












# Bioschemas

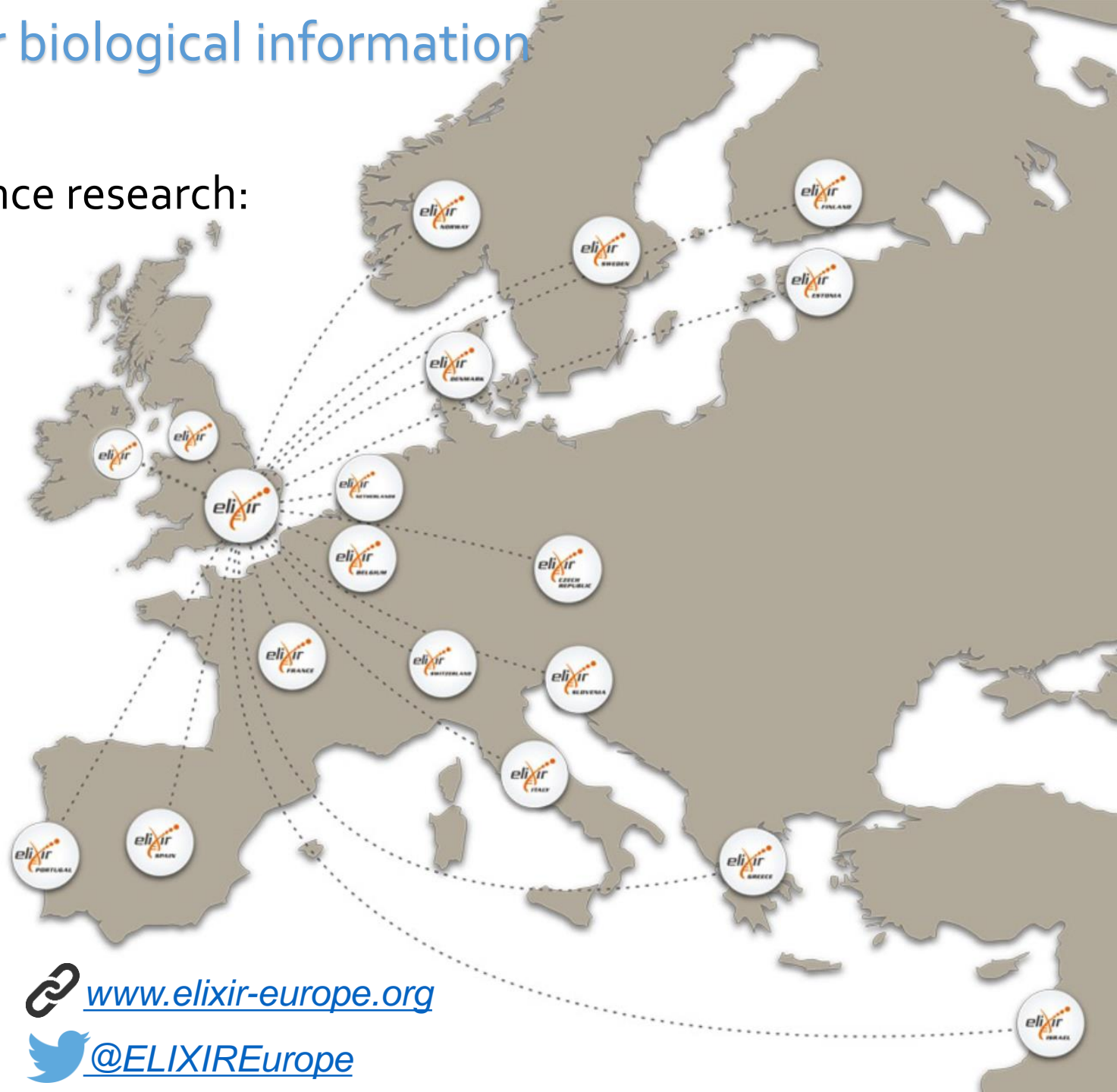
**Structured data markup for life  
sciences with Schema.org**

*Roberto Preste*

# ELIXIR: European infrastructure for biological information

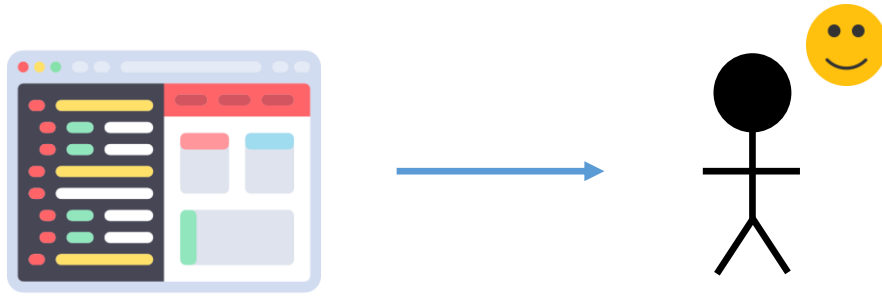
Data infrastructure for Europe's life-science research:

-  *Data*
-  *Interoperability*
-  *Tools*
-  *Compute*
-  *Training*
-  *Marine metagenomics*
-  *Crop and forest plants*
-  *Human data*
-  *Rare diseases*

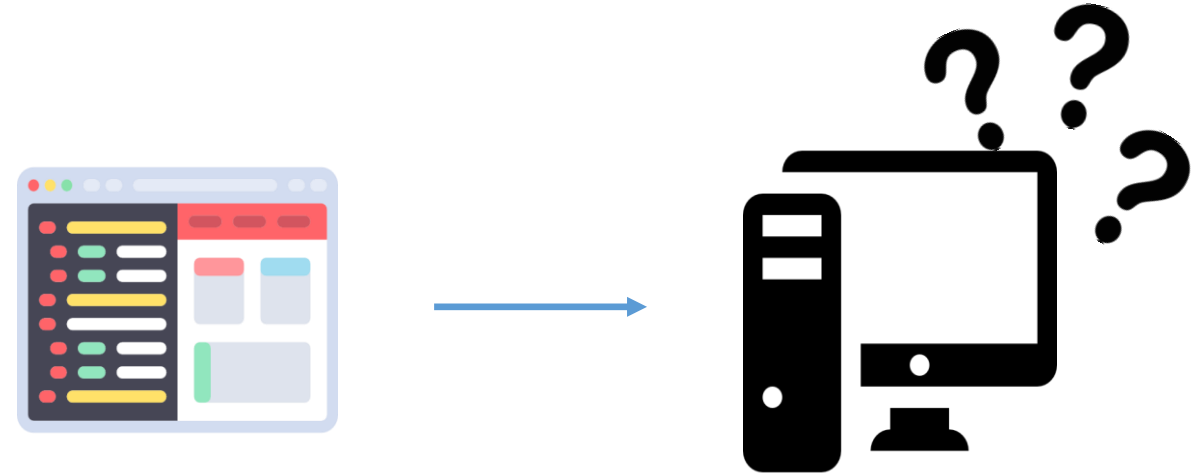


# Research and information sharing

Information is exposed in the Internet through web pages



Great for common users



Bad for automated and programmatical data collection

## Event

Thing > Event

An event happening at a certain time and location, such as a concert, lecture, or festival. Ticketing information may be added via the [offers](#) property. Repeated events may be structured as separate Event objects.

Usage: Between 100,000 and 250,000 domains

[more...]

Property	Expected Type	Description
Properties from <a href="#">Event</a>		
<a href="#">actor</a>	<a href="#">Person</a>	An actor, e.g. in tv, radio, movie, video games etc., or in an event. Actors can be associated with individual items or with a series, episode, clip. Supersedes <a href="#">actors</a> .
<a href="#">aggregateRating</a>	<a href="#">AggregateRating</a>	The overall rating, based on a collection of reviews or ratings, of the item.
<a href="#">attendee</a>	<a href="#">Organization</a> or <a href="#">Person</a>	A person or organization attending the event. Supersedes <a href="#">attendees</a> .
<a href="#">composer</a>	<a href="#">Organization</a> or <a href="#">Person</a>	The person or organization who wrote a composition, or who is the composer of a work performed at some event.
<a href="#">contributor</a>	<a href="#">Organization</a> or <a href="#">Person</a>	A secondary contributor to the CreativeWork or Event.
<a href="#">director</a>	<a href="#">Person</a>	A director of e.g. tv, radio, movie, video gaming etc. content, or of an event. Directors can be associated with individual items or with a series, episode, clip. Supersedes <a href="#">directors</a> .
<a href="#">doorTime</a>	<a href="#">DateTime</a>	The time admission will commence.
<a href="#">duration</a>	<a href="#">Duration</a>	The duration of the item (movie, audio recording, event, etc.) in <a href="#">ISO 8601 date format</a> .

## Organization

Thing > Organization

An organization such as a school, NGO, corporation, club, etc.

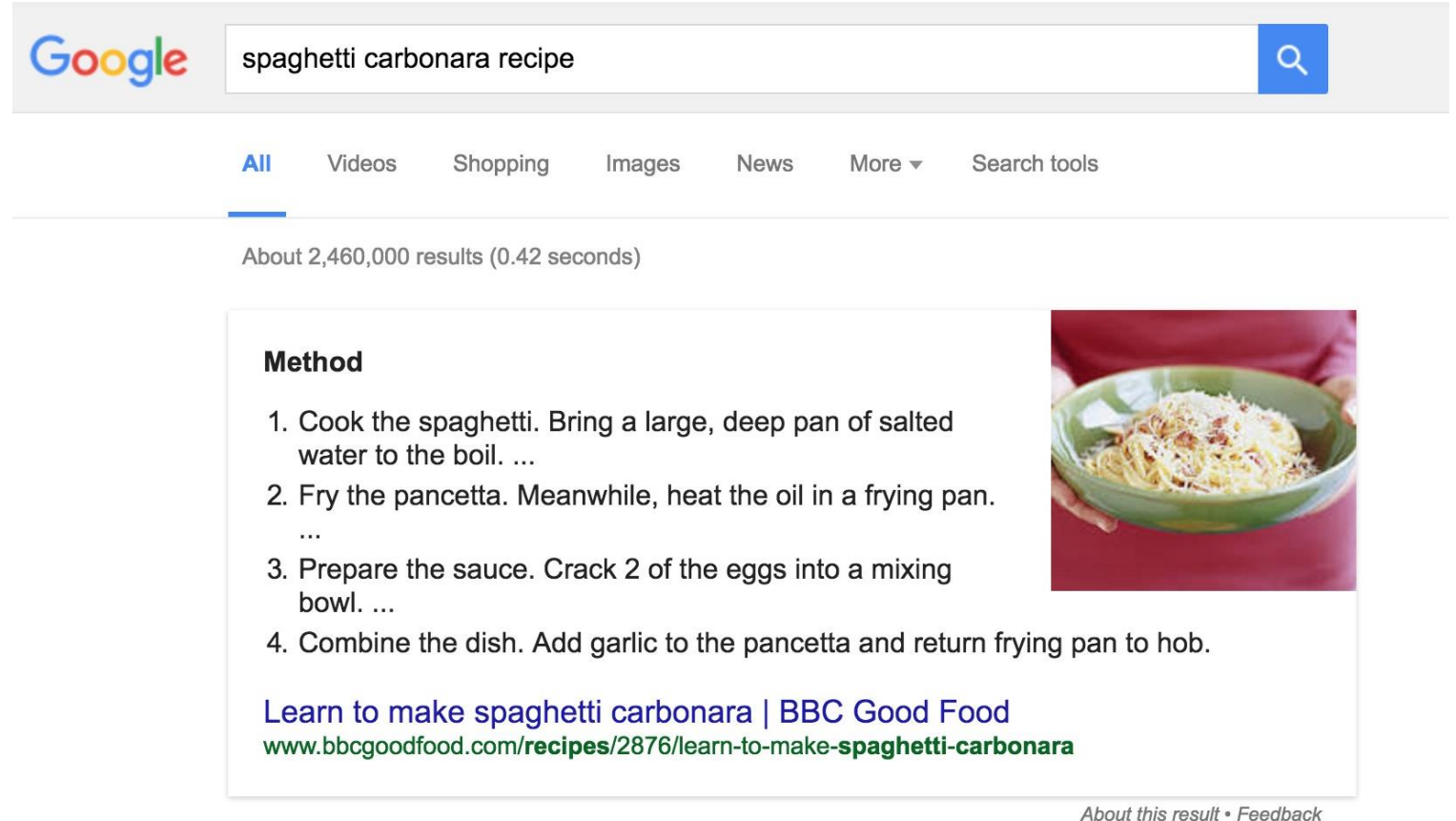
Usage: Over 1,000,000 domains

[more...]

Property	Expected Type	Description
Properties from <a href="#">Organization</a>		
<a href="#">address</a>	<a href="#">PostalAddress</a> or <a href="#">Text</a>	Physical address of the item.
<a href="#">aggregateRating</a>	<a href="#">AggregateRating</a>	The overall rating, based on a collection of reviews or ratings, of the item.
<a href="#">alumni</a>	<a href="#">Person</a>	Alumni of an organization. Inverse property: <a href="#">alumniOf</a> .
<a href="#">areaServed</a>	<a href="#">AdministrativeArea</a> or <a href="#">GeoShape</a> or <a href="#">Place</a> or <a href="#">Text</a>	The geographic area where a service or offered item is provided. Supersedes <a href="#">serviceArea</a> .
<a href="#">award</a>	<a href="#">Text</a>	An award won by or for this item. Supersedes <a href="#">awards</a> .
<a href="#">brand</a>	<a href="#">Brand</a> or <a href="#">Organization</a>	The brand(s) associated with a product or service, or the brand(s) maintained by an organization or business person.

Community and collaborative initiative to integrate structured data markup on web pages, email messages and on the Internet in general, without altering the presentation layer

Allows search engines to easily access websites' content and provide more useful results based on their underlying metadata



Google spaghetti carbonara recipe

All Videos Shopping Images News More Search tools

About 2,460,000 results (0.42 seconds)

**Method**

1. Cook the spaghetti. Bring a large, deep pan of salted water to the boil. ...
2. Fry the pancetta. Meanwhile, heat the oil in a frying pan. ...
3. Prepare the sauce. Crack 2 of the eggs into a mixing bowl. ...
4. Combine the dish. Add garlic to the pancetta and return frying pan to hob.

[Learn to make spaghetti carbonara | BBC Good Food](#)  
[www.bbcgoodfood.com/recipes/2876/learn-to-make-spaghetti-carbonara](http://www.bbcgoodfood.com/recipes/2876/learn-to-make-spaghetti-carbonara)

About this result • Feedback

### Ultimate spaghetti carbonara | BBC Good Food



[www.bbcgoodfood.com/recipes/1052/ultimate-spaghetti-carbonara](http://www.bbcgoodfood.com/recipes/1052/ultimate-spaghetti-carbonara) ▼

★★★★★ Rating: 4.6 - 126 votes - 35 mins - 655 cal

Discover how to make the perfect **Spaghetti carbonara** - with a little help from Gennaro Contaldo ... While the spaghetti is **cooking**, fry the pancetta with the garlic.

[Learn to make spaghetti ...](#) · [The ultimate makeover](#) · [Courgette carbonara](#)

### Learn to make spaghetti carbonara | BBC Good Food



[www.bbcgoodfood.com/recipes/2876/learn-to-make-spaghetti-carbonara](http://www.bbcgoodfood.com/recipes/2876/learn-to-make-spaghetti-carbonara) ▼

★★★★★ Rating: 4.2 - 28 votes - 20 mins - 734 cal

Method. Cook the **spaghetti**. Bring a large, deep pan of salted water to the boil. Fry the

Adopted by > 10 million websites

Sponsored by

YAHOO!



Google Yandex

...but still not this popular in the  
life science community!





- [Biosoftware description using bio.tools and schema.org \(NETTAB 2016 Workshop\)](#). October 25-26, 2016, Rome, Italy
- [Bioschemas hands-on meeting](#). November 8-9, 2016, Harpenden, Hertfordshire, UK

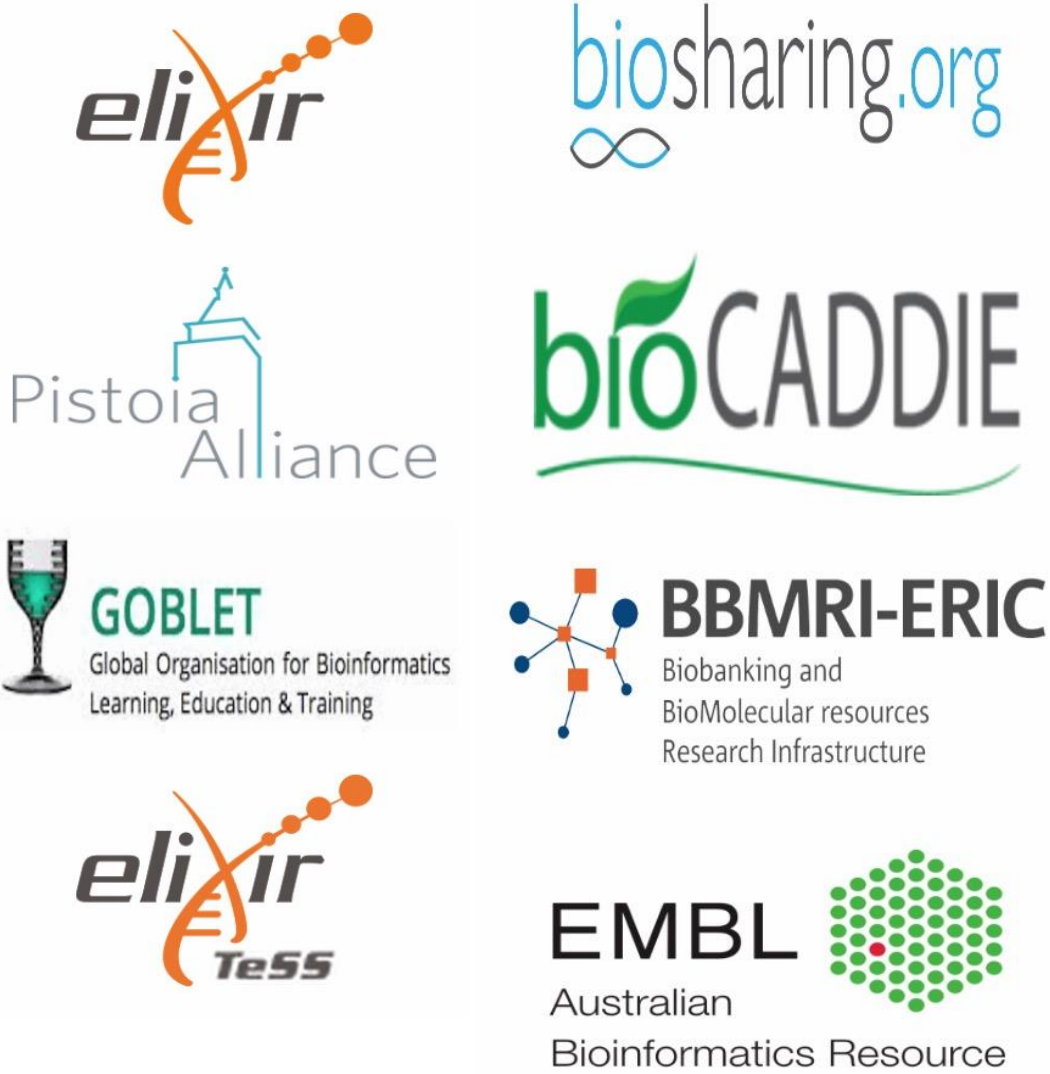
Bioschemas aims to improve data interoperability in life sciences. It does this by encouraging people in life science to use schema.org markup, so that their websites and services contain consistently structured information. This structured information then makes it easier to discover, collate and analyse distributed data. The main outcome of Bioschemas is a collection of specifications that provide guidelines to facilitate a more consistent adoption of schema.org markup within the life sciences. Bioschemas operates as an open community initiative. You are welcome to [join a community group](#).

Bioschemas aims to apply the Schema.org markup in life science  
Better discoverability and usability of structured data



# Bioschemas: organization

Open community initiative:



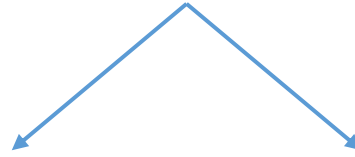
Organized in groups:

Group	Email	Email archive	Tasks/Issues	Shared Folder
Event	<a href="mailto:events@bioschemas.org">events@bioschemas.org</a>	<a href="#">🔗</a>	<a href="#">🔗</a>	<a href="#">🔗</a>
Training Material	<a href="mailto:training-material@bioschemas.org">training-material@bioschemas.org</a>	<a href="#">🔗</a>	<a href="#">🔗</a>	<a href="#">🔗</a>
Organization	<a href="mailto:organization@bioschemas.org">organization@bioschemas.org</a>	<a href="#">🔗</a>	<a href="#">🔗</a>	<a href="#">🔗</a>
Person	<a href="mailto:person@bioschemas.org">person@bioschemas.org</a>	<a href="#">🔗</a>	<a href="#">🔗</a>	<a href="#">🔗</a>
Standard	<a href="mailto:standard@bioschemas.org">standard@bioschemas.org</a>	<a href="#">🔗</a>	<a href="#">🔗</a>	<a href="#">🔗</a>
Data	<a href="mailto:data@bioschemas.org">data@bioschemas.org</a>	<a href="#">🔗</a>	<a href="#">🔗</a>	<a href="#">🔗</a>
Tool	<a href="mailto:tool@bioschemas.org">tool@bioschemas.org</a>	<a href="#">🔗</a>	<a href="#">🔗</a>	<a href="#">🔗</a>
Data Repositories	<a href="mailto:datarepositories@bioschemas.org">datarepositories@bioschemas.org</a>	<a href="#">🔗</a>	<a href="#">🔗</a>	<a href="#">🔗</a>
Community	<a href="mailto:community@bioschemas.org">community@bioschemas.org</a>	<a href="#">🔗</a>	<a href="#">🔗</a>	<a href="#">🔗</a>
Commons	<a href="mailto:commons@bioschemas.org">commons@bioschemas.org</a>	<a href="#">🔗</a>	<a href="#">🔗</a>	<a href="#">🔗</a>



# Bioschemas: specifications

## Content types



### Generic content types

E.g.: training materials,  
datasets

Can be used in many disciplines,  
besides life science

### Biological content types

E.g.: pathways, proteins

Are domain-specific

In collaboration with

**[health-lifesci.schema.org](https://health-lifesci.schema.org)**

to integrate and extend

Schema.org types and properties

# Bioschemas: specifications

- ***Introduction***
- Data model
- Content guidelines
- Cardinality and controlled vocabularies
- New properties
- Examples

Overview of the problem, goal of the specification, technologies used to implement the solution

## Problem statement

Conferences, workshops, meetings and events in general play a very important role in knowledge sharing and acquisition of new skills. Though there are several technological solutions for event sharing, events in life sciences are still not described in a consistent manner that would make them easy to discover, exchange or compare.

Because there is no single standard to follow, the dissemination, discovery and aggregation of events is not effective. As a result, the advertisement of an event in third party websites normally requires manual curation to shape the content to each provider's requirements.

## Proposed solution

### Rationale

In the development of the Life Science Events standard we have considered the following design goals.

#### *Consensus*

Many organisations and repositories providing events already exist. It is important this standard takes into account their experience and contribution.

#### *Adoption*

Many organisations already have a website or system providing information about events. They will not be willing to change their methods unless there is a clear benefit and a low barrier for adoption.

#### *Reuse*

There are existing formats and technologies suitable to represent at least some information about events. This specification will avoid reinvention and seek to extend existing standards.



# Bioschemas: specifications

- Introduction
- ***Data model***
- Content guidelines
- Cardinality and controlled vocabularies
- New properties
- Examples

Describes how to elaborate and implement more specific guidelines into a Schema.org skeleton

## Data model

The data model proposed involves:

1. **Adopting the Schema.org Event type, and extending it with additional properties.** Schema.org already has a way of describing events, through its [Event type](#). In this document we suggest using this type to describe life science events, but we also suggest new properties for this type, so that event descriptions can be more accurate and useful in life sciences. If the community agrees, these additional properties will be put forward for adoption to Schema.org.
2. **Adopting a standard way of using the Schema.org Event type.** Many properties in the Schema.org Event type are loosely defined, and we propose guidelines on how to use them so that they are more specific and consistent. These guidelines include concepts not supported by Schema.org, such as cardinality, controlled vocabularies and content guidelines (minimum, optional and recommended fields). For example, we suggest the use of a controlled vocabulary based on the EDAM ontology for the 'topics' property. These recommendations will not be part of the Schema.org Event type, but are proposed as best practices in using that type in life science.

# Bioschemas: specifications

- Introduction
- Data model
- **Content guidelines**
- Cardinality and controlled vocabularies
- New properties
- Examples

Defines a set of Minimum fields that are mandatory, Recommended fields for optimal discovery and integration, and Optional fields to enhance the user experience

## Event type definition

### Data fields

Legend:

CN: Cardinality (one, many)  
CG: Content Guideline (M: minimum; R: recommended; O: optional)  
CV: Controlled Vocabulary

Property	Expected Type	Description	CN	CG	CV
Existing properties in <a href="https://schema.org/Event">schema.org/Event</a>					
aggregateRating	AggregateRating	The overall rating, based on a collection of reviews or ratings, of the item.			
attendee	Organization or Person	A person or organization attending the event. Supersedes attendees.			
doorTime	DateTime	The time admission will commence.			
duration	Duration	The duration of the item (movie, audio recording, event, etc.) in ISO 8601 date format.			
endDate	Date	The end date and time of the item (in ISO 8601 date format).	One	M	
eventStatus	<del>EventStatusType</del>	An eventStatus of an event represents its status; particularly useful when an event is cancelled or rescheduled.			x
offers	Offer	An offer to provide this item—for example, an offer to sell a product, rent the DVD of a movie, or give away tickets to an event. Can use <del>eligibleCustomerType</del> and <del>eligibleDuration</del> properties to express any special offers.	One	O	
organizer	Organization or Person	An organizer of an Event.	Many	R	
performer	Organization or Person	A performer at the event—for example, a presenter, musician, musical group or actor. <del>Supersedes performers.</del>	Many	O	

# Bioschemas: specifications

- Introduction
- Data model
- Content guidelines
- *Cardinality and controlled vocabularies*
- New properties
- Examples

Define the number of times a property can be instantiated and specific terms that need to be used

## Event type definition

### Data fields

Legend:

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endDate	Date	The end date and time of the item (in ISO 8601 date format).	One	M	
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organizer	Organization or Person	An organizer of an Event.	Many	R	
performer	Organization or Person	A performer at the event—for example, a presenter, musician, musical group or actor. <del>Supersedesperformers.</del>	Many	O	



# Bioschemas: specifications

- Introduction
- Data model
- Content guidelines
- Cardinality and controlled vocabularies
- ***New properties***
- Examples

New properties can be suggested in order to provide more accurate and useful type description in life science

Proposed new properties for the Event type					
eventId	Text	Unique Id for the event.	One	O	
prerequisite	Text	A list of prerequisites to be able to attend the event.	Many	R	
accreditation	Organization or Text	Type of accreditation or organisation that accredits the event.	One	R	
eligibility	Text	Defines the type of eligibility to attend this event e.g first come first served.	Many	R	x
capacity	Integer	Available number of spaces	One	R	
contact	Organization or Person	Main point of contact that can be contacted for general queries. This would be an event organiser or an administrator.	Many	M	
attachment	URL	Any files or related websites which give more information about this event. e.g. flyers, third party sites handling tickets.	Many	O	



# Bioschemas: specifications

- Introduction
- Data model
- Content guidelines
- Cardinality and controlled vocabularies
- New properties
- *Examples*

No Markup

Microdata

RDFa

JSON-LD

...

**Epigenomics of Common Diseases**

This conference will bring together leading scientists from the fields of epigenomics, genetics and bioinformatics.

Event type: Workshops and courses

Date: Wednesday 15 April 2015

No Markup

Microdata

RDFa

JSON-LD

```
<div itemscope itemtype="http://schema.org/Event">
```

```
...
  <div itemprop="name">Epigenomics of Common Diseases</div>
  <div itemprop="description">This conference will bring together leading scier
  <div>Event type: <span itemprop="eventType">Workshops and courses</span></div>
  <div>Date: <meta itemprop="startDate" content="2015-04-15T">Wednesday 15 Apri
  ...
```

No Markup

Microdata

RDFa

JSON-LD

```
<div vocab="http://schema.org/" typeof="Event">
```

```
...
  <div property="name">Epigenomics of Common Diseases</div>
  <div property="description">This conference will bring together leading scientists from the fields of epigenomic
  <div>Event type: <span property="eventType">Workshops and courses</span></div>
  <div>Date: <meta property="startDate" content="2015-04-15T">Wednesday 15 April 2015</div>
  ...
```

No Markup

Microdata

RDFa

JSON-LD

```
<script type="application/ld+json">
```

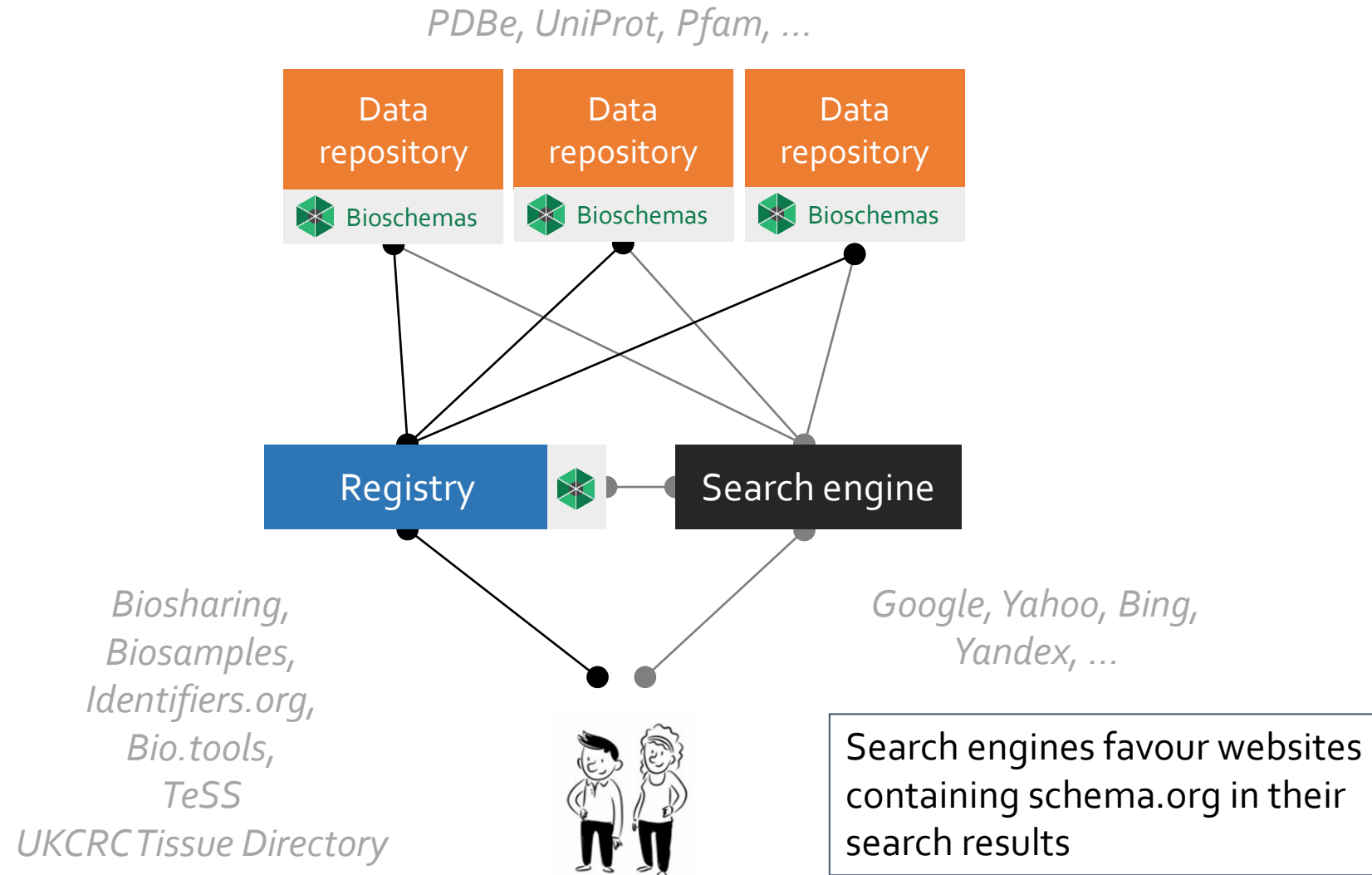
```
{
  "@context": "http://schema.org/",
  "@type": "Event",
  "name": "Epigenomics of Common Diseases",
  "description": "This conference will bring together leading scientists from the fields of epigenomics, genetics and bioinformatics.",
  "eventType": "Workshops and courses",
  "startDate": "2015-04-15T"
}
```



# Bioschemas

# Bioschemas: applications

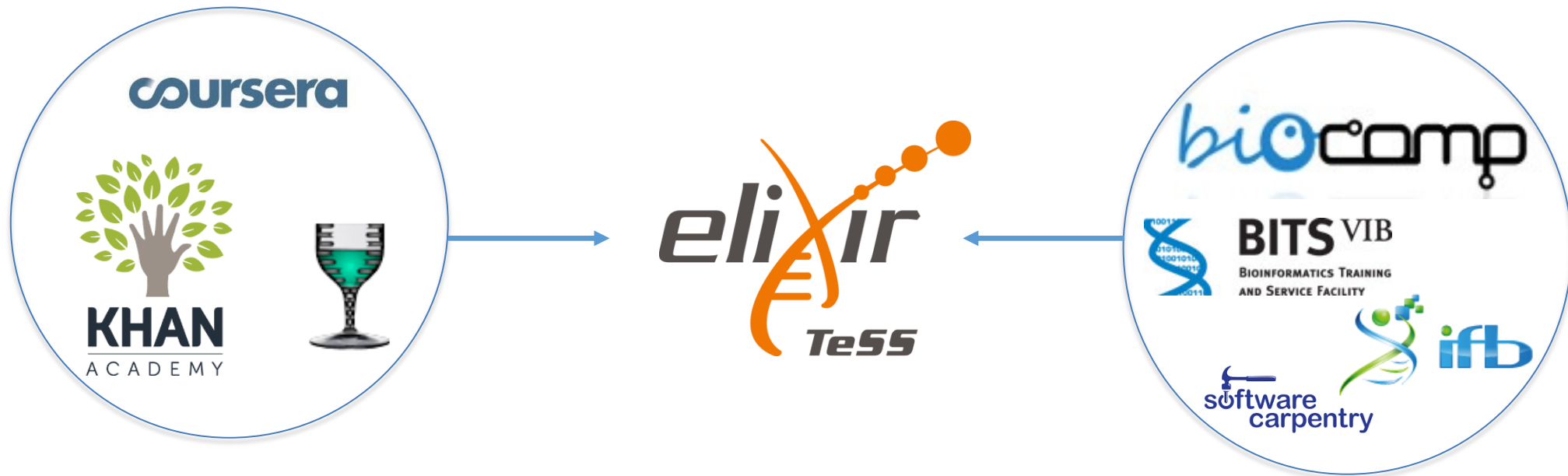
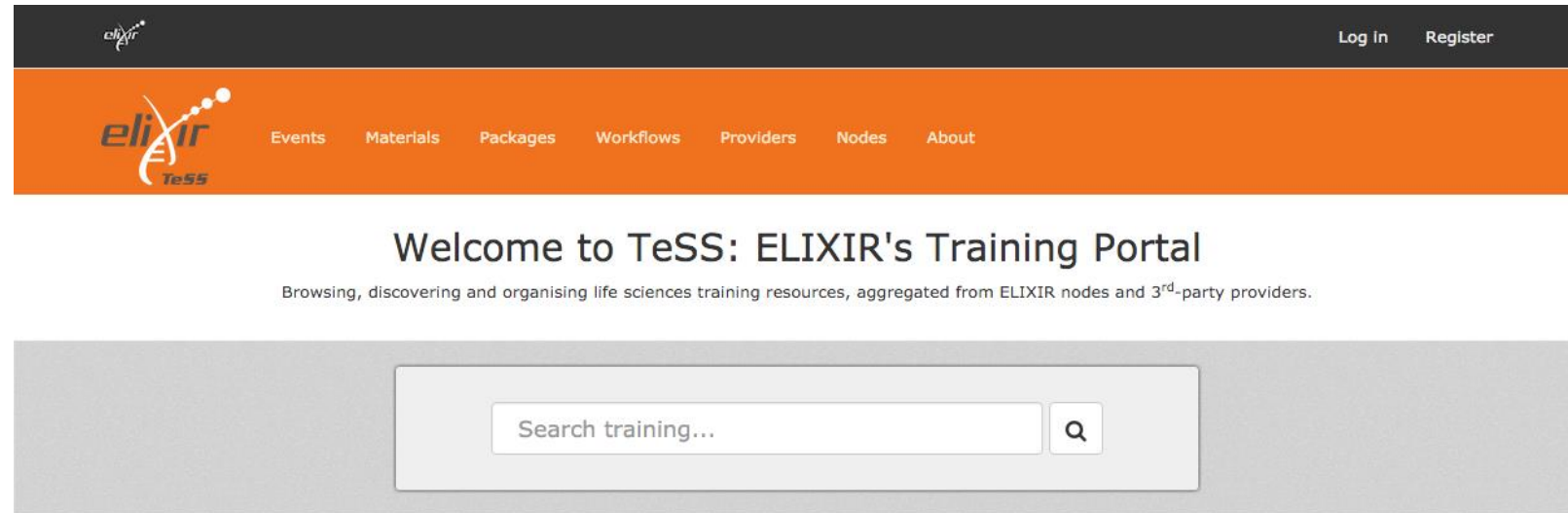
## Improving search results via Bioschemas



# Bioschemas: applications

TeSS: ELIXIR's Training Portal

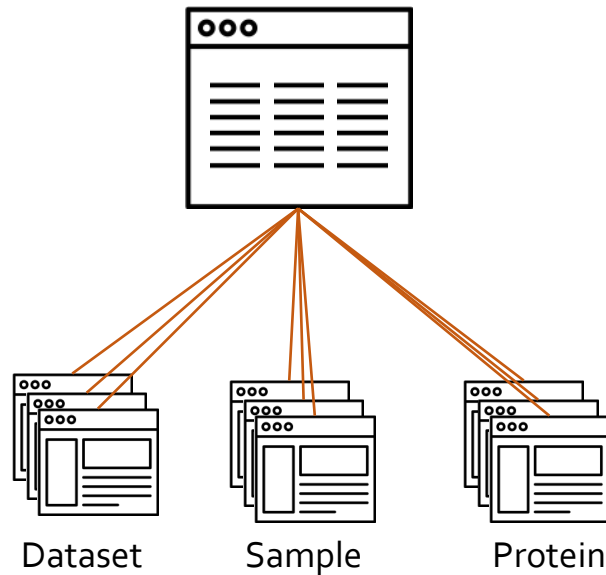
<https://tess.elixir-uk.org>



## Discovery, Registration and Validation

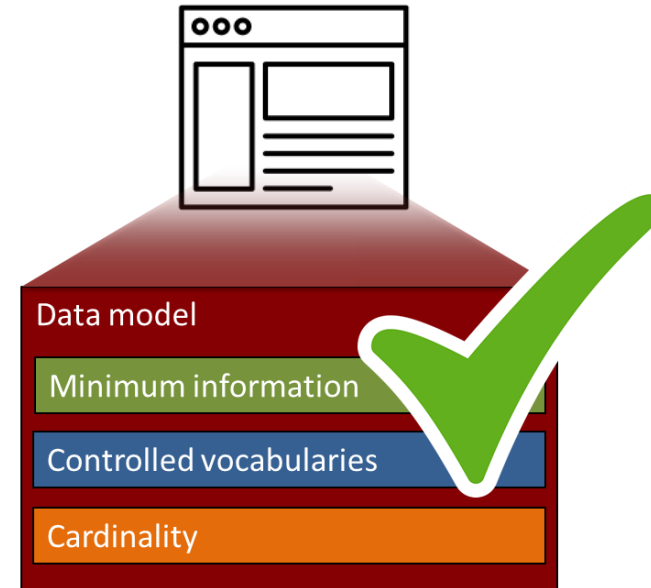
### DISCOVERY

Provide a simple registry where providers or consumers can describe of sites providing content in schema.org compliant with Bioschemas



### VALIDATION

Provide a GUI to validate Bioschemas compliant websites and Validate data repositories adopting Bioschemas







# Bioschemas

## Registry & Validator

Home Registry Test Website Submit Website

### Test And Submit A Website

With the Submit tool you can test a specific URL for its compliance with the Bioschemas specifications and submit it to the Registry for public consultation. You can choose to test all the children links for that page (links with the same root URL) as well as scraping your URL for one specific Bioschemas type (Event, Organization Person, Training Material).

Website URL:

Website Name:

If you choose not to provide a name for the URL you are testing, the *title* field content from the tested website will be used as its name

☐ Validate children links too

Scrape a specific Bioschemas type: All Types

☐ Mail notification when the process is done

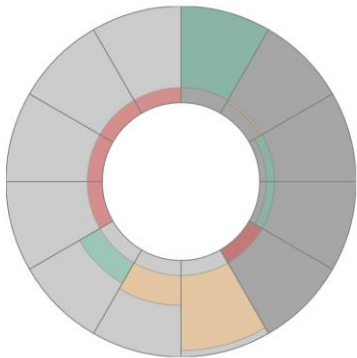
Validate!

#### Summary

### PerspectiveDrawings

[http://d.lib.ncsu.edu/collections/catalog/mc00383-001-ff0004-001-001\\_0004](http://d.lib.ncsu.edu/collections/catalog/mc00383-001-ff0004-001-001_0004)

Bioschemas type: CreativeWork (9 entries)



#### Compliance

- Correct property
- Wrong property
- Not provided

#### Guideline

- Minimum property
- Recomm. property

#### Minimum and Recommended Properties

☐ Show properties description

Compliance ▾	Property ▾	Type ▾	Guideline ▾	CV ▾	Cardinality ▾
93%	<a href="#">url</a>	URL	Recommended	No	Many
100%	<a href="#">name</a>	Text	Minimum	No	One
0%	<a href="#">license</a>	URL or CreativeWork	Recommended	Yes	One
47%	<a href="#">keywords</a>	Text	Recommended	No	Many
13%	<a href="#">genre</a>	Text or URL	Minimum	Yes	Many
40%	<a href="#">description</a>	Text	Recommended	No	One
7%	<a href="#">dateModified</a>	Date or DateTime	Minimum	No	One
0%	<a href="#">contributor</a>	Person or Organization	Recommended	No	Many
0%	<a href="#">author</a>	Person or Organization	Recommended	No	Many
0%	<a href="#">audience</a>	Audience	Minimum	Yes	Many
7%	<a href="#">about</a>	Thing	Minimum	No	One
0%	level	Text	Recommended	Yes	One



## Implementation Study Objectives



### Life sciences Content Types

Schema.org content types for life science Data

- Data repository, Dataset
- Samples, Protein annotations
- Phenotype annotations

### Discovery and validation

- Publication of metadata
- Automated integration of metadata in specialised registries

Discovery and validation of Bioschemas entries

### Community Support and Promotion

Support community and adoption  
Alignment of technical activities  
Working group within ELIXIR  
Collaboration between ELIXIR and BD2K  
Test benefits and issues

Hands-on workshops  
Small delivery team

## Upcoming activities

- **Bioschemas AGM**, 8<sup>th</sup>-9<sup>th</sup> November, Rothamsted (UK)  
Details on <https://goo.gl/hu7uYK>
- More content types for life science in development:
  - Tools
  - Data repository
  - Dataset
  - Sample
  - Phenotype
  - Protein annotations

# Acknowledgements

## Bioschemas community

### Group chairs

- **Community**  
Premysl Velek
- **Event**  
Martin Cook
- **Training materials**  
Aleksandra Nenadic & Gabriella Rustici
- **Organization**  
Richard Holland & Rafael C Jimenez
- **Person**  
Niall Beard
- **Standard**  
A Gonzalez-Beltran & P McQuilton

### Organization representatives

- **ELIXIR**  
Premysl Velek
- **Pistoia Alliance**  
Richard Holland
- **GOBLET**  
Terry Atwood
- **BBMRI**  
Michaela Mayrhofer
- **TeSS**  
Niall Beard
- **BioSharing**  
SA Sansone, A Gonzalez-Beltran, P McQuilton, P Rocca-Serra
- **NIH BD2K bioCADDIE**  
SA Sansone, A Gonzalez-Beltran, Jeff Grethe

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- Richard Holland
- Alejandra Gonzalez-Beltran
- Andrew Lonie
- Carole Goble
- Peter McQuilton
- Premysl Velek
- Ian Dunlop
- Jef Grethe
- Milo Thurston
- Niklas Blomberg
- Yasset Perez-Riverol
- Sarala Wimalaratne
- Nick Juty
- Jose Luis Ambite
- Brane Leskošek
- Celia van Gelder
- Christa Janko
- Christine Staiger
- Dan Brickley
- Daniel Faria
- Dmitry Repchevsky
- Daniel Sobral
- Daniel Vaughan
- Ian Fore
- Frederik Coppens
- Josep Gelpi
- ChuQiao Gong
- Hedi Peterson
- Hervé Ménager
- Nina Hrtonova
- Isabelle Perseil
- Jaap Heringa
- Jon Ison
- John Hancock
- Simon Jupp
- John D. Van Horn
- Ivana Krenkova
- Laura Furlong
- Morris Swertz
- Mateusz Kuzak
- Mario Alberich
- Mark Thompson
- Maria Martin
- Mikael Borg
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- Norman Morrison
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- Olivier Sallou
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- Rob Finn
- Renzo Kottmann
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- Sara Light
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- Susanna Sansone
- Tony Burdett
- Terry Atwood
- Cath Brooksbank
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- Michaela Mayrhofer
- Philippe Rocca-Serra







# Bioschemas

**Thank you!**

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*<http://bioschemas.org>*



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