Reaction Incident Information

Engaging the community in collecting and sharing safety learnings

2017 Spring ACS Meeting CHAS Division Symposium: Information Flow in Environmental Health and Safety (CHAS 32)

Carmen Nitsche, Gabrielle Whittick, Mark Manfredi

April 4, 2017

Safety must be a priority

Safety is hard

- When things go wrong, we tend to blame the individual
- In reality systemic, process weaknesses contribute to failure
- What is obvious to you may not be to others
- Just because nothing bad happened does not mean it was safe

To cultivate safety culture

- Focus on prevention
- Examine systems and processes
- All levels must be involved
- **Reward sharing**
- **Promote institutional knowledge retention**

The Drivers for the Chemical Safety Library (CSL)

- Accidents and near-misses happen every day
- Prevention depends on knowledge of what has happened before
- Our colleagues are often our best teachers
- No one wants to get hurt in the lab
- Difficult to find real-life insights
- Data is scattered in silos
- Lessons learned are often forgotten
- Even reported incidents are not readily discoverable

The Drivers for the Chemical Safety Library

- Accidents and near-miss
day
- Pre
kno
hap
- Ou
our
- No one wants to get hurt in the lab

- Difficult to find real-life

ered in silos

ned are

en

d incidents

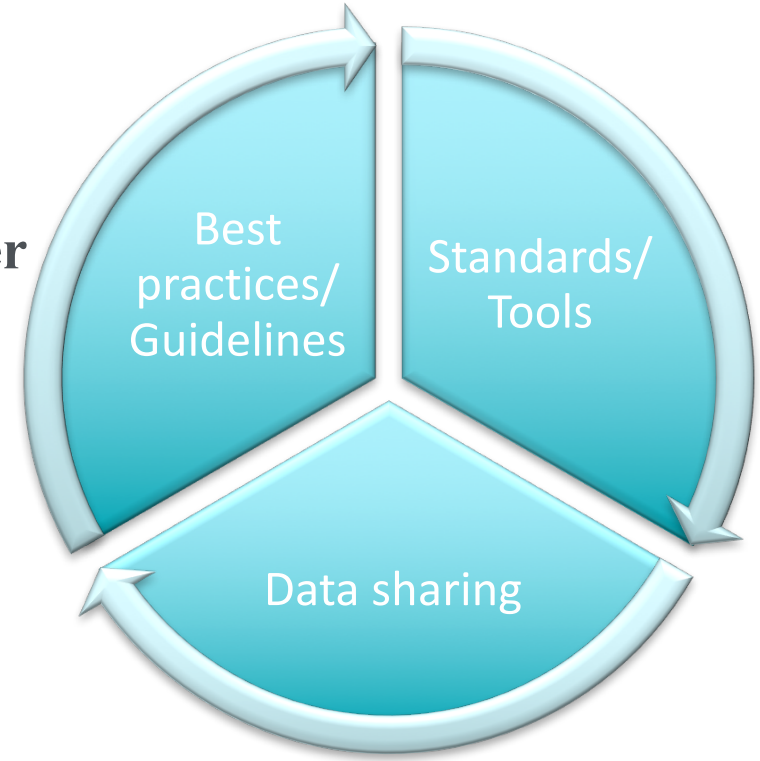
y

e

Ideal opportunity for cross-industry collaboration and cooperation

The Pistoia Alliance: Who we are & what we do

- A global, **not-for-profit 501**(c)(6) alliance of life science companies, technology vendors, publishers, and academic groups.
- Dedicated to **improving life sciences R&D** innovation and effectiveness through **pre-competitive collaborative projects and other activities**
- Offer a proven framework for **open innovation & collaboration**



CSCS
A Pistoia Alliance Innovation
CONTROLLED SUBSTANCE COMPLIANCE SERVICE

PRESIDENT'S STARTUP CHALLENGE
Pistoia Alliance
2016

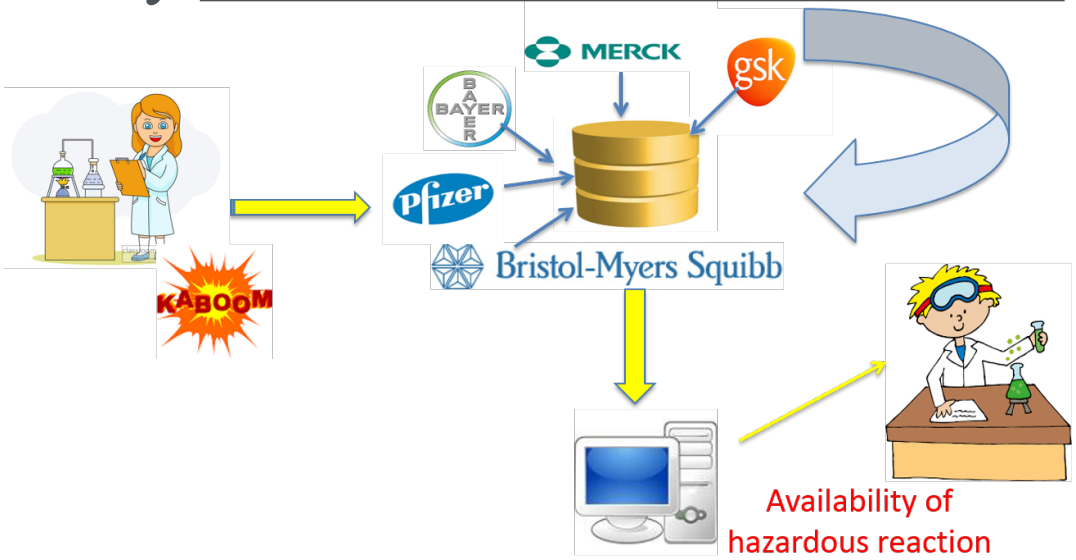
The Pistoia Alliance
Sequence Squeeze
COMPETITION
Pistoia Alliance

HELM
A Pistoia Alliance Innovation
Hierarchical Editing Language for Macromolecules

tranSMART
FOUNDATION

Chemical Safety Library: goal & value proposition

The Pistoia Alliance *Chemical Safety Library* project will capture and share previously inaccessible reaction incident information.



Making this data available to the chemical community at large will allow organizations to learn and avoid reaction incidents experienced by the wider community, enhancing overall laboratory safety.

Project progression

1. BMS brings project idea to the Pistoia Alliance mid-2015
2. Project team forms in late 2015
3. Publicized via IP3, conferences, personal communication
4. Project team defines data model and begins collecting data
5. ACS offers C&ENews Safety Letters content for inclusion
5. BIOVIA builds the prototype service Fall 2016
6. Testing completed February 2017
7. CSL prototype releases to public March 14, 2017

What resources are used today?

- Various substance-based reference sources
- Material Safety Data Sheets (MSDS)
- Scientific literature
- Personal knowledge and experience
- Laboratory Chemical Safety Summaries (LCSS)
  - https://pubchem.ncbi.nlm.nih.gov/lcss/
  - Collaboration between PubChem and ACS-CHAS, ACS-CINF and the ACS-CCS

Source Name	Total
Bretherick's	13
MSDS *	6
Employee Knowledge	5
SciFinder	4
ACS + Journals	2
Sax's Dangerous properties	2
Vendor SDS *	2
CAMEO	1
Chemwatch SDS *	1
Google	1

What resources are used today?

- Various substance-based reference sources
- Mat
(MS
- Scie
- Pers
expe
- Lab
Sum
  - ht
gov/icss/
  - Collaboration between PubChem and ACS-CHAS, ACS-CINF and the ACS-CCS

	Total
	13
	6
	5
	4
	2
erties	2
	2
	1
	1
Google	1

Reagent/substance safety data sources abound

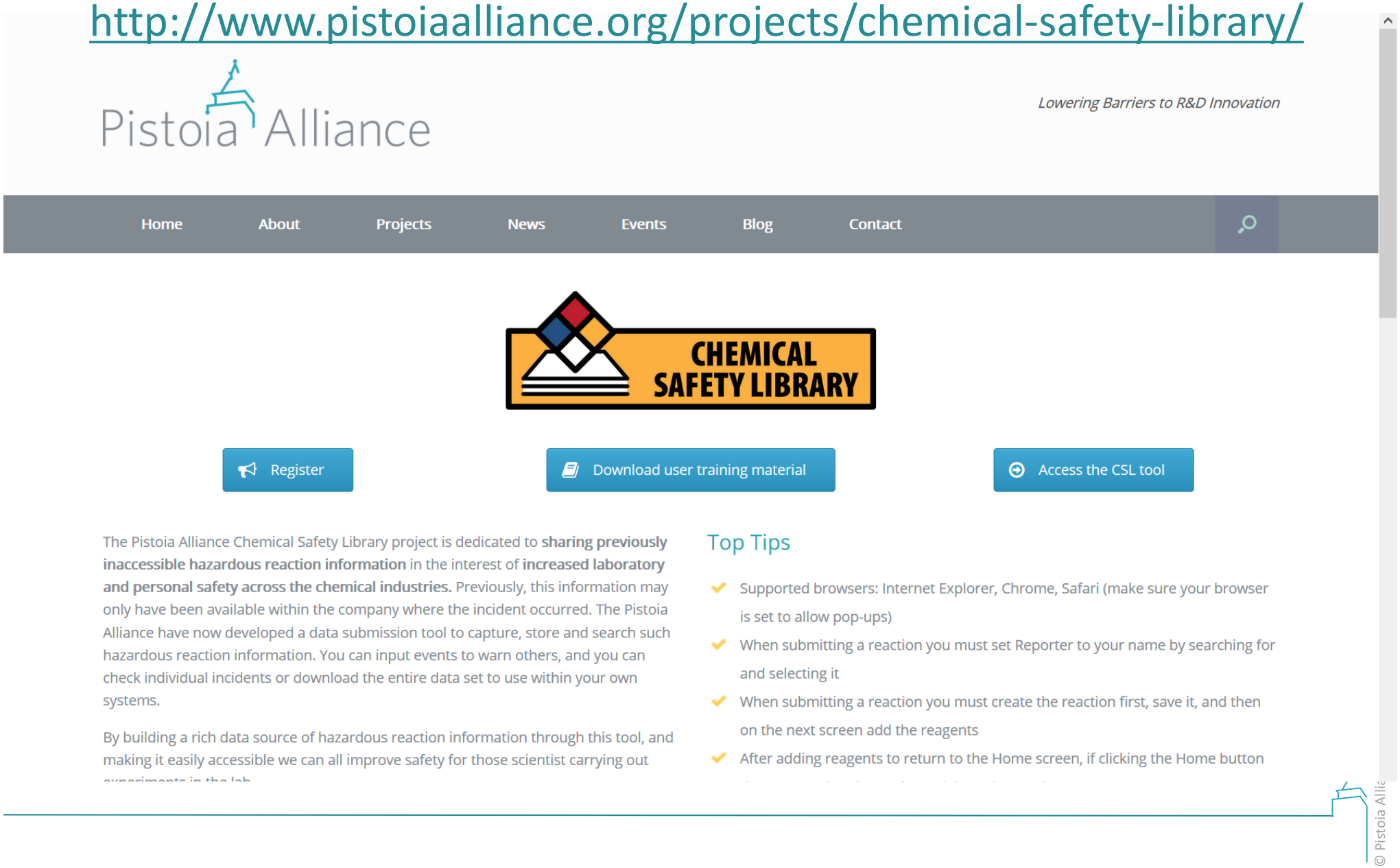
Not so for reactions

Creating the prototype service

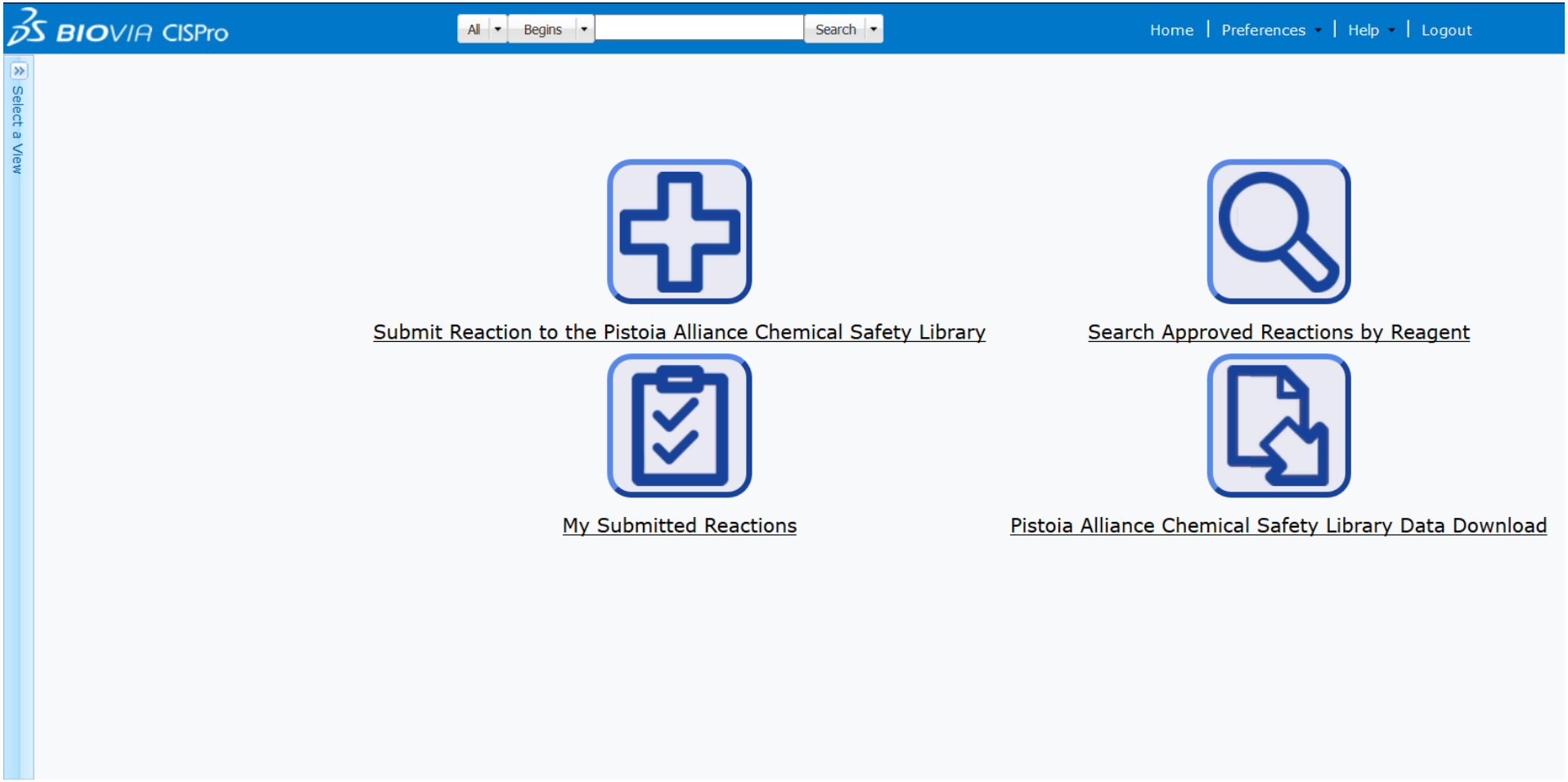
- **Requirements**
  - Build simple service to validate premise: community is willing to share incident info
  - Make sure data is movable and reusable
  - Implement features that simplify curation and oversight
  - Leverage existing reagent info during data entry process
- **Execution**
  - Based on BIOVIA CISPro
  - Takes 3 minutes to enter an incident
  - Has basic search capability for incidents by reagent
  - Full set of data available as csv (by reagent)
  - Registration required
  - Sigma Aldrich reagent data preloaded to simplify user data entry

CSL prototype

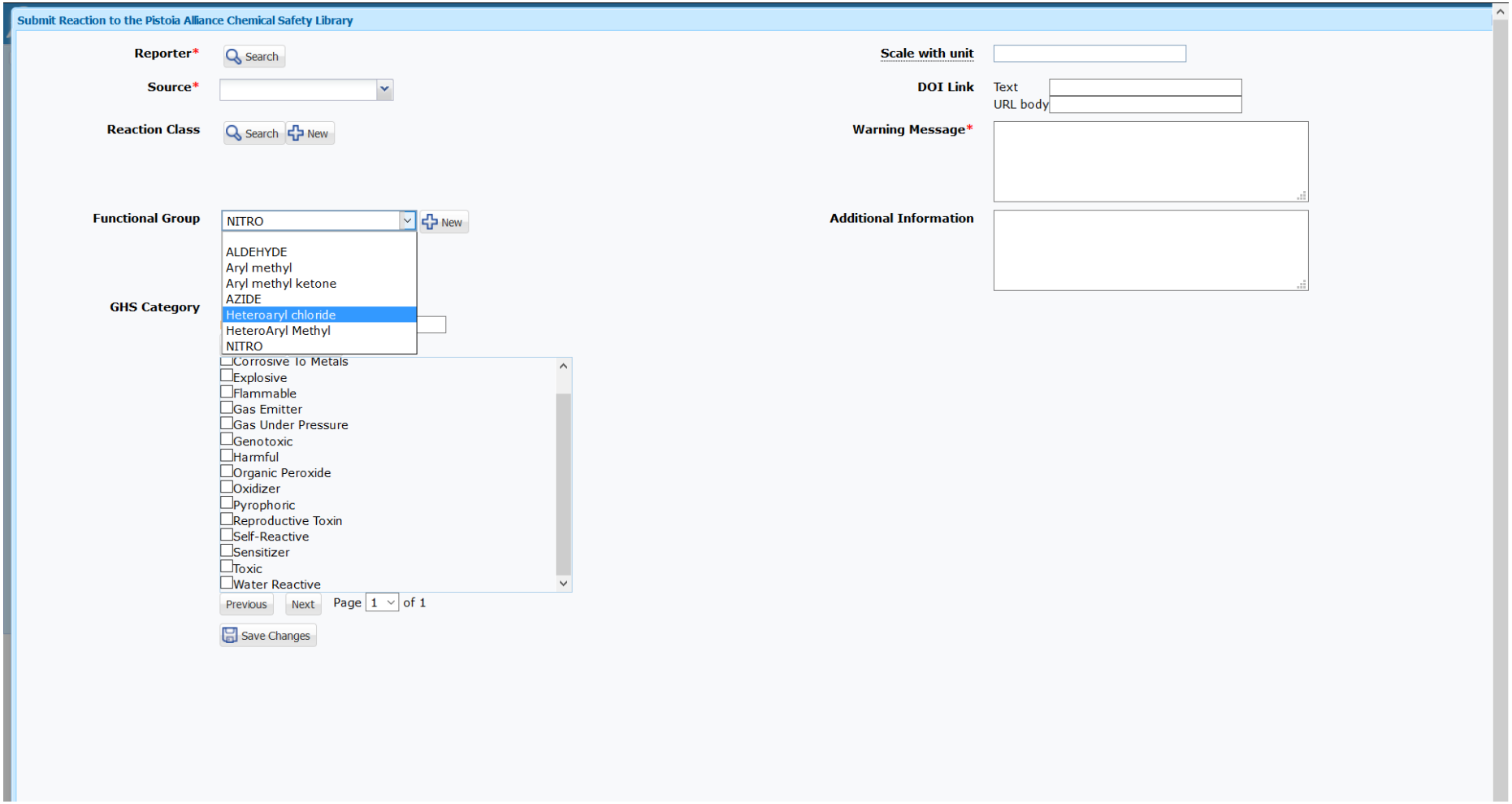
http://www.pistoiaalliance.org/projects/chemical-safety-library/



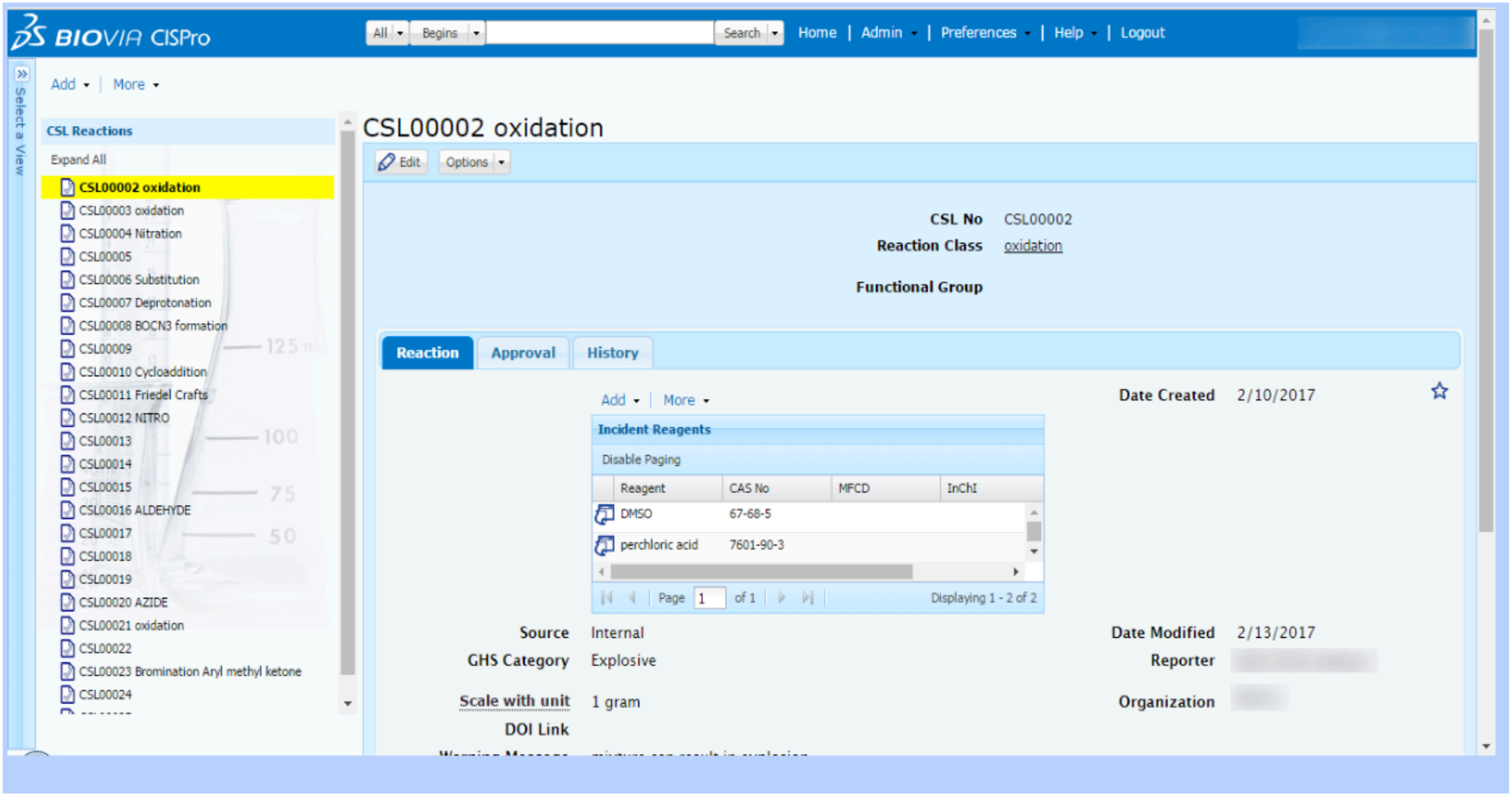
The CSL prototype



The CSL prototype: adding an incident



The CSL prototype: new reaction added



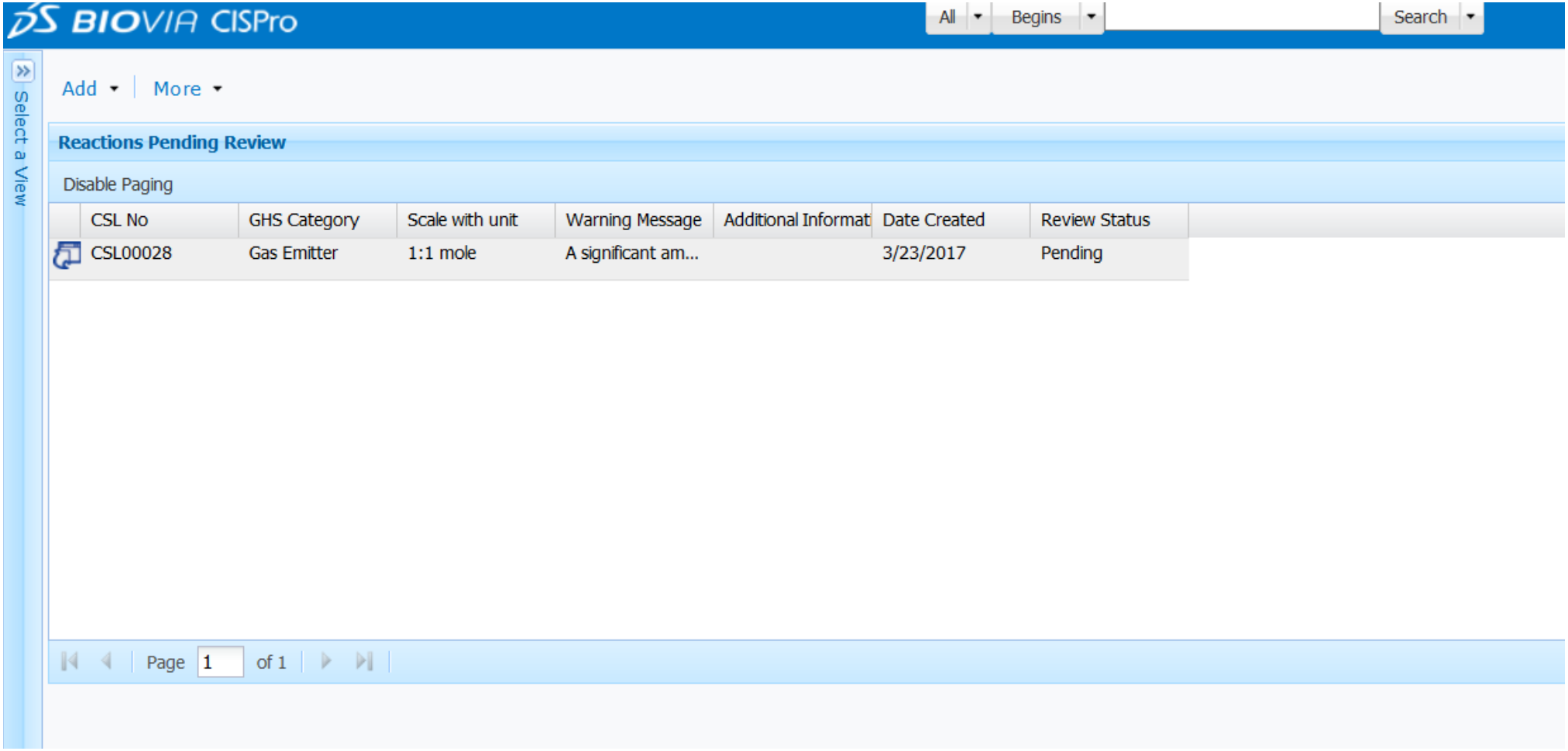
The CSL prototype: all data available for download

CSL Data Download

Disable Paging

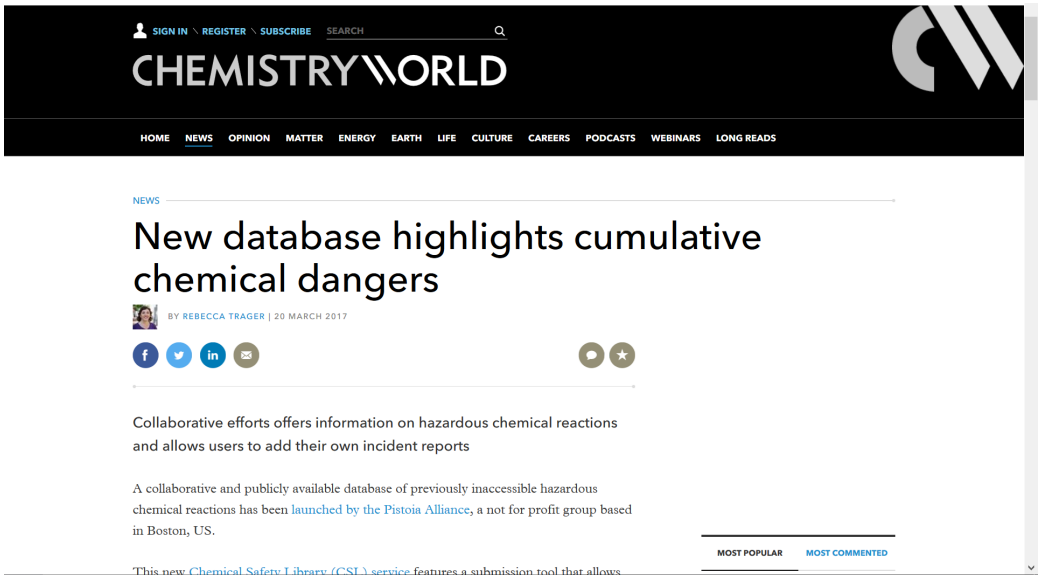
CSL No	Reaction Class	Functional Group	Reagent Name	CAS No	MFCD	GHS Category	SMILES	INCHI	Warning Message
CSL00002	oxidation		DMSO	67-68-5		Explosive			mixture can result in explosion
CSL00002	oxidation		perchloric acid	7601-90-3		Explosive			mixture can result in explosion
CSL00003	oxidation		sodium percarbonate	15680-89-4		Explosive			can form explosive acetone peroxide compour
CSL00003	oxidation		ACETONE	67-64-1		Explosive			can form explosive acetone peroxide compour
CSL00004	Nitration		NITRIC ACID	52583-42-3, 7697-...	MFCD00011349	Explosive	O[N+](=O)[O-]	InChI=1S/HNO3/c2-...	Can explode and/or have large exotherm. Use
CSL00004	Nitration		Ac2O			Explosive			Can explode and/or have large exotherm. Use
CSL00005			THF						Can polymerize, large exotherm. Avoid combi
CSL00005			Triflic anhydride						Can polymerize, large exotherm. Avoid combi
CSL00006	Substitution		DICHLOROMETHANE	75-09-2	MFCD00000881	Explosive	ClCCl	InChI=1S/CH2Cl2/c2...	Formation of diazidomethane which can explo
CSL00006	Substitution		SODIUM AZIDE	26628-22-8	MFCD00003536	Explosive	[Na]N=[N+]=[N-]	InChI=1S/N3.Na/c1-...	Formation of diazidomethane which can expl
CSL00007	Deprotonation		SODIUM HYDRIDE	7646-69-7	MFCD00003471				Thermal runaway reaction already at tempera
CSL00007	Deprotonation		DMF						Thermal runaway reaction already at tempera
CSL00008	BOCN3 formation		HNO2			Explosive			Explosion during workup when half of the solv
CSL00008	BOCN3 formation		BOCNHNH2			Explosive			Explosion during workup when half of the solv
CSL00009			ACETONE	67-64-1		Explosive			Formation of acetone peroxides possible. Try
CSL00009			H2O2			Explosive			Formation of acetone peroxides possible. Try
CSL00010	Cycloaddition		BF3			Explosive			Combinations of TMSN3 and Lewis acids can d
CSL00010	Cycloaddition		TMSN3			Explosive			Combinations of TMSN3 and Lewis acids can d
CSL00011	Friedel Crafts		AlCl3						Explosive decomposition > 120Â°C observed
CSL00011	Friedel Crafts		NITROBENZENE	98-95-3	MFCD00007043		[O-][N+](=O)c1ccccc1	InChI=1S/C6H5NO2...	Explosive decomposition > 120Â°C observed
CSL00012		NITRO	2-ETHYLHEXYLAMINE	104-75-6	MFCD00008148	Explosive	CCCCC(CC)CN	InChI=1S/C8H19N/c...	Warning - This combination can cause a run-a
CSL00012		NITRO	1-CHLORO-2-NITRO...	88-73-3	MFCD00007061	Explosive	[O-][N+](=O)c1ccccc1Cl	InChI=1S/C6H4ClNO...	Warning - This combination can cause a run-a

Administrators monitor new incident inputs



The CSL prototype launch

http://cen.acs.org/articles/95/i12/Database-hazardous-reactions-launched.html



https://www.chemistryworld.com/news/new-database-highlights-cumulative-chemical-dangers/3006996.article

- 300 accounts requested within 36 hrs
- Last week: over 500 requested
- April 2: over 600 accounts requested

Prototype next steps

- Validate the premise: **community is interested**
- Validate the premise: **community ready to share**
- Validate the data model: We are **capturing the right data**
- Establish the effort needed to maintain the system
- Look for **long term partner** to sustain the effort
- Hackathons/competitions to leverage the data and enhance offering

We need your help

- **Enter your incidents, near misses, literature-backed events**
- **Get your colleagues involved**

- What barriers do you see to general participation?

- Would you submit an entry?

Acknowledgements

CSL Funding Members

Bayer
BMS
GSK
Merck Co
Merck KGaA
Pfizer

Steering Committee

David Nirschl BMS - Project Champion
Mark Manfredi BMS - Project Lead
Gabrielle Whittick - Pistoia Alliance Project Mngr

Karl Cable GSK
Manja Fieberg Bayer
David Tschaen Merck Co
Veit Ulshoefer Merck KGaA
Robert Wade Pfizer

Nick Lynch Pistoia Alliance
Carmen Nitsche Pistoia Alliance
John Wise Pistoia Alliance

Project Team

Ben Bracke PerkinElmer
Derek Brown Amgen
Karl Cable GSK
Steven Coffey Pfizer
Bret Daniel MilliporeSigma
Jochen Erler Bayer
Beth Fisher Merck
Sudhir Hande AZ
Achim Herrmann Merck KGaA
Tony Johnson AZ
Kostas Marinakis Elsevier
Leah Rae McEwan Cornell Univ
Daniel Meibom Bayer
Akos Papp ChemAxon
Jeffrey Sperry Pfizer
Dave Tschaen Merck
Victor Rosso BMS
Mariana Vaschetto Dotmatics

Development/Content support

Leann Wong Biovia
Yoshiko Fukui Biova
Mike Willis MilliporeSigma
Jyllian Kelmsley C&ENews

Community of Interest

Andrew Nation
Victor Rosso
Yannick Djoumbou Feunang
Rob Brown
Nathan Watson
Ron Gantt
David Christenson
Marc Rounsaville
Ken Kretchman
Chris A Jakober
Martin Neitzel
Carol Mcnab
Neal Langermann
Rebecca Urbanek
Bharath Ramachandran
Andreas Friese
Daniel Freiner,
Devon Johnston
Evan Bolton
John May
Markus Weisser
Quan Yang
Jon Patterson
Roger Sayle
Tim Dudgeon
Ralph Stuart


If you want to go fast,
go alone.
If you want to go far,
go together.
- African Proverb -
Pistoia
Alliance

Pistoia Alliance

info@pistoiaalliance.org

@pistoiaalliance

www.pistoiaalliance.org