recommend a home lab method for use by volunteers
- Produce training program
- Increase use of volunteer-collected data
- Go in the same direction!!



# Why research *E. coli* home lab methods with volunteers?



- Citizens want an easy, reliable, inexpensive method
- High cost of lab analyses & shipping
- Lab access can be problematic
- Many economical home lab methods available
- No independent study comparing these methods to traditional lab methods – nor how they work for volunteers

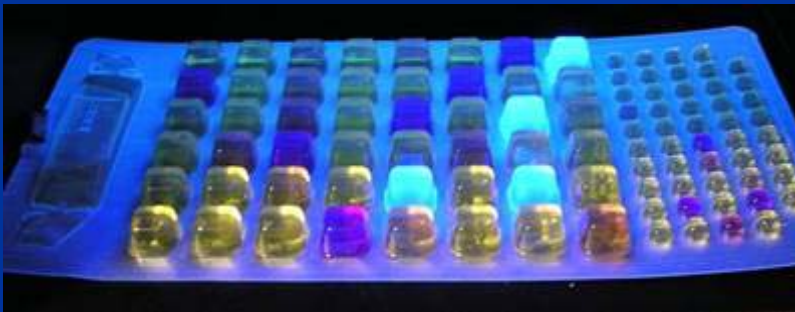
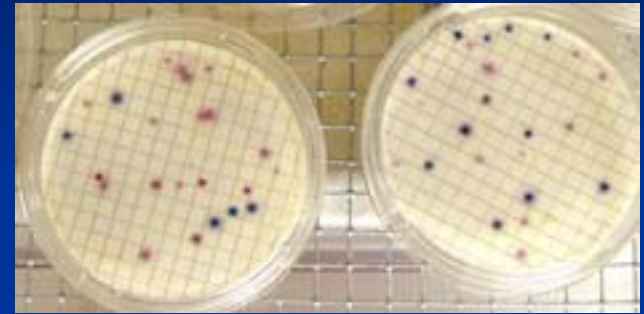
# Project Overview

- Year 1 - 2004
  - Pilot testing 5 home lab methods in 2 states (Iowa and Indiana) → recommendation
  - Developed training materials
- Year 2 - 2005
  - Compared recommended home lab methods to state lab methods in all 6 states
  - Evaluated data and training methods
- Year 3 - 2006
  - Continued testing home lab vs. state lab methods
  - Shared results and materials



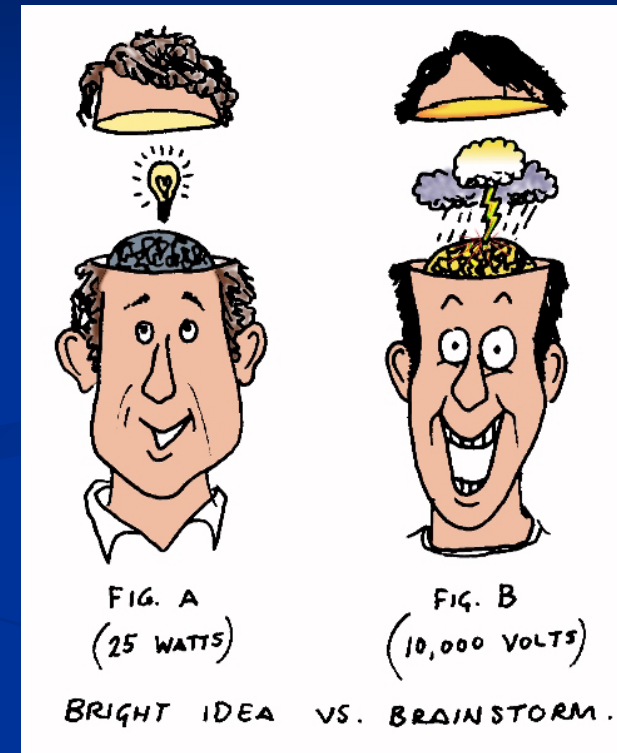
# 2004 Testing – Iowa & Indiana

- Home lab methods:
  - Coliscan<sup>®</sup> Easygel (incubated)
  - Coliscan<sup>®</sup> Easygel (not incubated)
  - 3M<sup>™</sup> Petrifilm<sup>™</sup>
  - Coliscan<sup>®</sup> MF Method Kit (*IN only*)
  - Colisure<sup>®</sup> Method with IDEXX Quanti-Tray/2000<sup>™</sup> (*IA only*)



# Results – 4 Decision Criteria

- Evaluation of
  - 1) Cost of home lab methods
  - 2) Ability to make distinctions on impaired waters (235 cfu/100ml)
  - 3) Regression models (lab vs. volunteer)
  - 4) User friendliness (volunteer preferences on surveys)
- So what did this yield?



# Results:

## (1) Cost of Home Lab Methods

Method	Cost/Sample	Additional Costs
Coliscan <sup>®</sup> Easygel	\$1.85	Incubator (varies)
3M <sup>™</sup> Petrifilm <sup>™</sup>	\$1.06	Incubator (varies)
Coliscan <sup>®</sup> MF	\$1.70	Incubator (varies) Filter apparatus (\$7.00) Syringe & hose (\$2.50)
Colisure <sup>™</sup> Method with the IDEXX Quanti-Tray <sup>®</sup> /2000	<b>\$5.45</b>	Incubator (varies) <b>Sealer (\$4,000)</b> UV light & box (\$240)



# 2004 Results:

## (2) Identify Impairments

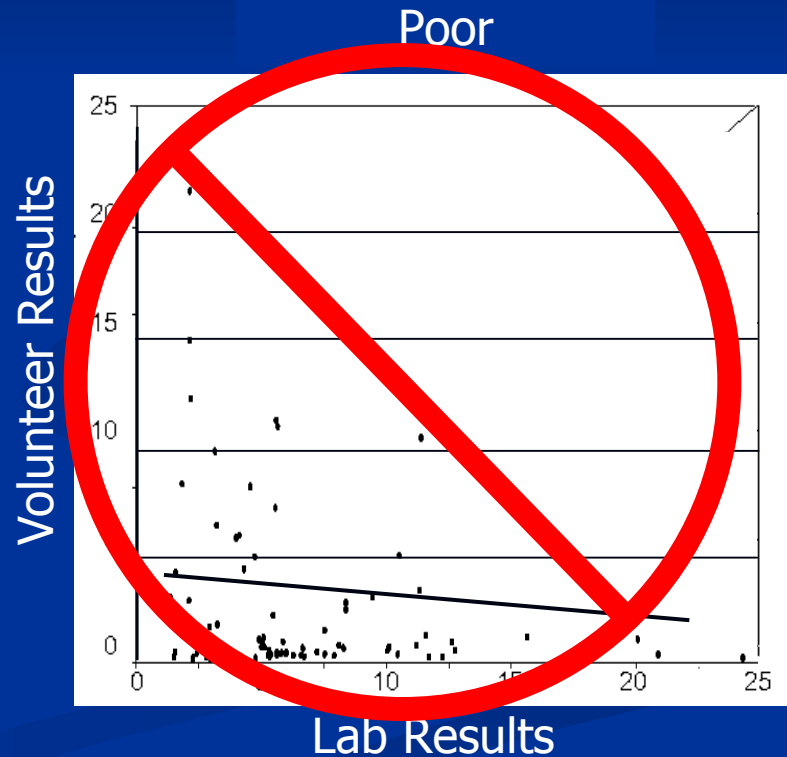
- Four methods were statistically significant for predicting above or below EPA standards (235 cfu/100 mL)
  - IDEXX Colisure
  - 3M™ Petrifilm™
  - Easygel – incubated
  - Easygel – not incubated

Volunteer	NO	YES
	<b>235 cfu?</b>	
	YES	NO
		Lab

# 2004 Results:

## (3) Regression Models

- Home lab methods showing best relationship as compared to lab values:
  - IDEXX Colisure
  - 3M™ Petrifilm™
  - Easygel – Incubated
- Those with poor correlation
  - Easygel – Non Incubated
  - Coliscan MF



# 2004 Results:

## (4) Volunteer Preference

- Based on “End of Season” Evaluations
- Preferences mirrored accuracy results
- Positive reaction to 3M<sup>TM</sup> Petrifilm<sup>TM</sup>, Easygel Incubated, and IDEXX Colisure
- Less enthusiastic about Coliscan MF and Easygel not incubated



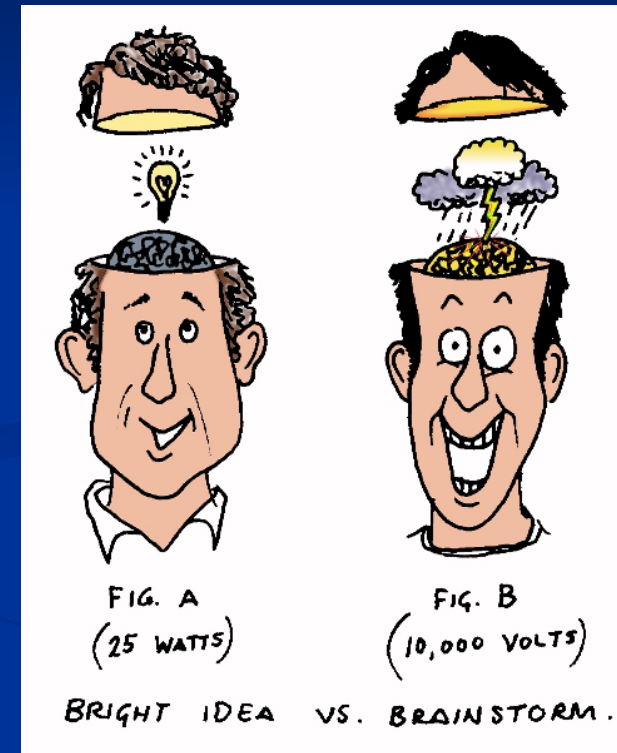
# Preliminary Decision

- And the winners were...
  - 3M™ Petrifilm™
  - Incubated Coliscan® Easygel
- Michigan, Minnesota, Ohio, and Wisconsin used these methods in 2005 and 2006
- Iowa and Indiana volunteers...
  - Continued monitoring all 5 methods during 2005, plus...
  - IDEXX Colilert™ was tested in Iowa in 2005 & 2006
  - IDEXX Colisure™ & Colilert™ were tested in Indiana in 2006



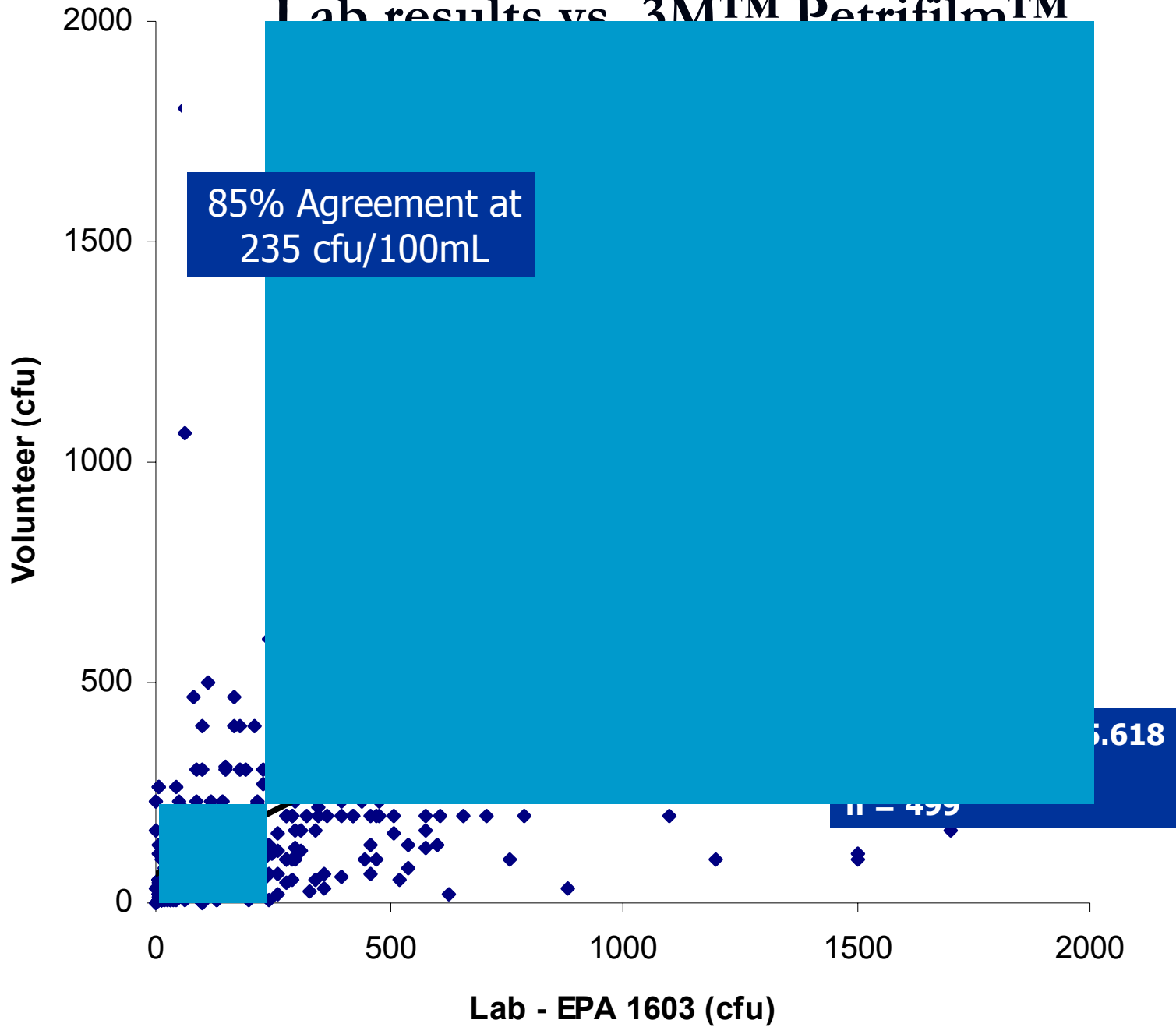
# Results – Decision Criteria

- Evaluation of
  - 1) Cost of home lab methods
  - 2) Ability to make distinctions on impaired waters (235 cfu/100ml)
  - 3) Regression models (lab vs. volunteer)
  - 4) User friendliness (volunteer preferences on surveys)





# Lab results vs. 3MTM Petrifilm™



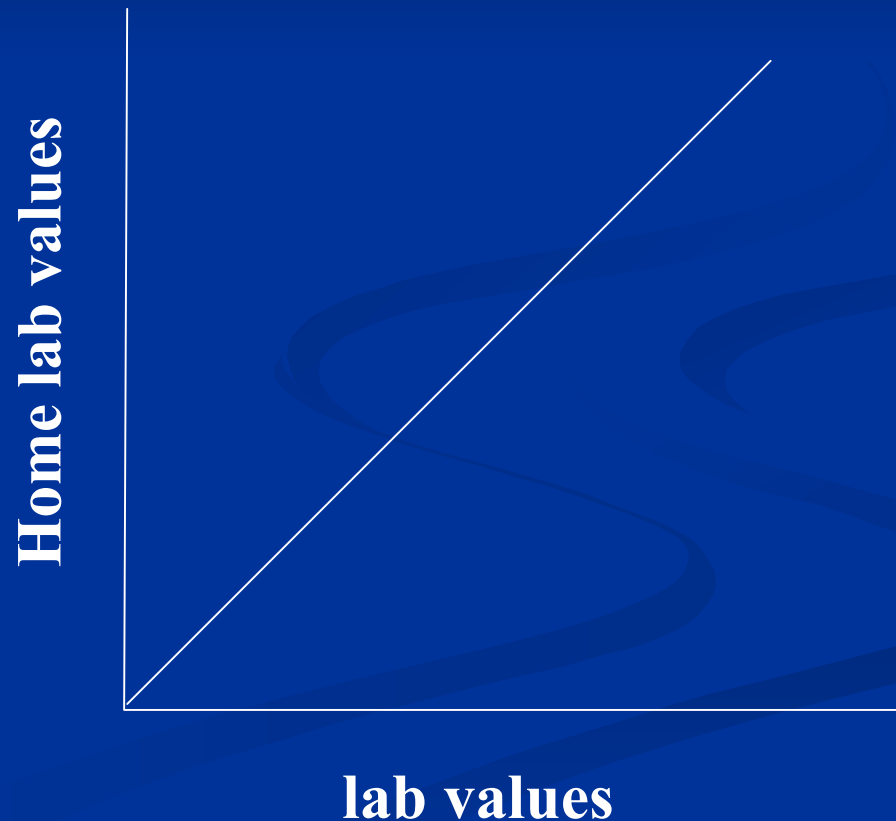
# 2005 Results

Percent of samples with home lab and state lab values **both** either **above or below** the 235 cfu/100 mL **cutoff** value.

Test	n	% Agreement
Colisure (IDEXX)	174	88%
Petrifilm (3M)	499	85%
Colilert (IDEXX)	163	83%
Easygel - Incubated	504	81%
Coliscan MF	95	79%
<del>Easygel - Room Temp</del>	<del>250</del>	<del>63%</del>

# Regressions

- Equation of line:  $y = mx + b$
- Best case scenario:
  - Volunteer data match lab data exactly
  - $m = \text{slope} = 1$
  - $b = \text{intercept} = 0$
  - $R^2 = 1$

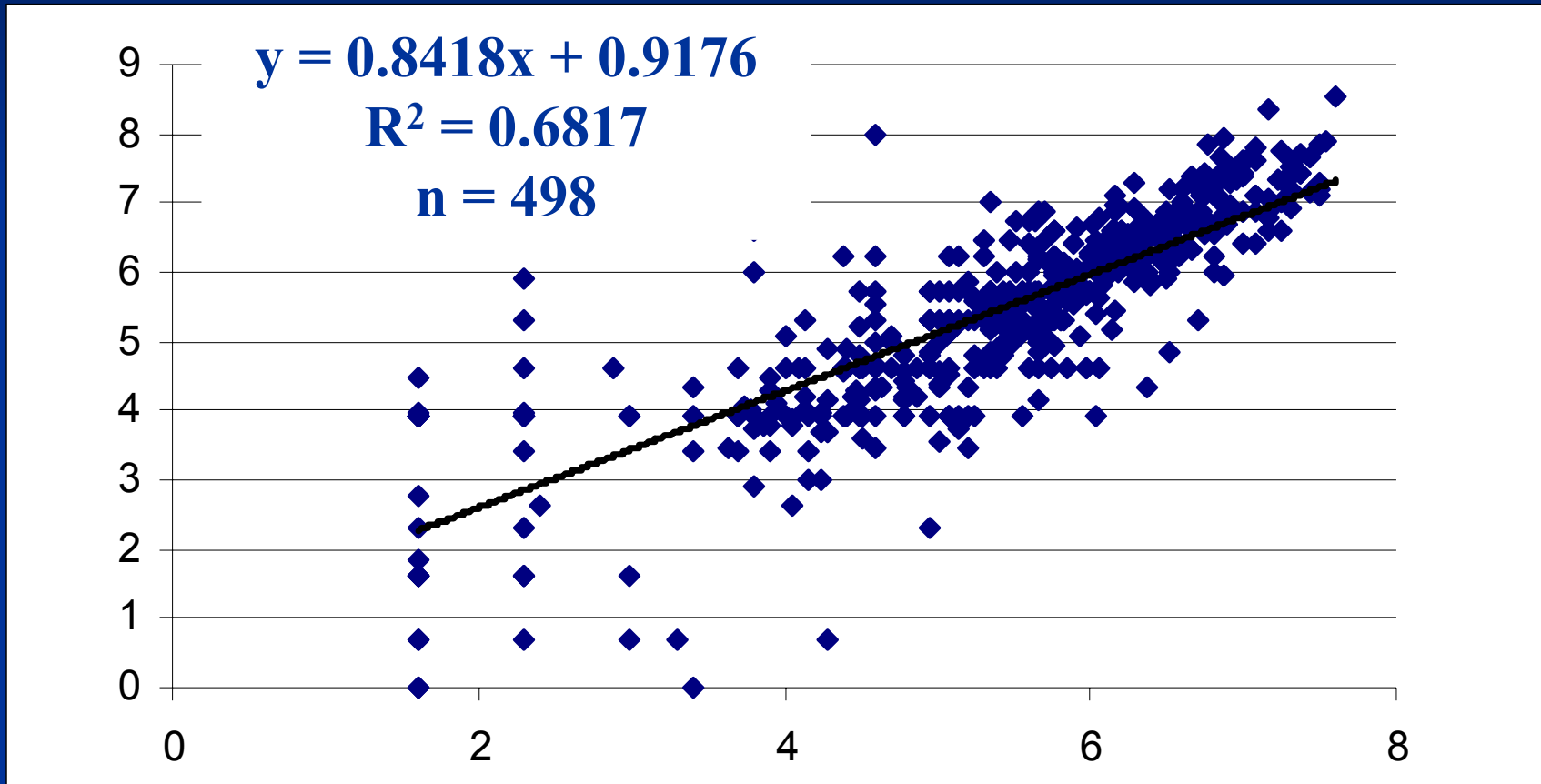


# Lab vs. home lab – IN & IA

## IDEXX Colisure

### 2004-6

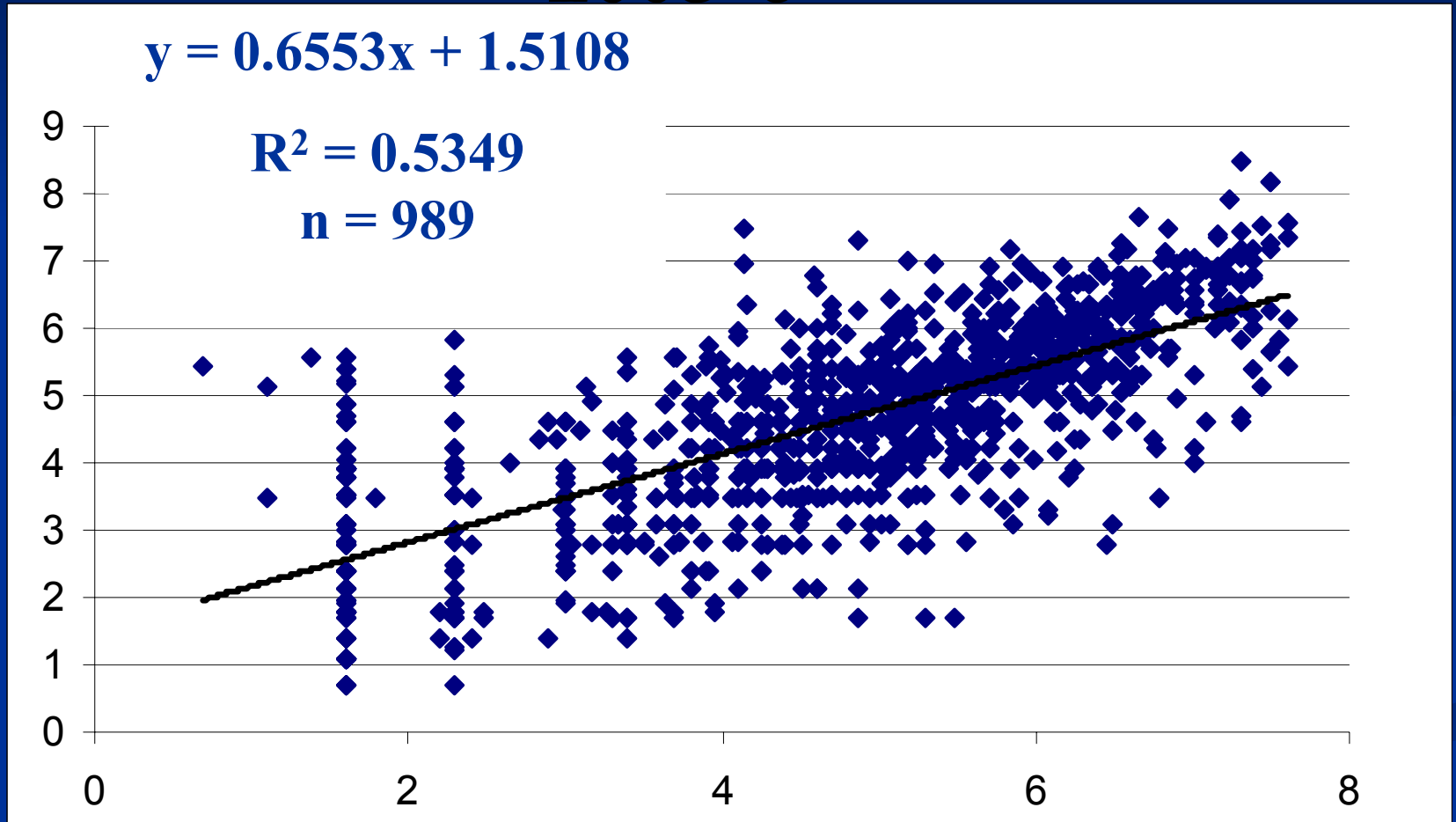
Natural log Colisure 24 hr values



Natural log lab values

# Lab vs. home lab - All states Coliscan Easygel - incubated 2005-6

Natural log Easygel 24 hr values



Natural log lab values

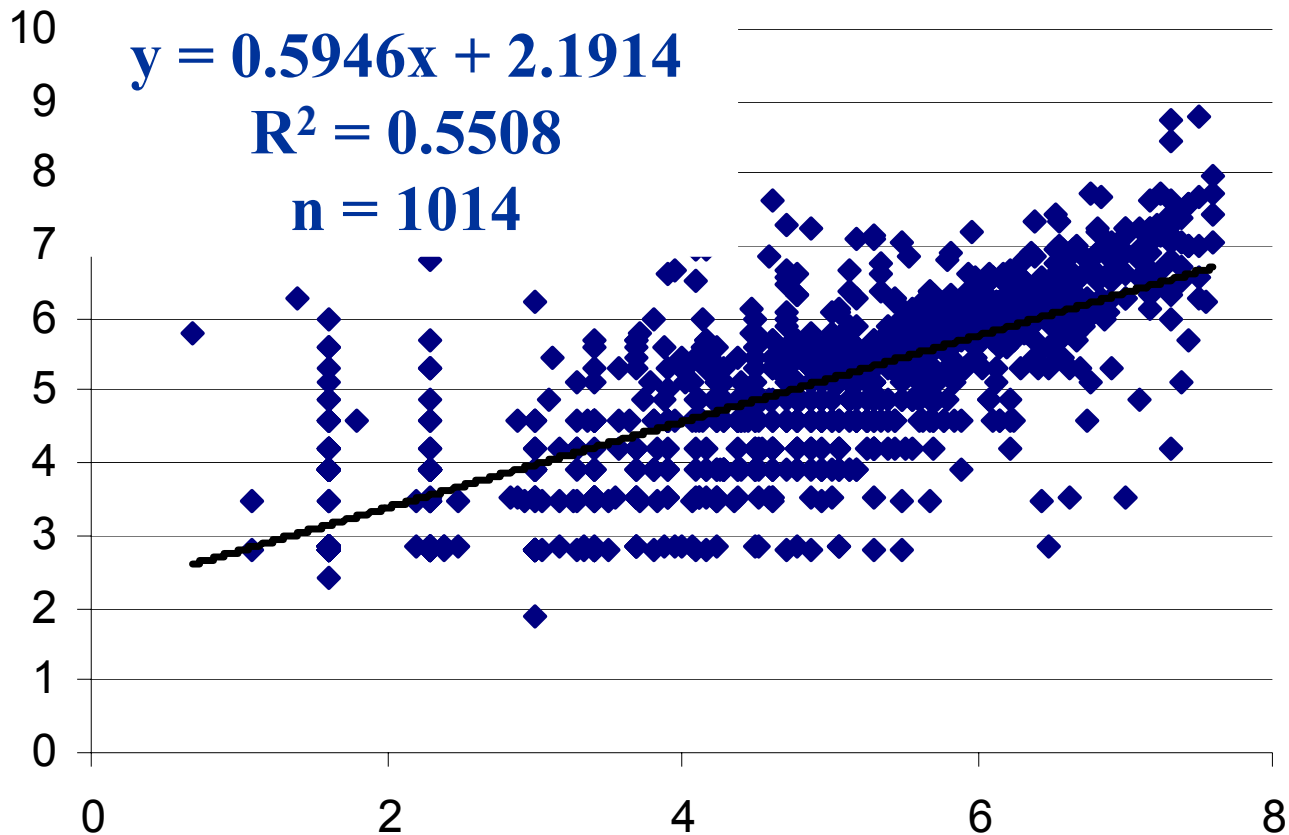


# Lab vs. home lab - all states

## 3M Petrifilm

### 2005-6

Natural log Petrifilm 24 hr values

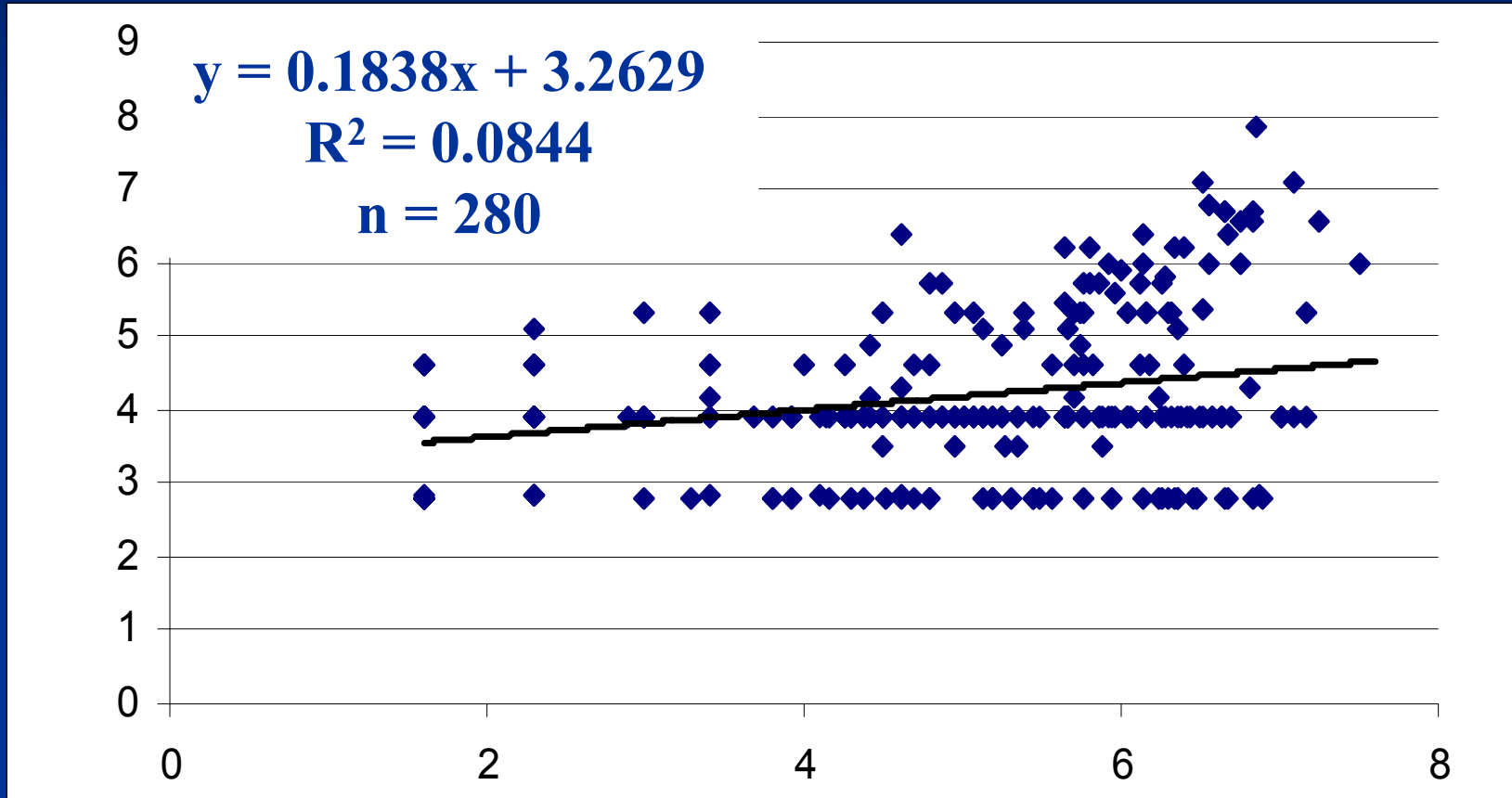


Natural log lab values

# Lab vs. home lab – IN & IA

## Easygel – not incubated 2004-5

Natural log Easygel- non-  
incubated 24 hr values



Natural log lab values

# 2004-6 Results: Regression Models

- Home lab methods showing best relationship between volunteer and lab values are:
  - IDEXX Colisure
  - IDEXX Colilert
  - 3M™ Petrifilm™
  - Easygel – Incubated
- Those with poor correlation
  - Easygel – Not Incubated
  - Coliscan MF

# 2006 Results:

## Volunteer Preferences

- Volunteers preferred 3M Petrifilm (n=56)
  - 3M Petrifilm: 66% (37)
  - Easygel (incubated): 26.8% (15)
  - Colilert: 5.4% (3)
  - Colisure: 1.8% (1)
- Note: Eight people had the option to choose IDEXX methods; Four of those chose 3M Petrifilm

# 2006 Results:

## Volunteer Preferences

- Difficult time distinguishing between blue and teal colonies with Easygel
- Less time and mess to set up a Petrifilm test
- The Easygel method allowed samples to be diluted, which the Petrifilm method did not.
- IDEXX were easy to read; some had problems with incomplete fluorescence

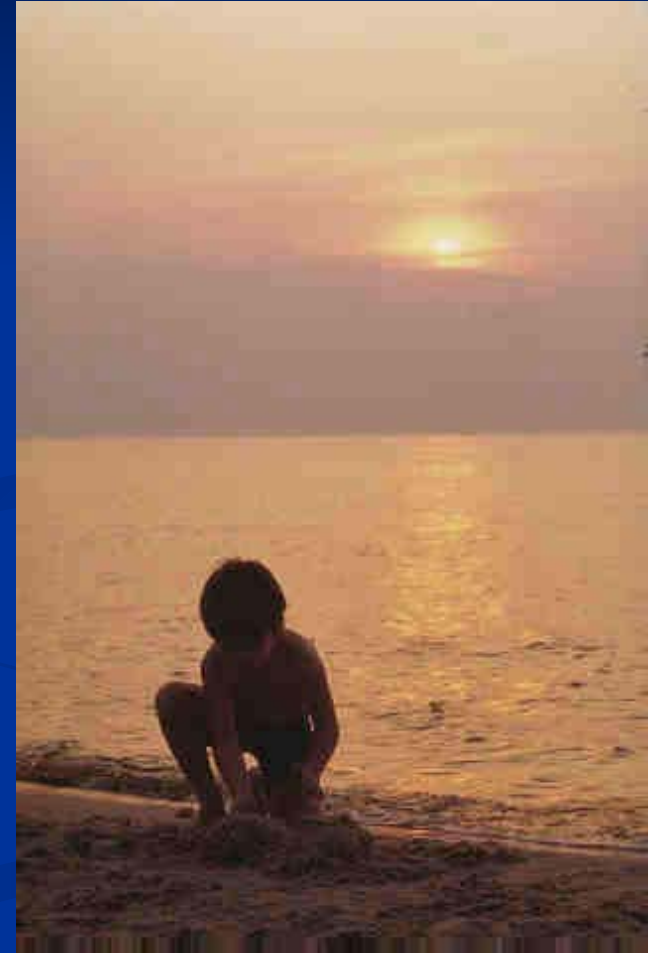


# Conclusions

- IDEXX Colisure and Colilert, Coliscan Easygel® (incubated), 3M™ Petrifilm™
  - Perform well hitting above and below 235 cfu/100 mL
  - Strongest correlations with lab results
- Volunteers across all states preferred 3M Petrifilm
- Cost of IDEXX prohibitive for some volunteer groups

# Recommended Method

- Which method depends on data needs of the group
  - Home well contamination?
  - Local swimming hole quality?
  - Community wastewater treatment plant?
  - “Get” a local farmer?
- These methods can be excellent screening tools
  - Need additional QA/QC measures if regulatory purposes



# Acknowledgements

- USDA CSREES
- USDA CSREES Great Lakes Regional Water Quality Program
- Volunteers in IA, IN, MI, MN, OH, and WI

[www.usawaterquality.org/volunteer/Ecoli](http://www.usawaterquality.org/volunteer/Ecoli)

