

Research Data

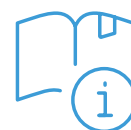
CHALLENGES AND OPPORTUNITIES FOR DATA SHARING IN JAPAN

White paper

ADVANCING
DISCOVERY



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This white paper and its underlying
data have been made openly available
in the Figshare repository

■ **Access white paper:**
[https://www.doi.org/10.6084/m9.
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■ **Access associated survey
dataset:**
[https://www.doi.org/10.6084/m9.
figshare.6328952](https://www.doi.org/10.6084/m9.figshare.6328952)

Introduction

This report provides a novel, quantitative and qualitative perspective on open science in Japan in 2018. It summarises the findings of a survey of more than 1,000 researchers in Japan, looking at the challenges and opportunities for data sharing in the region. The underlying dataset of the survey is available openly on Figshare.¹ To add expert perspectives to this report, it includes a summary of a roundtable discussion with key opinion leaders in the Japanese research community and representatives of major funding organisations, chaired by Springer Nature in Tokyo in 2018. It concludes with an interview with AMED, a funder of medical research in Japan, providing a more in-depth account of their innovative approach to sharing medical research data from rare diseases.

Springer Nature undertook this analysis as part of a series of global initiatives to better understand current perspectives, attitudes and actions in research data management, and the challenges in data sharing. As a major research publisher, we are committed to developing collaborative open research solutions, for example on data management and education. This survey of researchers in Japan follows a global survey in 2017 of more 7,000 researchers worldwide², asking specifically about data sharing at the point of submitting an article for publication. We received relatively few responses to this global survey from researchers in Japan, and China, so in 2018 we extended our research to these territories. Similar research based on a survey of researchers in China was published early in 2019³ and a further white paper synthesizing both the global and regional data published in April 2019.⁴

The goals of the survey of Japanese researchers in 2018 were to:

- Understand if researchers create **data management plans** and what, if any, barriers prevent them from doing so.
- Understand if researchers are **sharing data** and what, if any, barriers prevent them from doing so.
- Understand what **data types** are produced and who owns these.

The survey was conducted online in English and Japanese, with invitations to participate sent to registrants of Springer Nature email marketing lists in Japan and via social media. In total, 1,393 responses were received from active researchers (academic, scientific or clinical) in Japan, representing all major research disciplines and career stages.

By combining the results of this substantive survey with expert opinions from key stakeholders, and showcasing an important and ambitious project that is succeeding in sharing challenging types of research data, we provide a unique snapshot of the state of open science and research data sharing in Japan.

1,393 responses were received from active researchers in Japan, representing all major research disciplines and career stages

1 Allin, Katie; Baynes, Grace; Lucraft, Mithu; Penny, Dan; Chong, Steven; et al. (2018): Research data: challenges and opportunities for Japanese researchers- Springer Nature survey data. Figshare. Dataset. <https://doi.org/10.6084/m9.figshare.6328952.v1>

2 Stuart, David; Baynes, Grace; Hrynaskiewicz, Iain; Allin, Katie; Penny, Dan; Lucraft, Mithu; et al. (2018): Whitepaper: Practical challenges for researchers in data sharing. Figshare. Paper. <https://doi.org/10.6084/m9.figshare.5975011.v1>

3 Lucraft, Mithu; Allin, Katie; Baynes, Grace; Sakellaropoulou, Roza; et al. (2019): Challenges and Opportunities for Data Sharing in China. Figshare. Paper. <https://doi.org/10.6084/m9.figshare.7326605>

4 Lucraft, Mithu; Baynes, Grace; Allin, Katie; Hrynaskiewicz, Iain; Khodiyar, Varsha; et al. (2019): Five Essential Factors for Data Sharing. Figshare. Paper. <https://doi.org/10.6084/m9.figshare.7807949>

Japan

survey results



On data sharing

The good news is that sharing data is important to the majority of researchers in Japan. 95% of respondents had shared their data. 75% of respondents rated the discoverability of their data as being somewhat important (score of 6 or above out of 10) (n=1,062). The average score was 7.2, showing very similar findings to the Springer Nature global survey (average of 7.3).

Motivations for sharing data also resonate with global findings: The top two reasons why researchers in Japan would be motivated to share data are around research progression and helping others in a similar field (50%) and for the transparency and re-use of data (42%). Less motivation comes from funder, publisher or journal requirements or being requested to share data.

By

Mithu Lucraft, Marketing Director, Outreach and Open Research, and Katie Allin, Senior Research Analyst, Strategy & Market Intelligence Group, Springer Nature

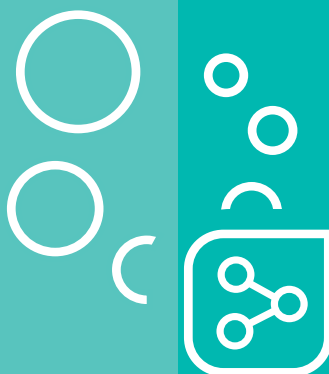
95% of Japanese researchers have shared their data (n=975)

Sharing data is important to the majority of Japanese researchers:

75%

of respondents rated the discoverability of their data as being somewhat important (score of 6 or above out of 10)

(n=1062)



The top two reasons why researchers would be motivated to share data are:

50%

'To progress research' in their field

42%

For the transparency and re-use of data

(n=994)

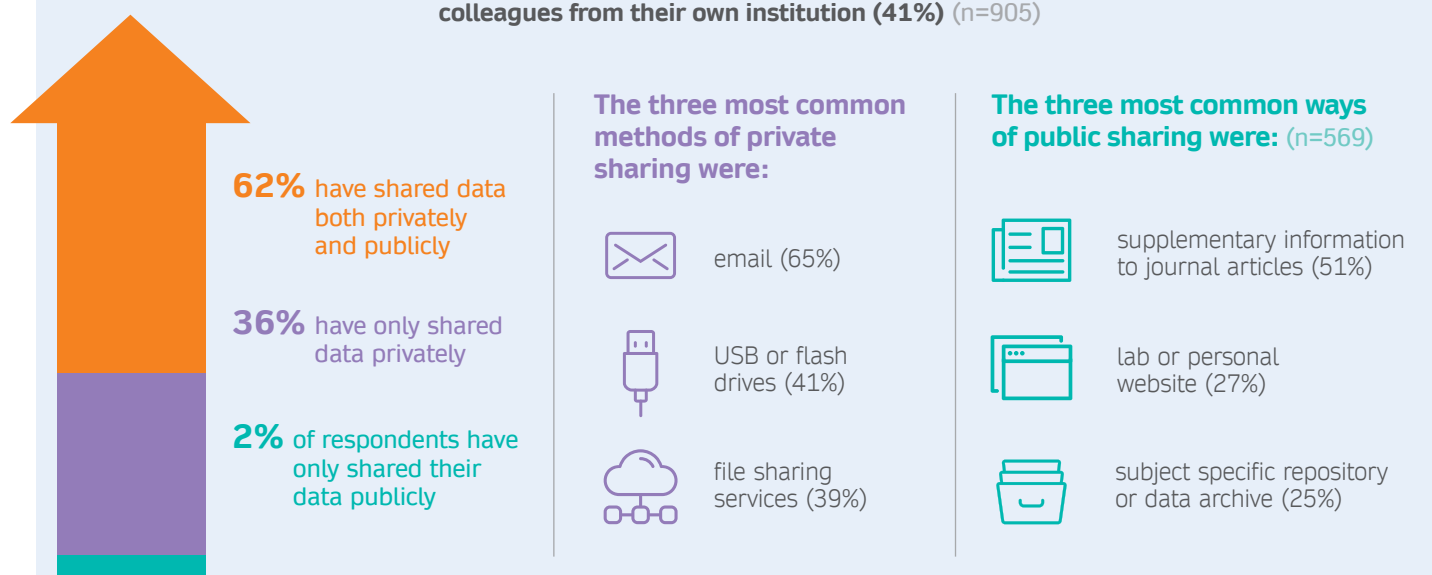
However data are often not being shared in the most optimal ways. Of the 95% of respondents who were sharing their data, 35% have only shared data privately. There were also differences noted by subject and seniority: physical sciences researchers were significantly more likely to only share privately compared to those in biological sciences (40% vs. 30%); first stage researchers were significantly more likely to select 'only privately' than all other seniorities (46%).

This compares to findings in the Springer Nature global survey which reported levels of public sharing from 76% (Poland) to Canada (50%). Private sharing of data is mainly amongst known peers (66%) and colleagues from their own institution (41%). The three most common methods of private sharing were: email (65%), USB or flash drives (41%) and file sharing services, such as Dropbox (39%). These methods are not consistent with best practice, which generally recommends more secure and persistent mechanisms for sharing data privately.

Public sharing of data was predominantly as supplementary information to journal articles (51%), followed by posting on lab/personal websites (27%) and depositing in a subject specific repository (25%). Researchers working in biological sciences showed a much higher selection of the option 'deposit data in subject specific repository/data archive' (46% selection) compared to researchers in the physical sciences and medical sciences. This is consistent with the global survey data which also found much higher levels of sharing by biological sciences researchers compared with those in other disciplines.

Private sharing of data is a lot more common than public sharing of data

Private sharing of data is mainly amongst **known peers (66%)** and **colleagues from their own institution (41%)** (n=905)

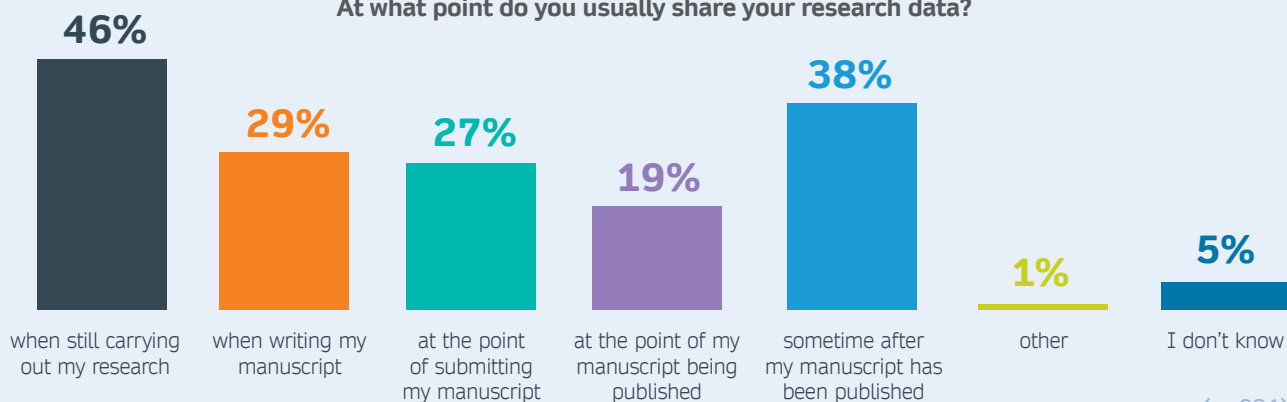


Most researchers (46%) share their data 'when still carrying out research.' Those who share data 'when still carrying out research' or 'when writing their manuscript' are more likely to share the data privately than publicly. Those researchers who share at the 'point of submitting their paper' or 'at publication' are more likely to share both publicly and privately.

Concerns about misuse of data is the main reason people are concerned about sharing their datasets (49%), followed by copyright and licensing concerns (42%), and the presence of sensitive information (35%). More medical researchers selected 'contains sensitive information' (47%) compared to any other subject area.

Most researchers (46%) share their data 'when still carrying out research'

At what point do you usually share your research data?



Of those who share data when still carrying out research (exclusively):

46% have done so only privately
53% both privately/publicly and only 1% only publicly

On data management plans

56% of researchers have created a data management plan (DMP) before. Of these, 45% of researchers 'always' or 'the majority of the time' create DMPs. Significantly more medical researchers create DMPs 'always' or the 'majority of the time' (33%) compared to researchers in the physical sciences (20%) or biological sciences (21%). A similar question in the State of Open Data survey⁵ in 2017 found that 23% of researchers globally have created a DMP before. 59% have implemented the DMPs they created 'always' or 'the majority of the time'.

56% of researchers have created a Data Management Plan (DMP) before. (n=1170)

Of these:

45% of researchers 'always' or 'the majority of the time' create DMPs

59% have implemented the DMPs they created 'always' or 'the majority of the time'

(n=655)



Of those who haven't created a DMP before:

46% had not heard of a DMP before

45% were not required to make a DMP by either their funder or institution

(n=509)

Unfamiliarity and a lack of requirement to make DMPs are the main reasons why people have not made one before: 46% had not heard of a DMP before and 45% said they were not required to make a DMP by either their funder or institution. This aligns with the main reasons researchers said they had made a DMP before: DMPs are recognised by those who have created them in the past as helping

⁵ Digital Science; Hahnel, Mark; Treadway, Jon; Fane, Briony; Kiley, Robert; Peters, Dale; et al. (2017): The State of Open Data Report 2017. figshare. Paper. <https://doi.org/10.6084/m9.figshare.5481187.v1>

'ensure efficient and effective management of data' (41%). A further 40% made DMPs because of a requirement at their institution.

59% of researchers have implemented the data management plans they have created 'always' or the 'majority of the time'. 80% of respondents who have made a DMP before said they experienced some kind of challenge when implementing it, with time being the biggest challenge (36%).

58% are likely to create DMPs in the future (n=1,068), however further support for researchers is needed: 34% of respondents 'strongly agree/agree' that they are confident in creating a good DMP but only 13% 'strongly agree/agree' that there is enough information and help available to help create a good DMP.

On funder requirements

On average 23% of respondents do not know what their main funders' requirements are in relation to data sharing. For example, the Japan Science & Technology Agency (JST) requires data sharing, however only 11% of respondents who identified JST as their main research funder correctly identified this. A further 66% incorrectly identified JST's requirements and 23% did not know enough information to provide an answer.

Similarly 34% of researchers do not know what their main funders' requirements are with regards to data management plans. JST is an example of one funder who has guidelines for data management plans (DMPs) and requires researchers to make them. However of the 115 researchers who identified JST as their main research funder, only 12% answered this correctly.



36% said time is the biggest challenge when it comes to implementing a DMP (n=601)



Only **13%** agree they have enough information to create a DMP
58% are likely to create a DMP in future (n=1,068)

The current state of awareness of funder requirements

34%

of respondents do not know what their main funders' requirements are in relation to DMPs (n=763)

23%

of respondents do not know what their main funders' requirements are in relation to data sharing (n=723)

Conclusions

Data sharing is widespread amongst the research community in Japan, but researchers do not always appear to be sharing data in optimal ways. The majority of sharing is private, among known peers and sent over email or USB. These put data at risk of being lost or poorly preserved. Where data is shared publicly it is often via supplementary information to journal articles which makes data less findable and usable compared to using data repositories. Awareness and use of data management plans (DMPs) is certainly not low: 56% have created a DMP and a similar proportion is likely to create one in the future. However, our results suggest awareness and use of DMPs by researchers in Japan could be increased. Institutions, funding agencies, publishers and researchers working together can continue to find innovative solutions to help solve these problems.

Insight 1 – Perspectives on open science and research data in Japan

Following the 2018 Japan Open Science Summit (JOSS) in Tokyo, Springer Nature invited major funding agencies and stakeholders to join us for a roundtable discussion about the state of open science in Japan, and to explore how we might collaborate to advance data best practice. In a lively conversation, we heard a commitment to open science, and a strong desire for data sharing best practice to be researcher-led and discipline-specific. Advice on future actions included a deeper understanding of concerns about data misuse, and better case studies on the benefits of data sharing to researchers.

We were honored that Kazuhiro Hayashi, Senior Research Fellow at the National Institute of Science and Technology Policy (NISTEP), agreed to co-chair the roundtable with us in a personal capacity, and that our guests made time to meet with us and were so engaged in sharing their perspectives. Joining us were:

- **Yuko Harayama**
Former Executive Member, Council for Science, Technology and Innovation (CSTI), Cabinet Office; Professor Emeritus, Tohoku University
- **Masaru Kitsuregawa**
Director General, National Institute of Informatics (NII)
- **Yasushi Ogasaka**
Director, Department of Databases for Information and Knowledge Infrastructure, Japan Science and Technology Agency (JST)
- **Yasuhiro Murayama**
Research Executive Director, National Institute of Information and Communications Technology (NICT)
- **Ryo Nakayama**
Director, Research Division, Japan Society for the Promotion of Science (JSPS)

Our roundtable began by seeking views on the current status of open science in Japan. The 2018 Japan Open Science Summit (JOSS) attracted more than 300 attendees and Kazuhiro Hayashi noted the marked change compared to previous events, both in terms of interest and progress in initiatives. There was a consensus that the current sense of momentum on open science in Japan has been driven by strong support from the Science Council, government and G8 agenda.

"Many years ago no one was speaking about Open Science in Japan. It all started in 2013, after Open Science became part of the policy agenda at the G8 Science Ministers meeting. Today, the cabinet office is proactively speaking at institutional level, inviting them to have data management policies in place."

Yuko Harayama

By

Grace Baynes, VP Research Data & New Product Development, Springer Nature

"The government actions toward open science were crucial in encouraging more commitment from the research community. It is however still in its early stages in Japan."

Yasuhiro Murayama

Moving to talk specifically about enabling research data and open data, our conversation identified four essential aspects to successful data sharing: policy, culture, a demonstrable scientific benefit to sharing data, and infrastructure to support data sharing. While policy was identified as critical, there was reluctance to adopt a top-down, policy enforcement approach. Instead, there was clear agreement that to create change we need to understand and create a culture which encourages best practices, and not impose.

"Designing research programs with fostering a culture of data-sharing is crucial, and developing them in consensus with researchers is essential."

Kazuhiro Hayashi

The funders around the table expressed a desire for the research community to create the momentum to share data, and help define discipline-appropriate ways of sharing. They were also clear that motivation for researchers to manage/share data will come from their own research, and seeing that it aids progress.

"The strongest motivation to share data comes from researchers' daily work, and it cannot be generalized through a whole discipline. Here lies the limitation of policy. Those specific motivations still need to be discovered and encouraged."

Yasushi Ogasaka

There was also a consensus that in research data best practice, there is no "one-size-fits all". Individual disciplines will have different needs and standards. The practice of doing research is changing and researchers need both training and support on new skills like data management. This cannot be generalised at an institutional or national level and needs to be discipline-specific. Yasushi Ogasaka shared that this is reflected in how JST is rolling out its data management policy in a phased way to each subject area, to ensure the policy is embedded, understood and appropriate to each discipline.

"The essence is not citation; it is sharing more data to produce even more data. Nonetheless, data sharing practice cannot be enforced to the academic community. The world of research should be inclusive, and accept diversity."

Masaru Kitsuregawa

The shared view was that it is ultimately up to researchers how much to share, that it will depend on the surrounding research culture and is very specific to Japan.

We also talked about better understanding researchers' reservations about sharing data. In the Springer Nature survey of researchers in Japan, concern about 'data misuse' was the most commonly stated barrier to data sharing. We were strongly encouraged to explore what researchers understand by the term 'data misuse', what their specific concerns are and if that varies by context or subject. One of Springer Nature's follow-ups will be to look at the free text comments in the survey responses. We will also consider conducting more in-depth interviews with researchers.

When we asked about what Springer Nature could do to encourage data best practice, the advice was clear. We need more discipline-specific cases studies from Japan and compelling examples of benefits of data management, data sharing and reuse to make the case for open science.

The themes of our discussion in Tokyo became a common thread in subsequent conversations with funders and foundations in the US and UK. Around the world we have consistently heard that we need better evidence of the benefits of good data practice to convince researchers it is worth their time to manage and share data, and that this evidence needs to be specific to their field(s) of research. There is a shared desire to stimulate grass-roots support from the researcher community. Coupling policy with practical support is also seen by funders we have spoken with around the world as key to making progress. Our learnings from these discussions have been instrumental in informing our thinking and our approach.

"Publishers are no longer publishers, they are solution providers"

Yasushi Ogasaka

Insight 2 – Data sharing for patients

Introduction

IRUD is an ambitious project to construct a comprehensive medical network and an internationally compatible data-sharing framework for patients with rare and undiagnosed diseases. The Initiative on Rare and Undiagnosed Diseases (IRUD), led and coordinated by the Japan Agency for Medical Research and Development (AMED), was initiated in 2015 to accelerate the pioneering efforts made by international counterparts. AMED also has its own data management plan and policy, which is available in English.⁶ Here, Dr. Takeya Adachi of AMED discusses with Iain Hrynaskiewicz some of the motivations for IRUD, the challenges and lessons learned from establishing the project, and how publishers can further support data sharing.

What were the motivations for the approach to data sharing practised by Japan's Initiative on Rare and Undiagnosed Diseases (IRUD)?

For rare and undiagnosed diseases we have been confronted with difficulties in obtaining appropriate or enough information on patients due to limited numbers. A decent number of patients is necessary for getting any statistical significance in clinical trials and to eliminate bias in observational studies. Especially, we have to tackle the so-called N-of-1 problem, elucidation of which leads to the diagnosis of patients. We have to find the “second case” of patients who would have similar or the same pathogenic variant of the same disease that would cause similar symptoms or phenotypes. Thus, data registrations and data sharing in both a domestic and international manner directly contribute to the success of this research. Data sharing is therefore quite indispensable to overcome the N-of-1 problem.

What has been the most challenging part in establishing IRUD?

We had two major problems in the promotion of IRUD. The first one was the harmonization of the diagnosis network of clinicians all over Japan. We had to create this in each region, with regional diagnosis committees. This resulted in increased successful diagnoses, even without the whole genome sequencing. Effective registration of each patient's phenotype is also promoted by the creation of these diagnosis committees. The second problem was that we had more than 400 clinical hospitals collaborating within the IRUD diagnosis network, each with their own institutional review boards and procedures, consent forms, etc. In response, we introduced a Central IRB (Institutional Review Board), into what is the first and largest-scale genome study in Japan.

Have there been any other implications for patient consent and research ethics policies and procedures?

The more broadly we want to share data, the more the regulation of privacy is restrictive. So, we created a two-step data sharing system, named IRUD Exchange, collaborating with an Australian team⁷ who shared their software and technology in undiagnosed disease programs. First, we shared an abundant amount of data within the IRUD research groups, and then we started sharing outside of IRUD. Those data included the standardized phenotype and the name of the candidate pathogenic

Q&A

Takeya Adachi, Program Officer, Japan Agency for Medical Research and Development (AMED), and Iain Hrynaskiewicz, Head of Data Publishing, Springer Nature

⁶ AMED, Data Sharing Policy for the Realization of Genomic Medicine; <https://www.amed.go.jp/content/000017356.pdf>

⁷ Orphanet Journal of Rare Diseases 2017; <https://doi.org/10.1186/s13023-017-0619-z>

variant, which is usually not regarded as personal information in an international context. I have to say that the “ADA-matrix” automatable discovery and access matrix, formulated by the [International Rare Disease Research Consortium \(IRDiRC\)](#)⁸ and the [Global Alliance for Genomic Health \(GA4GH\)](#),⁹ is one of the best platforms available now to connect datasets with its informed consent, for any data-sharing projects, including IRUD.

Were there any existing research projects elsewhere in the world which inspired the work of IRUD?

In the creation of IRUD, we were informed by other pioneering projects of undiagnosed diseases in other countries. For example, the Undiagnosed Diseases Program/Network (UDP/UDN) in the US, which was initiated by the National Human Genome Research Institute ([NHGRI](#)),¹⁰ NIH, as well as [FORGE](#)¹¹ (Functional element Overlap analysis of the Results of Genome Wide Association Study (GWAS) Experiments) – a major undiagnosed diseases program in Canada. And also the Deciphering Developmental Disorders ([DDD](#))¹² project followed by Genomics England in the UK. In order to effectively and efficiently create IRUD, we integrated the concepts of these programs to the Japanese situation. This included the universal health care system as well as the potential number of undiagnosed patients in Japan, as estimated by our national-scale field survey.

How are researchers who generate or analyse data for IRUD acknowledged (credited) for their contributions?

We would like to provide appropriate credit to researchers who generate or analyse data for IRUD. These researchers are not only in the core institutes of IRUD but also in clinical centres or collaborating hospitals. Thus, in the evaluation of institutes for second phase funding by AMED, we required all the institutions to include information about the number of patients they registered in IRUD or IRUD exchange databases, for domestic data sharing, and those they registered in the international patient matching system, for global data sharing. Eventually, abundant registration levels from some institutions could contribute to their evaluation, which generally links to more grants. This is one of the ways we, as a funding agency, can give credit to each collaborating entity.

Can you give us some examples of where IRUD has led to new important research hypotheses or findings as a result of data sharing? Any success stories you would highlight?

One example, among many others, would be how we overcame the N-of-1 problem via data sharing, in a novel disease with a CDC42 variant, which was identified in IRUD for the first time. And now, thanks to global data sharing, another patient has been found in Canada. The IRUD also contributed to the successful diagnosis of patients in Lithuania. This international collaboration is one of the most striking success stories for global data sharing across borders. Another great example comes from our good relations with Lithuania, where 20-30% of undiagnosed patients were successfully diagnosed thanks to active data sharing between Japanese and Lithuanian researchers.

8 International Rare Disease Research Consortium (IRDiRC); <http://www.irdirc.org/>

9 Global Alliance for Genomic Health (GA4GH); <https://www.ga4gh.org/>

10 National Human Genome Research Institute; <https://www.genome.gov/>

11 FORGE; <http://www.internationalgenome.org/forg-analysis/>

12 Deciphering Developmental Disorders project; <https://www.ddduk.org/>

What do you think scholarly publishers should do to support and promote data sharing?

To give a specific example, Japanese immunologist, Professor Tasuku Honjo won the 2018 Nobel Prize in Physiology or Medicine. The week before that, Clarivate Analytics revealed its forecast on “[citation laureates](#)”.¹³ The 2018 report included a database within Kyoto University called KEGG: Kyoto Encyclopedia of Genes and Genomes. This is quite a famous database, founded by Professor Minoru Kanehisa from Kyoto University. Clarivate Analytics selected him in as a possible laureate based on publication and citation data, but it is an example of how scientific contribution via databases or data sharing can be recognized. In that sense, publishers could help create different evaluation systems for data sharing and data sharing platforms. This could change the incentive regarding data sharing in an aggressive and/or sustainable manner.

Do you think journals and publishers should do more to promote data sharing?

Thinking of it from another angle, many funding agencies have difficulties getting a sustainable budget for their own databases. Indirect contribution of infrastructure projects to research results is often hard to evaluate. So, sustainability is a never ending problem for funding agencies. Discussions are now happening about how we can maintain our own databases in a sustainable way. Collaboration between funding agencies and publishers, to promote data sustainability, might be helpful. Of note, we funding agencies and academic publishers have already issued a statement underscoring a commitment to share information that will further research efforts in response to Zika virus outbreak in 2016.¹⁴

What do you think the wider research community (other disciplines of research) could learn from IRUD's approach to data sharing?

There are three points that could be shared with other domains. The first one is our policy named “*micro attribution*”. In this IRUD policy, we provided appropriate credit to the researchers and research assistants who generate the data, and this was for them an extra motivation, especially when their data sharing was directly linked with benefits to patients, and that the registration of data had a clear impact. Patients and their families are also participating in the research, and Patient and Public Involvement (PPI) is one important factor. The second one is our data sharing system which is key in contributing to pragmatic data sharing. One wonderful function of the IRUD Exchange database is that researchers in the institutions can easily register their patients' data not only in English but also in Japanese. They also can select the range of sharing of the data. And, only one click is enough to share the data with ongoing international projects. The third is harmonization of the program. Whereas any competition of researchers or research factions could contribute to data-registration from wider and larger regions, the standardization of the project facilitates data sharing. In this context, the Central IRB platform serves as a valuable solution for IRUD and for countries and regions who also share the same vision.

What actions should be taken by research funding agencies and institutions to enable more research data to be shared and reused?

I would like to quote here our President, Dr. Makoto Suematsu, who often says: **“Share the data, or cut the budget!”** for ALL of our patients.

13 Clarivate Analytics; Annual Forecast of Future Nobel Prize Recipients, 2018; <https://clarivate.com/blog/uncategorized/clarivate-analytics-reveals-annual-forecast-of-future-nobel-prize-recipients/>

14 AMED signs statement on Data Sharing in Public Health Emergencies in response to Zika outbreak, 2016; <https://www.amed.go.jp/en/news/topics/20160216.html>

For further reading

All reports and their underlying data have been made openly available in the figshare repository. Where additional resources, such as free infographics, are available, these can also be found in the links below.

Practical Challenges for Researchers in Data Sharing

White paper: <https://doi.org/10.6084/m9.figshare.5975011>

Full survey dataset: <https://doi.org/10.6084/m9.figshare.5971387.v2>

Infographic: <https://doi.org/10.6084/m9.figshare.5996786.v4>

The State of Open Data Report 2018

White paper: <https://doi.org/10.6084/m9.figshare.7195058.v2>

Full survey dataset: <https://doi.org/10.6084/m9.figshare.7234985.v1>

Interactive data: <https://knowledge.figshare.com/articles/item/state-of-open-data-2018>

Challenges and Opportunities for Data Sharing in China

White paper: <https://doi.org/10.6084/m9.figshare.7718441.v1>

Full survey dataset: <https://doi.org/10.6084/m9.figshare.7321604.v1>

Infographic: <https://doi.org/10.6084/m9.figshare.7782761>

Five Essential Factors for Data Sharing

White paper: <https://doi.org/10.6084/m9.figshare.7807949>

Infographic: <https://doi.org/10.6084/m9.figshare.7937195.v1>



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Yasuhiro Murayama, National Institute of Information and Communications Technology (NICT)

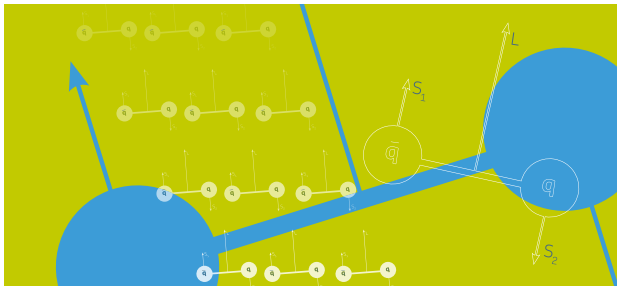
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In alphabetical order by last name

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Join the research data community to tell us your views <http://researchdata.springernature.com>



Hideki Yukawa (1907–1981)

Hideki Yukawa was a theoretical physicist. He proposed that the forces between protons and neutrons could be described by a force field and that they were linked through exchanging some unknown particle. He named this particle the U-particle (it was later renamed meson) and predicted its mass was somewhere between that of an electron and a proton. Yukawa's predicted meson was discovered in 1947, and he became the first Japanese scientist to receive the Nobel prize in physics in 1949. Yukawa continued to wrestle with the conceptual framework of elementary particle theory. He was also actively involved in the peace movement and co-signed the Russell–Einstein Manifesto of 1955.