

# Custom Software Development for Clinical and Basic Research

Presented By  
Division of Biomedical Informatics

## Agenda

- Introduction
- BMI Development Service Offerings
- Development Technologies
- Custom Development vs Out of Box (OTB)
- Sample of BMI Developed Applications

## Development Resources

- John Stullenberger (Development Team Lead)
  - Microsoft / .NET / SharePoint
- Jeremy Nix (Development Team Lead)
  - Java / I2B2 / Epic
- Andy Rupert (Development Team Lead)
  - Open Source (PHP)
  - Research Content Experts (Genomics)
- Appx 20 Developers
  - Research Grants
  - Divisional Operations Work
  - 1 week to Years

## **BMI .NET Team Service Offering**

- **Types of Applications**
  - Web Applications / Services
  - Desktop Applications
  - Mobile Device Development
- **Uses of our Applications**
  - Electronic Data Capture
  - Data Reporting
  - Interactive Systems
  - Collaboration Systems
  - Alert / Notification Systems
  - Utility / Automation Systems

## NET Development Technologies

- Java / Eclipse
- Python / Django / PHP
- C# .NET Development / Visual Studio Suite
- SharePoint 2010 Hosting / Development
- Oracle / SQL Server / MySQL
- Source Control
  - Team Foundation Server
  - SVN Repositories

## Development Technologies

- Third-Party Integration / .NET Framework
  - Epic Web Services
  - AARDEX / MEMS Web Services
- Amazon Web Services
- Microsoft Azure
- Mobile Development
  - iOS Development / XCode
    - iPad / iPhone / iTouch
  - HTML 5 / JavaScript

# Custom Development vs Out of Box (OTB) Key Differences

- **\*Cost**
- **\*Time**
- **\*Functionality**
- Flexibility
- Security
- Accessibility

# Custom Development vs Out of Box (OTB)

- Out the Box
  - Pros
    - Less Expensive
    - Faster to Implement
  - Cons
    - Limited Functionality
    - Limited Customization
  - 80 / 20 Rule

## C-MIND Study

- The C-MIND study is a 5 year NICHD funded contract tasked with creating standardized methods for recruiting, scanning and processing brain imaging data from children from birth through adolescence.
- Required custom intake forms, uploading of fMRI images, custom longitudinal query interface, and data processing.
- ~500 fields per participant (plus longitudinal aspect)
- PI's - Scott Holland, Jen Vannest



C-MIND

# \*Andy Dev\* C-MIND Data Management

[Sign In](#) [Dashboards](#) [Variable Dictionary](#) [Help](#)

Username:

Password:

Or click an icon below to log in using one of our trusted partners:



If you are having problems logging in please email [help-cmind@bmi.cchmc.org](mailto:help-cmind@bmi.cchmc.org) for questions.

Don't have an account? You can register for one [here](#)

Forgot your password? You can reset it [here](#)

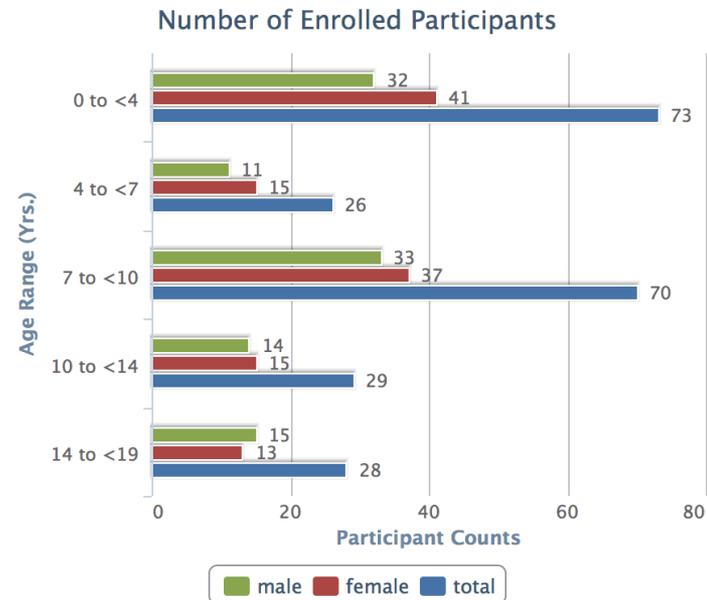


# \*Andy Dev\* C-MIND Data Management

Data Entry & Upload   Query and Processing   Dashboards   Variable Dictionary   Administration   Help

Recent Updates:

- 10/01/2014 - Ver. 1.712
  - Fixed dashboard query values
- 08/26/2014 - Ver. 1.710
  - Removed UCLA from longitudinal dashboard.
- 08/11/2014 - Ver. 1.612
  - Fixed a bug in displaying some query variables



**\*\*Age is based upon the age at first scan. If not present it will use age at screening, and if that is not present it will use the ID.**



## \*Andy Dev\* C-MIND Data Management

[Data Entry & Upload](#)
[Query and Processing](#)
[Dashboards](#)
[Variable Dictionary](#)
[Administration](#)
[Help](#)

Not Completed
  One Completed Entry
  Completed
  N/A

[Start New Screening](#)

**Year 1**

Year 2

Year 3

Participant	Withdrawn/ Phone Screens Only	Initial Screening Interview	Telephone Questionnaire (Long)	Signed Consent	Neurological Exam	Hearing Test	Neuropsych Battery Forms	Tanner Scale	Time in Scanner/ Medical Abnorm.	Stim-Q	NeuroRad. Findings
AndyTest_00M001	<input type="checkbox"/>	12/11/2011 Andrew Rupert	12/11/2011 Andrew Rupert	09/03/2014 Andrew Rupert	12/11/2011 Andrew Rupert	12/11/2011 Andrew Rupert		06/28/2012 Andrew Rupert		N/A	No Image Data
IRC04H_00F033	<input type="checkbox"/>	09/13/2013 Kansie Somers	09/13/2013 Kansie Somers	10/29/2014 Andrew Rupert				Complete Neuro-exam First		N/A	No Image Data
IRC04H_00F035	<input type="checkbox"/>	11/04/2013 Kansie Somers	11/04/2013 Kansie Somers	10/29/2014 Andrew Rupert				Complete Neuro-exam First		N/A	No Image Data
IRC04H_00M048	<input type="checkbox"/>	08/23/2013 Sarah Finucane	08/23/2013 Sarah Finucane	01/29/2014 Andrew Rupert				Complete Neuro-exam First		N/A	01/16/2014 James Leach
IRC04H_00M073	<input type="checkbox"/>	05/09/2014 Sarah Finucane	05/09/2014 Sarah Finucane	06/16/2014 Claire Sroka				Complete Neuro-exam First		N/A	06/02/2014 James Leach
IRC04H_00M076	<input type="checkbox"/>	06/16/2014 Claire Sroka		10/29/2014 Andrew Rupert				Complete Neuro-exam First		N/A	08/11/2014 James Leach
IRC04H_01M038	<input type="checkbox"/>	10/10/2013 Sarah Finucane	11/14/2013 Sarah Finucane	10/29/2014 Andrew Rupert				Complete Neuro-exam First		N/A	No Image Data
IRC04H_01M046	<input type="checkbox"/>	01/24/2014 Sarah Finucane	01/24/2014 Sarah Finucane	Need to back populate				Complete Neuro-exam First		N/A	No Image Data
IRC04H_02F045	<input type="checkbox"/>	08/08/2013 Kansie Somers	08/08/2013 Kansie Somers	01/29/2014 Andrew Rupert				Complete Neuro-exam First		N/A	No Image Data

## AndyTest\_00M001

Medical/Developmental History

Pregnancy, Labor, and Delivery

Demographics

Family History

Finish

1. Date at TQ Form:

09/17/2014



Use the calendar to select the date of screening.

2. How much does the child currently weigh?

50

lbs.

3. How tall is the child?

3

ft

0

in.

27.1

BMI (Calculated)

Weight-for-height is used as an exclusion criteria for ages 0-2 yrs.  
BMI is used as an exclusion criteria for ages 2-18 yrs.

4. Does the child have any chronic illnesses?

YES

NO

5. Has he ever been hospitalized?

YES

NO

6. Has the child ever had surgery?

YES

NO

7. Has he ever had an accident or injury resulting in a loss of consciousness?

YES

NO

8. Has the child ever seen a neurologist?

YES

NO

9. Have they ever had any seizures including when they were a baby?

YES

NO

## AndyTest\_00M001

Medical/Developmental History

Pregnancy, Labor, and Delivery

Demographics

Family History

Finish

1. Date at TQ Form:

09/17/2014

Use the calendar to select the date of screening.

2. How much does the child currently weigh?

50

lbs.

3. How tall is the child?

3

ft

6

in.

27.1

BMI (Calculated)

Weight for height is used as an exclusion criteria for ages 0-2 yrs.  
BMI is used as an exclusion criteria for ages 2-18 yrs.

BMI above 95th percentile.

Your current action will cause the participant to be flagged as excluded once the form is saved.

OK

4. Does the child have any chronic illnesses?

YES

NO

5. Has he ever been hospitalized?

YES

NO

6. Has the child ever had surgery?

YES

NO

7. Has he ever had an accident or injury resulting in a loss of consciousness?

YES

NO

8. Has the child ever seen a neurologist?

YES

NO

9. Have they ever had any seizures including when they were a baby?

YES

NO



# C-MIND Data Management

Data Entry & Upload

Query and Processing

Dashboards

Variable Dictionary

Administration

Help

## FMRI Image Upload

Filenames must be in the format of {participantID}\_{scan}\_{session}\_{scan\_name}\_{scan#}\_1 and have the extension .par/.rec/.zip

+ Add files...

⊕ Start upload

⊖ Cancel upload

Drag Files Here

## Image Data Status

**A** - Alpha, **An** - Anatomical, **B** - BaselineCBF, **D** - DTI, **H** - Hardi, **R** - Resting State, **Se** - Sentences, **St** - Stories, **T** - T1Est, **T2** - T2 Flare, **G** - GRE Field Map

Filter subjects:

*\*\* Click on the participant ID to view the image details.*

Subject	Session	Physiological			Functional		
		Upload	Reviewed	Status	Upload	Reviewed	Status
IRC04H_00F001	1	A,An,B,T,D,T2,G	A,An,B,T,D,T2,G	Upload	A,An,St,R,H,G	A,An,St,R,H,G	Complete
IRC04H_00F001	2	A,An,B,T,D,T2,G	A,An,B,T,D,T2,G	Complete	A,An,St,R,H,G	A,An,St,R,H,G	Upload
IRC04H_00F004	1	A,An,B,T,D,T2,G	A,An,B,T,D,T2,G	Complete	A,An,St,R,H,G	A,An,St,R,H,G	Complete
IRC04H_00F007	1	A,An,B,T,D,T2,G	A,An,B,T,D,T2,G	Complete	A,An,St,R,H,G	A,An,St,R,H,G	Upload
IRC04H_00F011	1	A,An,B,T,D,T2,G	A,An,B,T,D,T2,G	Upload	A,An,St,R,H,G	A,An,St,R,H,G	Complete
IRC04H_00F012	1	A,An,B,T,D,T2,G	A,An,B,T,D,T2,G	Upload	A,An,St,R,H,G	A,An,St,R,H,G	Upload
IRC04H_00F015	1	A,An,B,T,D,T2,G	A,An,B,T,D,T2,G	Complete	A,An,St,R,H,G	A,An,St,R,H,G	Complete
IRC04H_00F020	1	A,An,B,T,D,T2,G	A,An,B,T,D,T2,G	Complete	A,An,St,R,H,G	A,An,St,R,H,G	Complete
IRC04H_00F031	1	A,An,B,T,D,T2,G	A,An,B,T,D,T2,G	Complete	A,An,St,R,H,G	A,An,St,R,H,G	Complete
IRC04H_00F032	1	A,An,B,T,D,T2,G	A,An,B,T,D,T2,G	Upload	A,An,St,R,H,G	A,An,St,R,H,G	ASL/BOLD
IRC04H_00F036	1	A,An,B,T,D,T2,G	A,An,B,T,D,T2,G	Upload	A,An,St,R,H,G	A,An,St,R,H,G	Upload
IRC04H_00F037	1	A,An,B,T,D,T2,G	A,An,B,T,D,T2,G	Complete	A,An,St,R,H,G	A,An,St,R,H,G	Complete
IRC04H_00M002	1	A,An,B,T,D,T2,G	A,An,B,T,D,T2,G	Complete	A,An,St,R,H,G	A,An,St,R,H,G	Complete
IRC04H_00M003	1	A,An,B,T,D,T2,G	A,An,B,T,D,T2,G	Complete	A,An,St,R,H,G	A,An,St,R,H,G	Complete
IRC04H_00M016	1	A,An,B,T,D,T2,G	A,An,B,T,D,T2,G	Upload	A,An,St,R,H,G	A,An,St,R,H,G	Upload
IRC04H_00M018	1	A,An,B,T,D,T2,G	A,An,B,T,D,T2,G	Upload	A,An,St,R,H,G	A,An,St,R,H,G	ASL/BOLD
IRC04H_00M018	2	A,An,B,T,D,T2,G	A,An,B,T,D,T2,G	Complete	A,An,St,R,H,G	A,An,St,R,H,G	Complete

Displaying 1 - 15 of 260

15  results per page



**C-MIND Release**  
 Last Data Update: 2015-04-30  
 Registered Users: 98 Date: 10/11/2015

Query and Processing | Dashboards | Variable Dictionary | Administration | Help

**CURRENT SELECTION**  
 Participants where...  
 Participant Status - Participant Age at First Scan (Months) less than '48'  
 and  
 Gender is 'M'  
 Files where...

**PARTICIPANT FILTERS**

Participant Age at First Scan (Months) Less Than < 48  
 Gender is M

**RESULTS**

Participant Information | **Imaging Information**

All Participant Imaging Information

<<first <prev next> last>> 10 1 of 183 pages (1823 total files , 11.17 GB)

View Image	Participant ID	Year	File Type
	IRC04H_00M002	1	Raw
	IRC04H_00M002	1	T1 Grey Matter Partial Volume Estimate
	IRC04H_00M002	1	T1 White Matter Partial Volume Estimate
	IRC04H_00M002	1	T1 CSF Matter Partial Volume Estimate
	IRC04H_00M002	1	Brain Extracted Structural
	IRC04H_00M002	1	Nonlinear (ANTs) Normalized T1 Grey Matter Partial Volume Estimate
	IRC04H_00M002	1	Nonlinear (ANTs) Normalized T1 White Matter Partial Volume Estimate
	IRC04H_00M002	1	Nonlinear (ANTs) Normalized T1 CSF Matter Partial Volume Estimate
	IRC04H_00M002	1	Linear (FLIRT) Normalized T1 Grey Matter Partial Volume Estimate
	IRC04H_00M002	1	Linear (FLIRT) Normalized T1 White Matter Partial Volume Estimate

Anatomical 1

**C-MIND Release**  
 https://cmind.research.cchmc.org/papaya/index/rownum/0

File Options 0

## Sort Scheduler

- Used to schedule times on the Research Flow Cytometry Core's cell sorters.
- Based on an open source application found online for the scheduling of conference rooms.
- Customized to collect cell sorter parameters upon appointment booking.
- Lead Contacts: Sherry Thornton, Monica DeLay

## Administrator



Welcome Back, Andrew  
Log Out | My Control Panel

Wednesday, October 14, 2015  
Help

### > My Quick Links ?

- » Bookings
- » My Calendar
- » Schedule Calendar
- » Email Preferences
- » Email Administrator
- » Log Out

### System Administration

- » Manage Schedules
- » Manage Blackout Times
- » Manage Resources
- » Manage Announcements
  
- » Manage Groups
- » Manage Users
- » Manage Reservations
- » Approve Reservations
  
- » Mass Email Users
- » Search Reservations
- » Export Database Content
- » View System Stats

### > My Announcements ?

#### Announcements as of 10/14/2015

- There are no announcements.

### > My Reservations ?

Start Date	End Date	Resource	Start Time	End Time	Created
You do not have any reservations scheduled.					

# Modifying Existing Open Source Tools for Research

My Reservations	My Past Reservations	My Participation	My Past Participation	Other Reservations	Other Past Reservations	Pending Approval	Blacked Out Time
-----------------	----------------------	------------------	-----------------------	--------------------	-------------------------	------------------	------------------

Monday, 10/12/2015	7:30am	8:00am	9:00am	10:00am	11:00am	12:00pm	1:00pm	2:00pm	3:00pm	4:00pm	5:00pm	6:00pm	7:00pm
4-Laser Ariel	Startup			Javid Mohammed				Jose Javier 70 µm		Jonathan Schick	Shutdown		
5-laser Arnie	Startup			Yutaka Maeda 100 µm		Luis Queme 100 µm	Javid Mohammed						Shutdown
MoFlo XDP	Startup			Ramesh Nayak 100 µm			Sarah Potter 100 µm		Shutdown				

Tuesday, 10/13/2015	7:30am	8:00am	9:00am	10:00am	11:00am	12:00pm	1:00pm	2:00pm	3:00pm	4:00pm	5:00pm	6:00pm	7:00pm
4-Laser Ariel	Startup			Heping Xu 70 µm				Sachin Kumar 100 µm		Damien Reynaud		Shutdown	
5-laser Arnie	Startup			Megha Desai 70 µm			Carine Bouffi 70 µm			Rajeswari Jayavaradhan		Shutdown	
MoFlo XDP	Startup			Sara Meyer 100 µm		Xian Li 100 µm		Sarah Potter 100 µm		Shutdown			

Wednesday, 10/14/2015	7:30am	8:00am	9:00am	10:00am	11:00am	12:00pm	1:00pm	2:00pm	3:00pm	4:00pm	5:00pm	6:00pm	7:00pm	
4-Laser Ariel	Startup			Jing Fang 100 µm			Ashwini Hinge 70 µm		Monica DeLay		Shutdown			
5-laser Arnie	Startup			David Muench 100 µm		Oded Volovelsky 70 µm		Mei Wang 70 µm			Jonathan Schick		Shutdown	
MoFlo XDP	Startup			Javid Mohammed								Shutdown		

Thursday, 10/15/2015	7:30am	8:00am	9:00am	10:00am	11:00am	12:00pm	1:00pm	2:00pm	3:00pm	4:00pm	5:00pm	6:00pm	7:00pm
4-Laser Ariel	Startup		Staff Meeting	Maha Almanan 70 µm							Shutdown		
5-laser Arnie	Startup		Staff Meeting	Tim Hubbell		Heping Xu 70 µm			Shutdown				
MoFlo XDP	Startup			David Muench 100 µm		Xiaomeng Ren 100 µm		Takuji Suzuki		Andre Olsson 100 µm		Shutdown	

# Modifying Existing Open Source Tools for Research

You are **modifying** an existing reservation.

Basic	
Location	R5001
Phone	636-2770
Notes	BL2 or BL2+
<b>Please change the starting and ending times:</b>	
Start 10/16/2015	End 10/16/2015
10:00am	2:00pm
<b>Will be reserved for:</b>	
Name	Megha Desai Change
Phone	31029
Email	megha.desai@cchmc.org
PI	Jose Cancelas
Created	09/18/2015 @ 03:48:08 PM
Last Modified	N/A
<b>Notes</b>	
TMH, YFP+, APcy7+, APC-,	
Reminder	-- Never -- before reservation
<input type="checkbox"/> Delete?	
<b>Save</b>	<b>Cancel</b>

Sort Set Up	
Type of Cells/Study	m BM
Have you done this sort with us before?	<input checked="" type="radio"/> Yes <input type="radio"/> No
BSL Level/Agent	2 retro and lenti >48hrs
Cell Size (µm)	
Number of Samples	3
Starting Cell Number	<5 e6 each
Number of Cells Needed	
% of Target Cells Expected	
Nozzle Size	<input checked="" type="radio"/> 70 µm <input type="radio"/> 85 µm <input type="radio"/> 100 µm <input type="radio"/> 130 µm
ND Filter	<input type="radio"/> 1.0 <input checked="" type="radio"/> 1.5 <input type="radio"/> 2.0
Purpose of Sort	<input type="radio"/> RNA <input type="radio"/> Transplant <input checked="" type="radio"/> Culture <input type="radio"/> Other
Populations Collected	YFP+ APcy7+ AP
Sample Tube	<input type="radio"/> 1ml <input checked="" type="radio"/> 5ml <input type="radio"/> 15ml Conical
Sort Type	<input checked="" type="radio"/> 1-way <input type="radio"/> 2-way <input type="radio"/> 3-way <input type="radio"/> 4-way
Collection Tube	<input type="radio"/> Eppendorf <input checked="" type="radio"/> FACS Tubes <input type="radio"/> 15ml <input type="radio"/> ACDU
Sample Temp (°C)	4
Collection Temp (°C)	4
Colors Used	YFP 7AAD APC Cy7 APC

**Check Availability**

# Working with BMI

- **Jane Khoury, DBE**
- **Clear-Er, Stop-It Clear-FDR**
  - SharePoint /.NET Hybrid
- **H2O Randomization Application**
  - .NET Web Application

# Questions ?

.NET Development

[Help-dotnet@bmi.cchmc.org](mailto:Help-dotnet@bmi.cchmc.org)

SharePoint Hosting / Development

[Help-sharepoint@bmi.cchmc.org](mailto:Help-sharepoint@bmi.cchmc.org)

If you are unsure ...

[help@bmi.cchmc.org](mailto:help@bmi.cchmc.org)