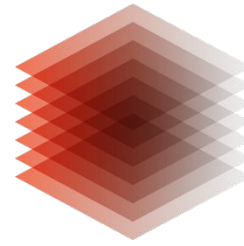


LEIBNIZ-INFORMATIONSZENTRUM
TECHNIK UND NATURWISSENSCHAFTEN
UNIVERSITÄTSBIBLIOTHEK

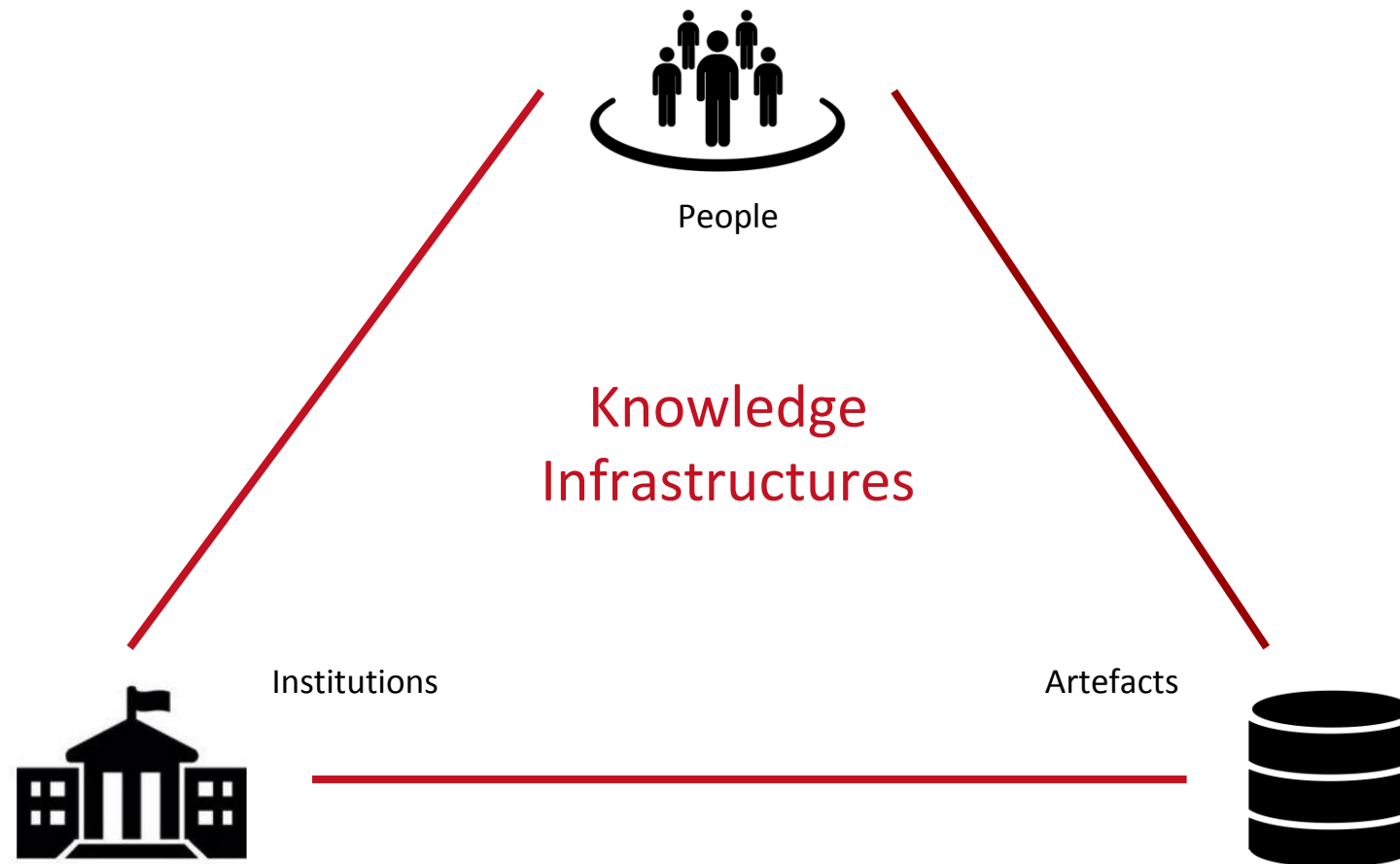


TIB

From Information to Knowledge with AI, in Scientific Knowledge Infrastructures

Markus Stocker







Scientists
Programmers
Technicians
Data Curators



People

Scientific
Knowledge
Infrastructures



Infrastructures
Publishers
Universities
Libraries

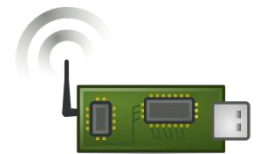


Institutions

Artefacts



Data
Software
Instruments
Samples



Iron-regulatory proteins secure iron availability in cardiomyocytes to prevent heart failure

**Saba Haddad^{1,2}, Yong Wang^{1,2}, Bruno Galy^{3,4}, Mortimer Korf-Klingebiel^{1,2},
Valentin Hirsch^{1,2}, Abdul M. Baru^{1,2}, Fatemeh Rostami^{1,2}, Marc R. Reboll^{1,2},
Jörg Heineke², Ulrich Flögel⁵, Stephanie Groos⁶, André Renner⁷, Karl Toischer⁸,
Fabian Zimmermann⁹, Stefan Engeli¹⁰, Jens Jordan¹⁰, Johann Bauersachs²,
Matthias W. Hentze³, Kai C. Wollert^{1,2}, and Tibor Kempf^{1,2*}**

¹Division of Molecular and Translational Cardiology, Hannover Medical School, Carl-Neuberg-Straße 1, 30625 Hannover, Germany; ²Department of Cardiology and Angiology, Hannover Medical School, Carl-Neuberg-Straße 1, 30625 Hannover, Germany; ³European Molecular Biology Laboratory, Meyerhofstraße 1, 69117 Heidelberg, Germany; ⁴Division of Virus-associated Carcinogenesis, German Cancer Research Centre, Im Neuenheimer Feld 280, 69120 Heidelberg, Germany; ⁵Department of Molecular Cardiology, University of Düsseldorf, Universitätsstraße 1, 40225 Düsseldorf, Germany; ⁶Institute of Cell Biology, Hannover Medical School, Carl-Neuberg-Straße 1, 30625 Hannover, Germany; ⁷Department of Thoracic and Cardiovascular Surgery, University of Bochum, Georgstraße 11, 32545 Bad Oeynhausen, Germany; ⁸Department of Cardiology and Pneumology, University of Göttingen, Robert-Koch-Straße 40, 37075 Göttingen, Germany; ⁹Department of Analytical Chemistry, Leibniz University Hannover, Callinstraße 1, 30167 Hannover, Germany; and ¹⁰Institute of Clinical Pharmacology, Hannover Medical School, Carl-Neuberg-Straße 1, 30625 Hannover, Germany

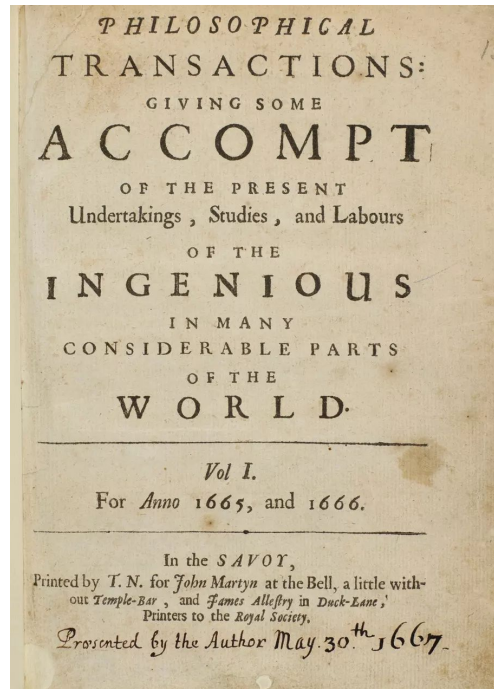
Received 30 November 2015; revised 27 June 2016; accepted 12 July 2016; online publish-ahead-of-print 21 August 2016

See page 373 for the editorial comment on this article (doi: 10.1093/eurheartj/ehw386)

The Article

**Primary artefact used to communicate
scientific information and knowledge**

- The global scientific knowledge base is little more than a collection of (digital) documents
- Communication from human authors to readers, inadequate for machines
- Fundamentally unchanged over the centuries



Anno 1665



European Heart Journal (2017) 38, 362–372
doi:10.1093/eurheartj/ehw333

BASIC SCIENCE

Iron-regulatory proteins secure iron availability in cardiomyocytes to prevent heart failure

Saba Haddad^{1,2}, Yong Wang^{1,2}, Bruno Galy^{3,4}, Mortimer Korf-Klingebiel^{1,2}, Valentin Hirsch^{1,2}, Abdul M. Baru^{1,2}, Fatemeh Rostami^{1,2}, Marc R. Reboll^{1,2}, Jörg Heineke², Ulrich Flögel⁵, Stephanie Groos⁶, André Renner⁷, Karl Toischer⁸, Fabian Zimmermann⁹, Stefan Engeli¹⁰, Jens Jordan¹⁰, Johann Bauersachs², Matthias W. Hentze³, Kai C. Wollert^{1,2}, and Tibor Kempf^{1,2*}

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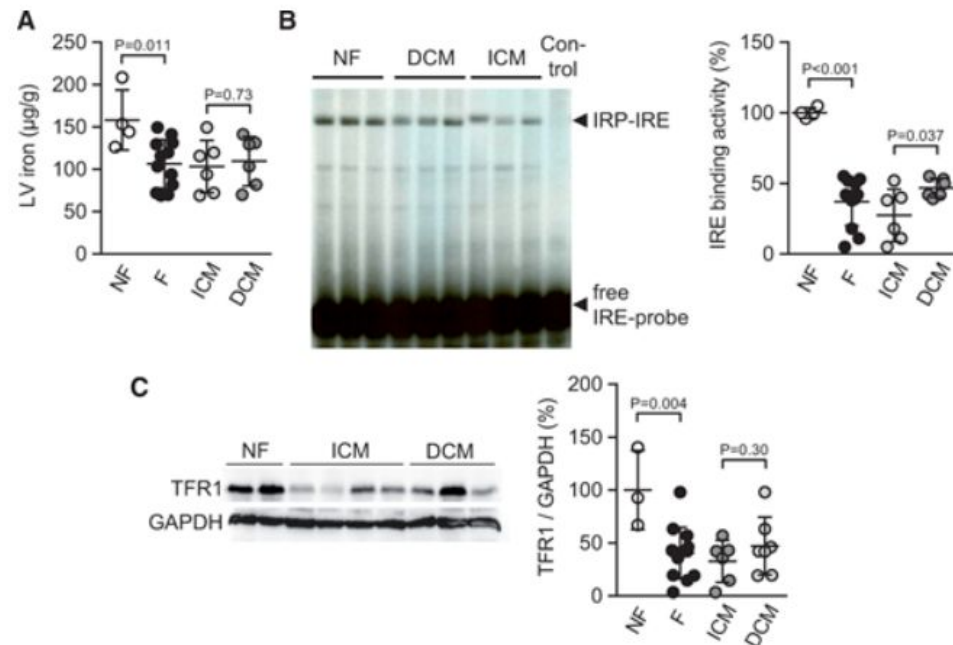
Anno 2019

Results

Reduced iron content, IRE binding activity, and transferrin receptor expression in the failing human heart

Consistent with previous reports,^{5,6} iron concentration was significantly lower in LV tissue samples from patients with advanced heart failure than in LV tissue samples from unused donor hearts (*Figure1A*). As shown by electrophoretic mobility shift assays, IRE binding activity was significantly reduced in failing hearts (most pronounced in patients with ischemic cardiomyopathy) (*Figure1B*). Protein expression levels of the transferrin receptor were significantly lower in failing hearts than in the controls (*Figure1C*).

Figure 1



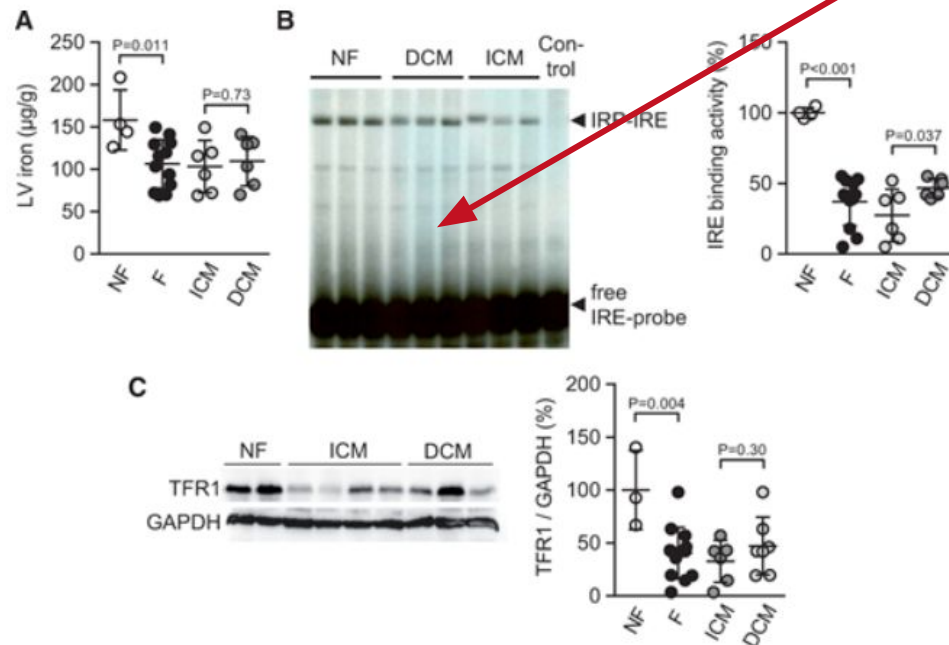
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As shown by electrophoretic mobility shift assays,

Figure 1



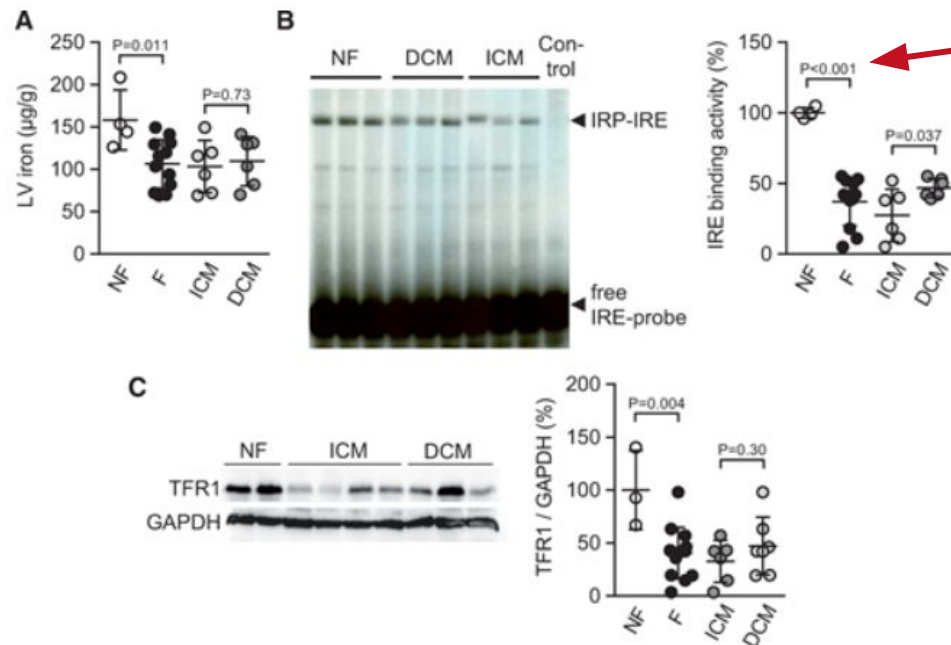
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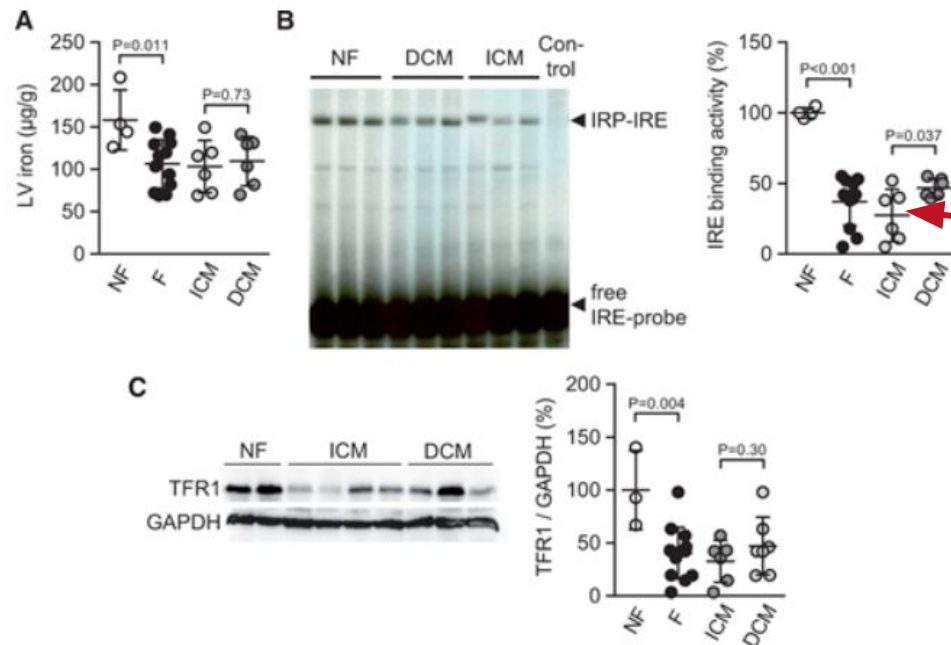
IRE binding activity was significantly reduced in failing hearts

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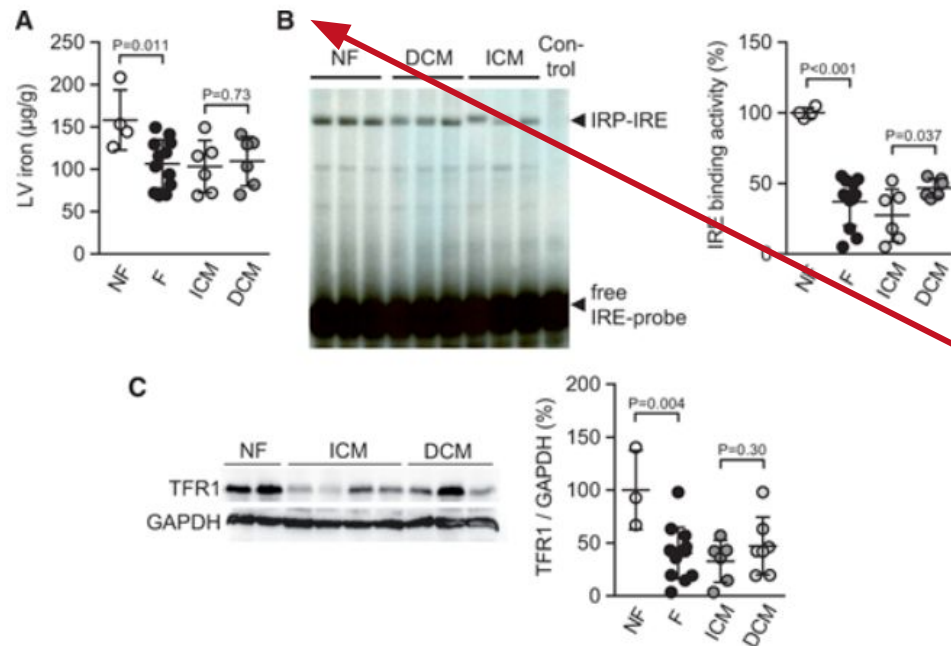
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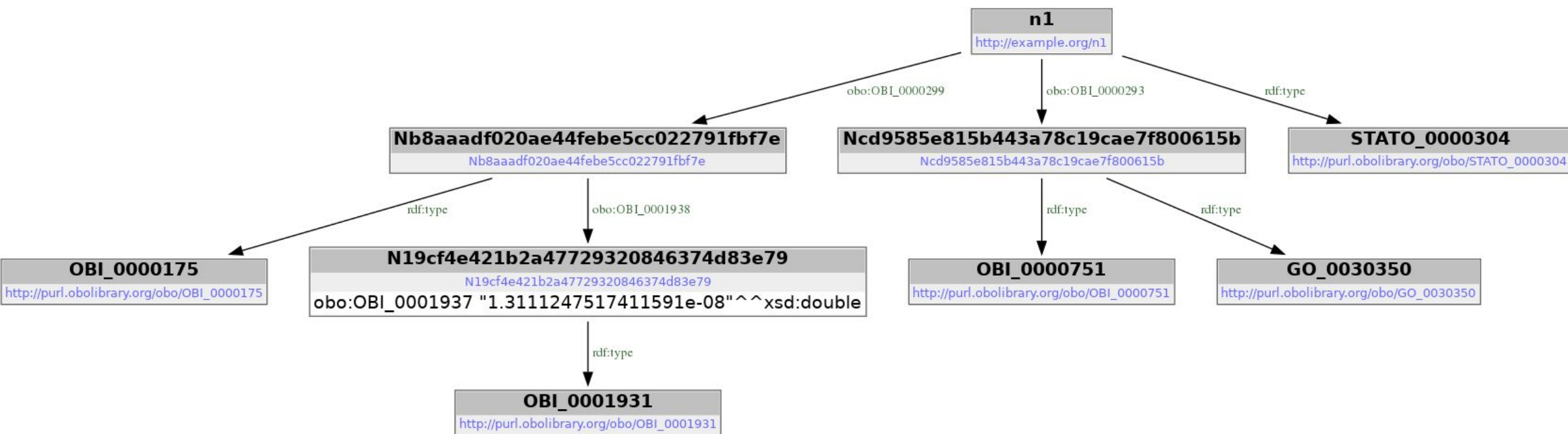


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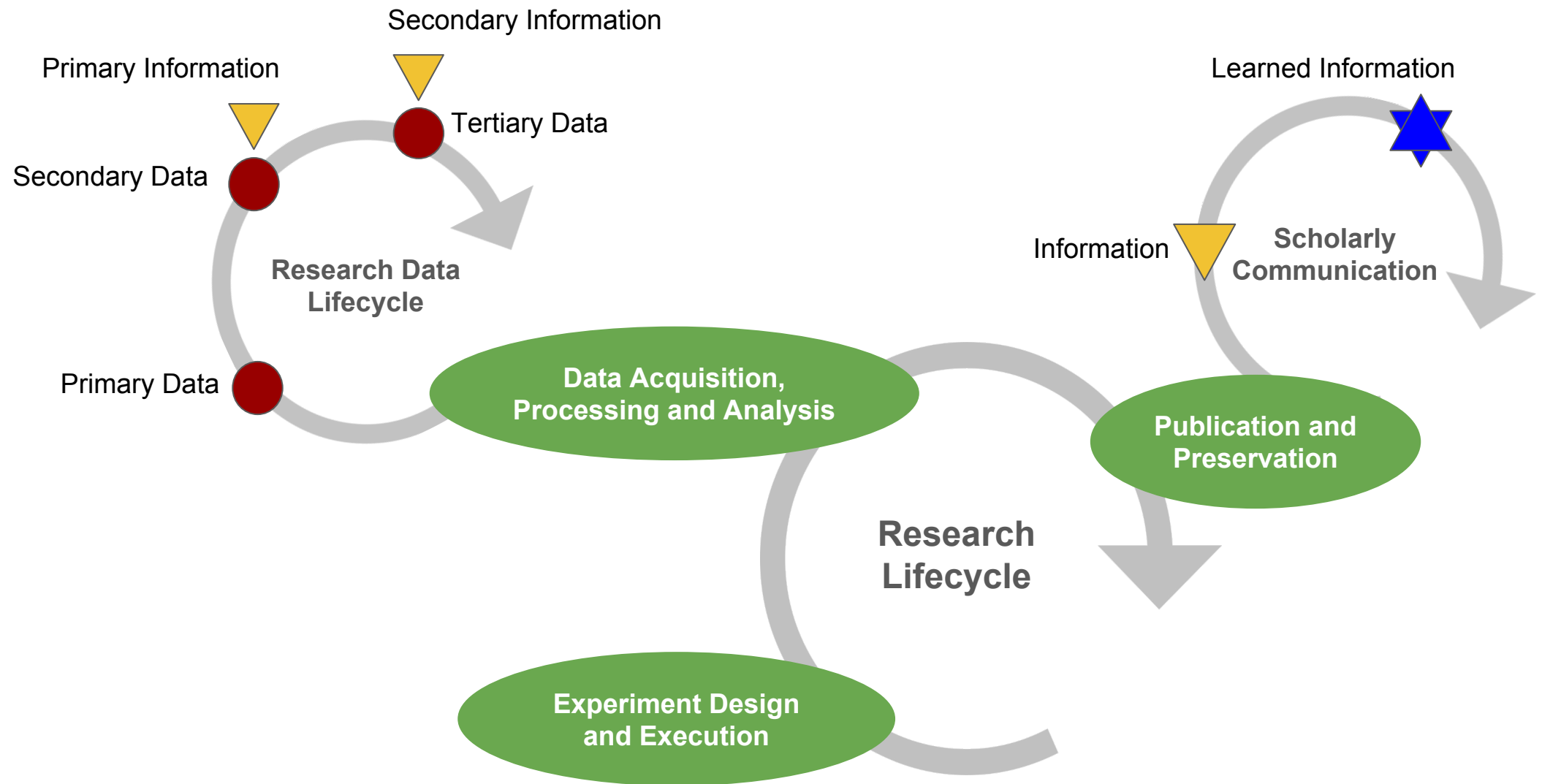
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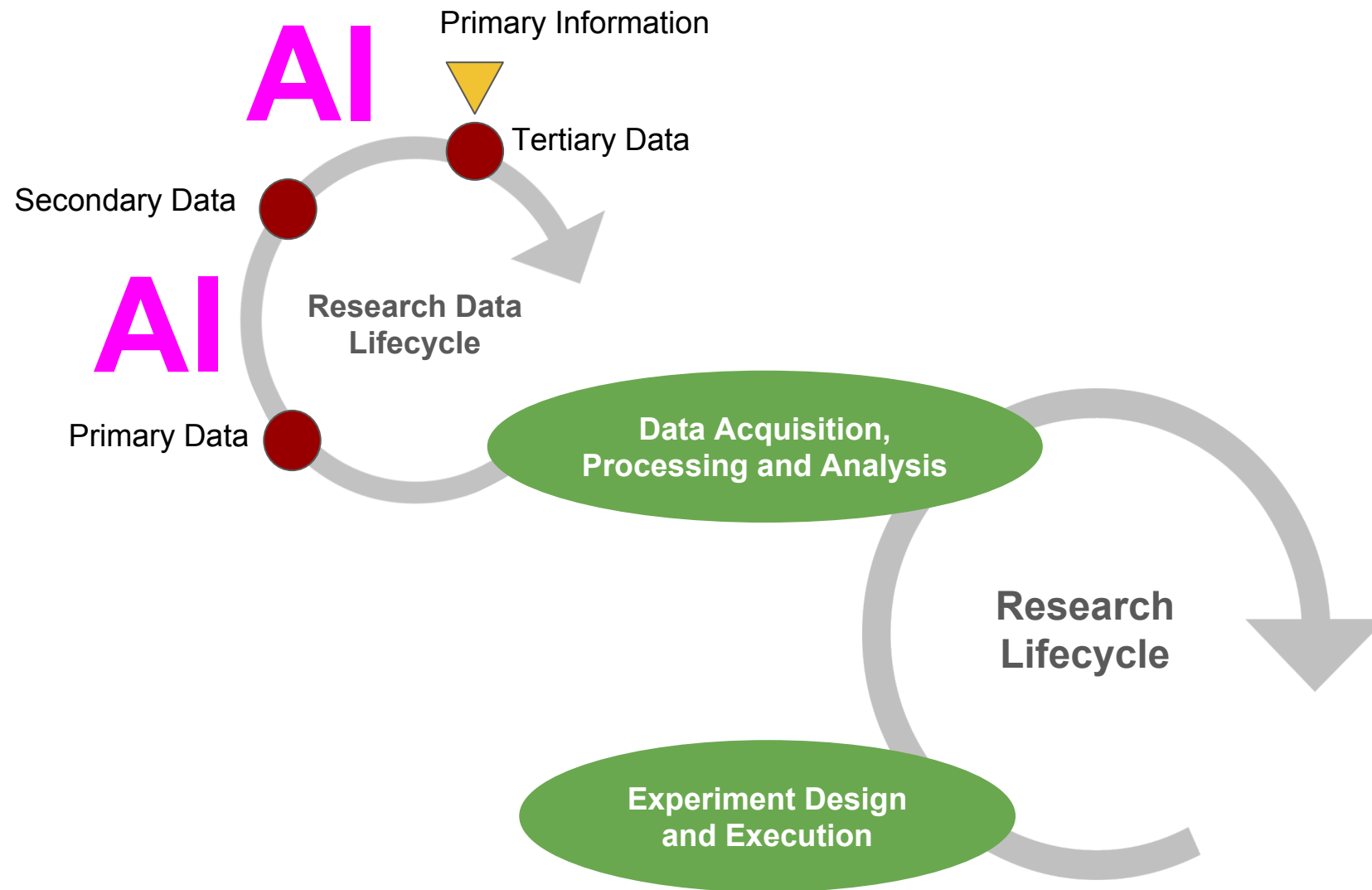
(Figure1B).



From Data to Knowledge, in Research



From Data to Knowledge **with AI,** in Research



Example



Particle Formation VRE

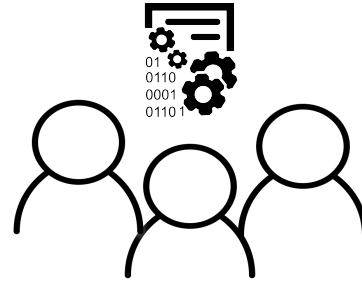


Particle Formation | Virtual Research Environment

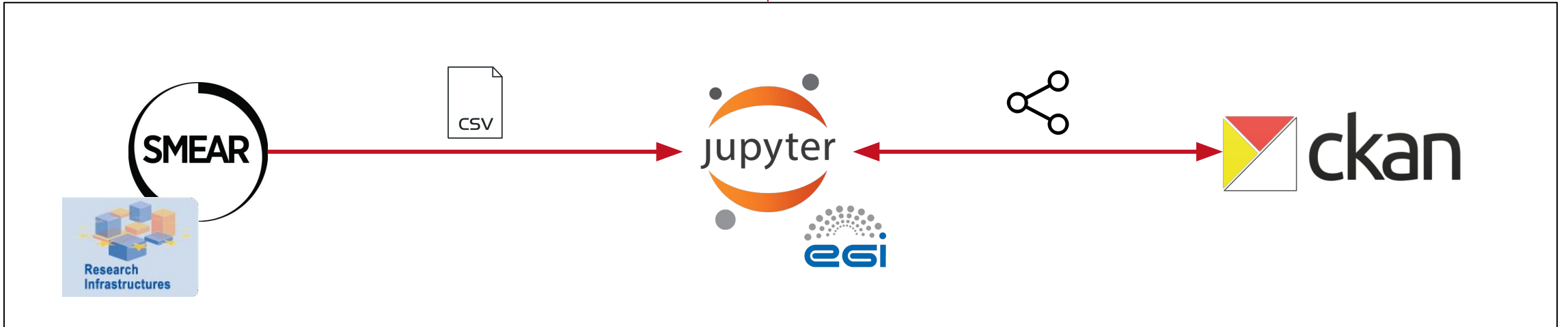
New particle formation events are a worldwide observed atmospheric phenomenon that affects human respiratory health and the global climate.

<https://services.d4science.org/web/particleformation>

Access the VRE



Virtual Research Environment



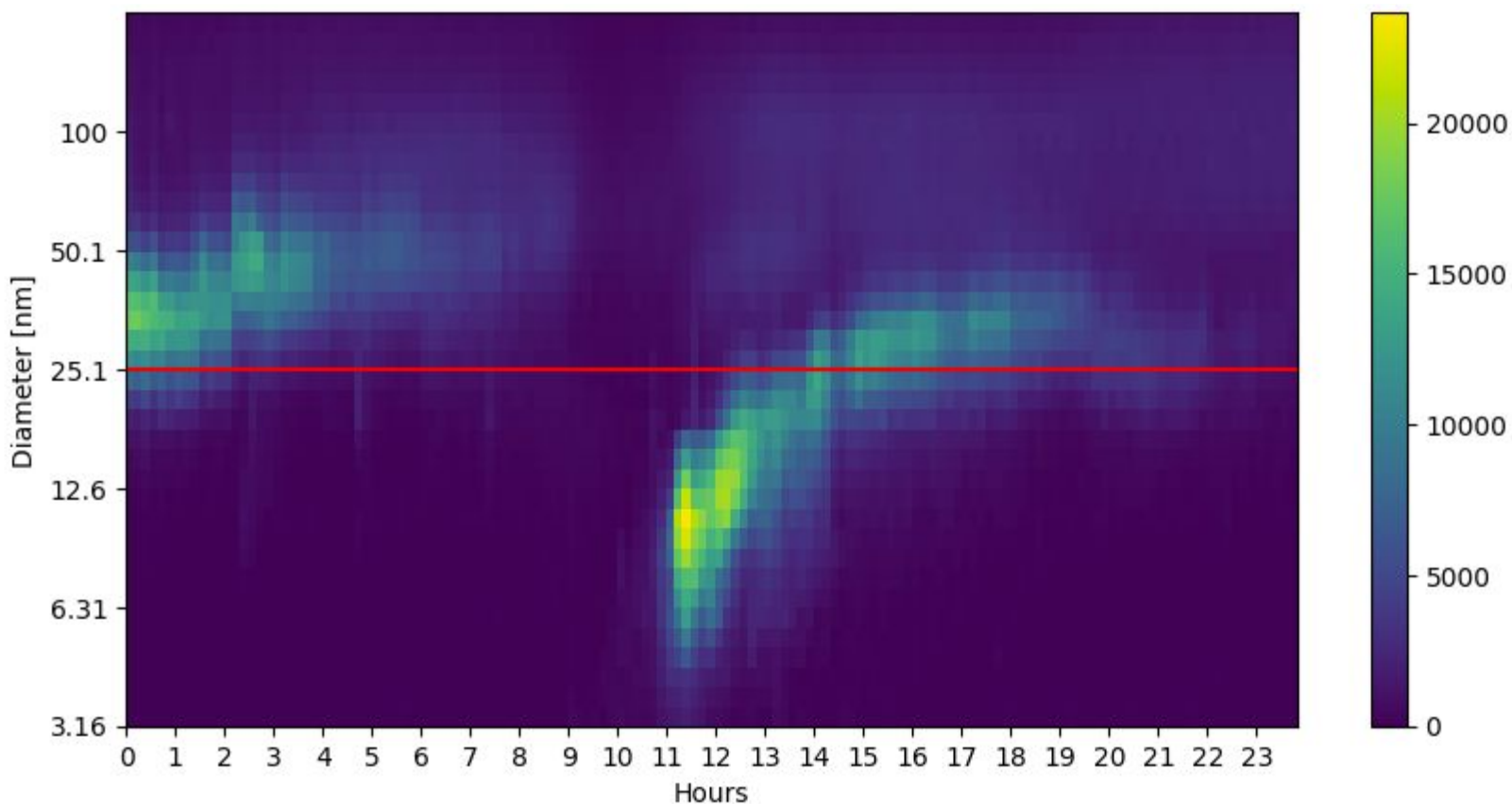
AI

```
starttime = datetime.now()

d = read_data(observational_data_file)
plot_data(d)

v = feature_vector(d)
v = np.array(v).reshape(1, -1)
v = scaler_detection.transform(v)

display(Markdown('<span style="color:red">Automated assessment by machine learning classifier: <span style="font-weight:bold">{} Day</span></span>'.format(classifier_detection.predict(v)[0])))
```



AI

Automated assessment by machine learning classifier: **Event Day**

```
place = 'Hyytiaelae'
```

```
df = read()
```

```
df.style.hide_columns(['uri'])
```

	beginning	end	classification	place	latitude	longitude
0	2007-05-18 12:30:00+03:00	2007-05-18 14:00:00+03:00	Class Ia	Hyytiälä	61.8456	24.2908
1	2011-04-19 09:00:00+03:00	2011-04-19 14:00:00+03:00	Class Ia	Hyytiälä	61.8456	24.2908
2	2013-04-04 10:00:00+03:00	2013-04-04 12:00:00+03:00	Class Ia	Hyytiälä	61.8456	24.2908

```
# Mean event duration in hours [h]
```

```
d = (df.end - df.beginning).astype('timedelta64[h]').mean()
```

```
d
```

```
2.6666666666666665
```

```
record(d)
```

Table 3. Monthly means of event start time, event end times, event duration, Sunrise and Sunset for nucleation events from (2002–2005) together with the Minimum (Min), Maximum (Max), Mean and Median for the whole study period.
Note that the September month is not statistically reliable.

Month	Event start time	Event end time	<u>Duration</u>	Sunrise	Sunset
1	10:29	16:53	06:23	07:50	16:53
2	12:17	18:41	06:23	07:21	17:33
3	11:14	17:18	06:04	06:30	18:14
4	11:30	16:50	05:20	05:34	18:52
5	10:21	15:31	05:09	04:50	19:29
6	9:05	14:51	05:46	04:34	19:53
7	9:43	14:25	04:41	04:50	19:48
8	9:57	15:37	05:40	05:24	19:10
9	11:00	16:27	05:27	06:01	18:15
10	11:57	17:37	05:40	06:39	17:18
11	12:05	18:30	06:24	07:19	16:38
12	12:03	18:35	06:32	07:49	16:29
Min	09:05	14:25	04:41	04:34	16:29
Max	12:17	18:41	06:32	07:50	19:53
<u>Mean</u>	10:58	16:46	05:47	06:13	18:12
Median	11:07	16:51	05:43	06:15	18:14

```
obo:IAO_0000004 rdfs:label "has measurement value" .

obo:IAO_0000039 rdfs:label "has measurement unit label" .

obo:OBI_0000293 rdfs:label "has_specified_input" .

obo:OBI_0000299 rdfs:label "has_specified_output" .

obo:OBI_0000312 rdfs:label "is_specified_output_of" .

<http://avaa.tdata.fi/web/smart/smeas/2257b3dfe45b2b5a1cd3335a491b6e53> a obo:IAO_0000032,
    obo:OBI_0000679,
    prov:Entity ;
obo:IAO_0000004 2.66666666667 ;
obo:IAO_0000039 obo:UO_0000032 ;
obo:OBI_0000312 <http://avaa.tdata.fi/web/smart/smeas/bed1cf864f3fef175cf783247658455d> ;
prov:wasDerivedFrom <http://avaa.tdata.fi/web/smart/smeas/2e0ed83b68c8ebe8255f7f1ca8f8aeb7> ;
prov:wasGeneratedBy <http://avaa.tdata.fi/web/smart/smeas/bed1cf864f3fef175cf783247658455d> .

<http://avaa.tdata.fi/web/smart/smeas/2c3514176ca67a77a99292cbb4b6a3ae> a obo:IAO_0000027 .

<http://avaa.tdata.fi/web/smart/smeas/2dfd71517e109fc779666e64788a49c8> a obo:IAO_0000027 .

<http://avaa.tdata.fi/web/smart/smeas/321844eda43b77fe582abb6ce489cc4d> a obo:IAO_0000027 .

obo:IAO_0000032 rdfs:label "scalar measurement datum" .

obo:IAO_0000100 rdfs:label "data set" .

obo:OBI_0000679 rdfs:label "average value" .

obo:OBI_0200079 rdfs:label "arithmetic mean calculation" .

obo:UO_0000003 rdfs:label "time unit" .

obo:UO_0000032 a obo:UO_0000003 ;
    rdfs:label "hour" .
```

OPEN RESEARCH KNOWLEDGE GRAPH

DIGITAL LIBRARIES FOR SEMANTIC SCIENTIFIC KNOWLEDGE



- Digital libraries for scientific knowledge communicated in scholarly literature
- Focus on the communicated content rather than the context
- The content is semantic i.e., machine readable (interpretable)

<http://orkg.org>