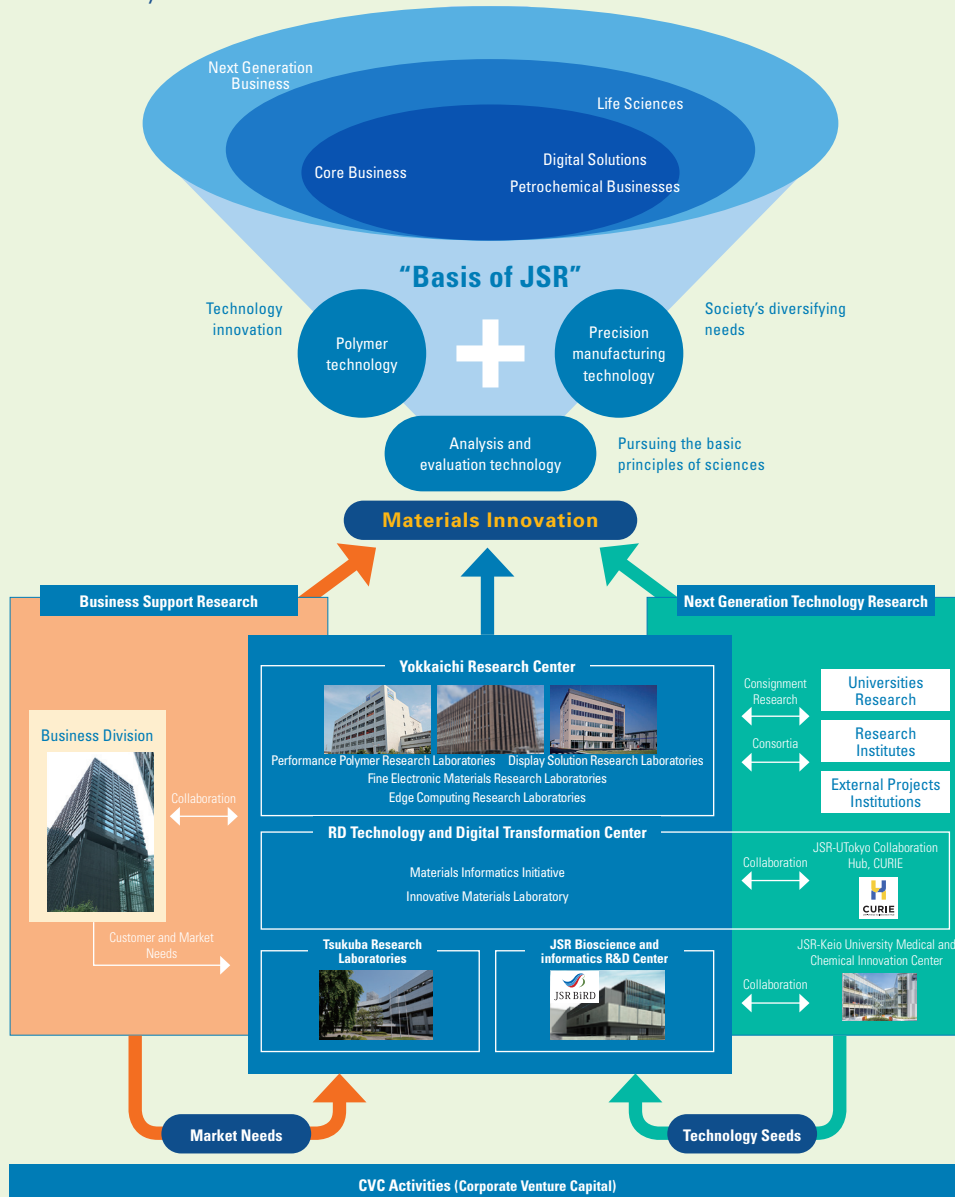


A Growing Network of People and Technology

R&D Policy and Structure



JSR Group is promoting R&D activities to prepare for rapidly changing social needs, such as changes stemming from digital transformation, growing pressure for a carbon-free society, and increasing interest in personalized medicine and healthy longevity. There are two primary missions in the research division: to conduct Business Support Research in fields that are currently being developed and new or applied research in peripheral areas, and to conduct Next-generation Technology Research such as seed research where future growth is expected.

Our priority in Business Support Research is cooperating with the value chain within JSR Group, from development to manufacturing, sales, and logistics. In addition to promoting the integration of R&D activities with business operations, such as emphasizing direct dialogue with customers so that researchers can delve into their needs, we are building an ecosystem that can provide global and timely support for customers' business promotion by enhancing technical services in each country in which we operate.

Regarding Next-generation Technology Research, we are engaged in R&D that anticipates the potential needs of the market. In June 2020, we reorganized related R&D divisions into the RD Technology and Digital Transformation Center to accelerate the transformation of our research approach. In addition to in-house research, we are promoting open innovation such as joint research with universities and research institutes in Japan and abroad, bringing in outside knowledge and technologies to overcome problems and create groundbreaking innovation. Through academic collaboration and drawing on the expertise the Group has cultivated over many years in its materials business, we are exploring possibilities for developing businesses in new fields and commercializing leading-edge research in areas that are new to us.

Materials informatics and the practical application of data-driven R&D methods have been another focus of the Group. The new data infrastructure for this requires digitalization and the construction of theoretical models, as well as new methods such as AI and quantum computing. JSR Group is moving forward with development from both angles. When the data infrastructure and new methods are ready for practical application, we are confident that it will enable us to carry out many conventional laboratory experiments on computers, leading to much shorter research and development periods.

Raising up Digital Transformation Professionals and Next-Generation Basic Technology

We will translate new research methods into future competitiveness.

Engagement with Enthought

—Initiatives to train in-house data scientists and construct databases—

Q What do digitalization and digital transformation mean to JSR, and what are you doing in these areas?

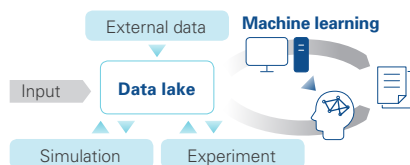
A We want to bring about R&D-driven corporate transformation, so we are working to acquire highly innovative technologies such as AI and quantum computing. The core technological elements of materials development include collecting and systematically organizing data generated by experiments and calculations, and then analyzing and visualizing this data. JSR is striving to lay the groundwork for new research and development methods by seamlessly connecting the whole data flow digitally. Our partner, Enthought, is supporting our efforts to incorporate this digitalization into the Group's businesses.

Q What kind of company is Enthought?

A Enthought, Inc. is a US-based company that supports corporate digital transformation. They are a group of experts in Python, the latest programming language, which has recently undergone advancements in AI technology, and in the development of Python-based services. But Enthought is not simply a provider of technology and services. They also analyze clients' business processes and seek to provide experiences that have real value. In terms of specific actions, JSR is sending researchers to Enthought. They bring with them real issues their departments are facing and use these as case studies in learning the basics of Python programming and Agile development methodologies. Those researchers will come back equipped to identify areas where the application of digital technologies can uncover value and bring what they have learned to bear on projects that involve their entire departments.

Q Do you sense that JSR Group has any expectations for digitalization?

A There are limits to the application of any technology or service. For example, when we started working with Enthought in 2017, AI wasn't really on JSR's radar yet. But through our engagement with Enthought and various other opportunities, the Group now has a better idea of what AI can make possible for us. Looking ahead, we will expand the scope of collaboration, going after more efficient development and the development of more high-precision materials as we seek to create new value.



Materials Informatics Initiative
RD Technology and Digital
Transformation Center
Yoshio Takimoto

The Institute of Statistical Mathematics, Research Organization of Information and Systems

—Basic technology research activities for materials informatics and other data-driven materials research—

Q Please tell us about the main role of the Institute of Statistical Mathematics (ISM).

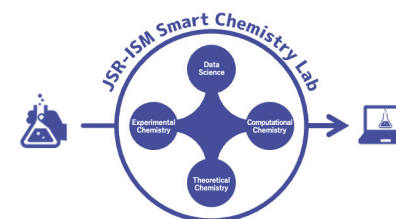
A ISM is the only research institute in Japan that specializes in statistical mathematics. The JSR-ISM Smart Chemistry Lab we established with ISM is developing algorithms to enable new materials development methods using data science. With the new algorithms, we aim to solve problems of materials development that conventional data science has not been able to address.

Q How is what you are doing different from the conventional use of data?

A Until now, data has mainly been used to examine the causes of material defects by analyzing the data after the fact. Whereas the effective use of data science will not only improve the accuracy of such post hoc analysis but also predict the results of experiments to some extent. This can reduce the number of experiments needed and can save a lot of time and money.

Q What role is this initiative playing in carrying forward the new R&D approach called Materials Informatics?

A To use a cooking analogy, the ISM's endeavors can be said to be at the stage of making new cooking utensils. Even if we're given ingredients that are hard to work with, which is data that until now was impossible to process well, the new utensils make it possible to process the data with a high degree of accuracy. Highly accurate data processing for R&D is like really tasty cooking, but new tools have to be learned. JSR is actively cultivating a pool of researchers who regularly participate in ISM's personnel development programs.



Materials Informatics Initiative
RD Technology and Digital
Transformation Center
Yu-ya Ohnishi

Joint Research across Disciplines

JSR Group is making use of quantum computers and AI in new approaches across various fields including R&D.

IBM Quantum Network

—Targeting implementation of research through shared use of quantum computers—

Q What kind of initiative is the IBM Quantum Network?

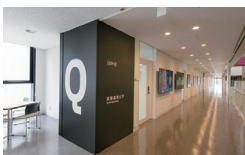
A IBM Quantum Network is a global community of members who want to make use of the quantum computers provided by IBM. As part of this community, JSR has been participating in the IBM Q Network Hub @ Keio University, which was established in 2018. Here, we are carrying out joint research using the university's quantum computer and developing new algorithms with numerous other member companies. Even though quantum computers are still under development, they are capable of computation that is simply impossible for conventional computers. JSR is able to draw on its strengths as a chemistry expert to raise questions about the kind of problems that should be solved using quantum computers.

Q Tell us about the future possibilities of quantum computing.

A We are currently using simulations in materials development, and we can expect to extend that to a broader range of applications. Also, I think down the road we will be able to solve the problem of massive power consumption, which is an issue in machine learning at the moment. This will allow us to do large-scale data processing at lower cost. We hope this will serve to replace much of the actual experimentation in JSR's research and development flow, making it cheaper and faster to get results than through actual experiments. It will also be possible to study areas that were previously difficult because the experiments were dangerous or for other reasons.

Q Are you training professionals who can handle quantum computing?

A Quantum technology and the programs used are totally different from conventional thinking and approaches, so it takes time to train researchers with solid knowledge of quantum computing. JSR is working to raise up what we call "quantum natives," mostly young researchers who will be instrumental in applying this technology in the future.



A view of IBM Q Network Hub @ Keio University



Materials Informatics Initiative
RD Technology and Digital
Transformation Center

Yu-ya Ohnishi

IBM Research Frontiers Institute (RFI)

—Joint research for technology implementation in the AI field—

Q What does the IBM Research Frontiers Institute do?

A The Frontiers Institute is an open innovation AI-related research consortium centered on IBM Research labs. The research concept consists of three pillars: creating and collecting data, reimagining computing with a view to AI utilization, and providing a new experience of data for users. We aim to bring about digital transformation by incorporating IBM's deep knowledge of AI into our businesses in the chemical industry.

Q What kind of changes can we expect from the practical application of AI?

A In a nutshell, I think AI represents a break away from empirical materials development through collaboration between AI and chemists. Of course, materials development in the past hasn't been based solely on experimental methods – at times, what we would call "tacit knowledge" has inspired ideas and sudden shifts in thinking that have led to tremendous breakthroughs. These eureka moments depend on the individual and no one knows when they will happen. The ultimate hope is that AI will provide this mechanically. Looking ahead to such a future, our immediate goal is to develop an AI system that efficiently elicits good ideas from materials developers. We are implementing this kind of system within JSR and have already begun to see results.

Q Will it be difficult to set JSR apart from other companies if this new technology becomes commonplace?

A Good innovative technology can change the business environment in a blink of an eye, so I feel our first priority is to keep pursuing cutting-edge technology through projects like the Frontiers Institute. When we put innovative technology into practice, we can become the first to benefit from it and I think it's easier to secure a leading position in that field. On top of that, another crucial thing is the variety of human resources. It goes without saying that we need digital professionals, but I don't feel that they alone can achieve transformation. I hope that people from a variety of backgrounds will be allocated to the organization and that out of the lively interaction between people working in seemingly different fields new technologies and business ideas will be born.



* This image is licensed.



Materials Informatics Initiative
RD Technology and Digital
Transformation Center

Yoshio Takimoto

Joint Research across Disciplines

JSR will deliver new technologies to society through various collaborations.

JSR-UTokyo Collaboration Hub, CURIE

—A comprehensive collaboration between industry and academia transcending the boundaries between chemistry and physics—

Q What are you hoping to achieve with this effort?

A JSR-UTokyo Collaboration Hub, CURIE, started out as part of our push for collaboration between industry and academia. It is a comprehensive collaboration hub established jointly by the Department of Physics in the University of Tokyo's Graduate School of Science, which is at the forefront of the physics field in Japan, and JSR, a chemical company. The fusion of academia and industry will enable JSR to bring new high-performance materials to society. Meanwhile, the Department of Physics will deepen its understanding of the functions of various materials that have become an essential part of society, uncover universal truths, and open up new fields of study. JSR is also offering a fellowship to support the research activities of excellent students.

Q Why is it important to collaborate with the field of physics?

A Physics and chemistry are similar in that they both deal with substances. The difference is that when a substance causes a phenomenon, chemistry focuses on the phenomenon, whereas physics focuses on why the phenomenon occurred. Through collaboration with the Department of Physics, which engages in cutting-edge physics research, we are aiming to develop new materials.

Q What's next for this initiative going forward?

A Going forward, I hope that the connection that has started with the Department of Physics will expand to other parts of academia. I also take pride in the fact that, through this collaboration, both parties can take the results of their latest research and make an immediate positive impact on society. Down the road, we will continue to explore new possibilities through collaboration that transcends the barriers between companies and fields.



JSR-UTokyo
Collaboration Hub, CURIE
General Manager
Itti Rittaporn

JSR Bioscience and informatics R&D Center (JSR BiRD)

—An open innovation hub in the field of life sciences—

Q Can you describe what kind of facility JSR BiRD is?

A JSR BiRD is a research facility in the field of life sciences where we are conducting research focusing on the field of microorganisms that exist in the human body called bacterial flora (microbiomes). Informatics researchers based at the facility are also working to strengthen their R&D capabilities by cultivating cutting-edge simulation and deep learning technologies. JSR BiRD also serves as an open innovation hub, setting aside dedicated space and creating a platform for innovation.

Q What are the greatest strengths of JSR's Life Sciences Business?

A JSR has a strong technological advantage in synthesizing polymers, which we honed in the Elastomers and Digital Solutions businesses. I myself came to JSR with a background in the pharmaceutical industry, and I was surprised to find such a high level of technology. One example is the technology needed to make uniform particle sizes. JSR has already commercialized in vitro diagnostic reagents and antibody refining materials using this technology, gaining a large customer base. Drawing on JSR's advanced polymer technology, we should be able to expect to increase drug efficacy, for example, by making the coating on the surface of the drug more uniform. In addition, although the field of microbiomes is attracting attention as a new modality, many pharmaceutical manufacturers hesitate to enter this field due to the difficulties involved. We would like to tackle various issues, including unmet medical needs*, from a variety of angles through research into the superior technologies and new modalities I talked about earlier.

* Unmet medical needs: Medical needs for diseases for which a cure has not been found.

Q What is the significance of encouraging open innovation at JSR BiRD?

A People with diverse backgrounds are already actively engaged in the Life Sciences Business. On top of this, JSR BiRD brings together top-notch researchers from both inside and outside the company and gives them space to devote themselves fully to their everyday research. This kind of diversity makes it easier for innovation to happen, and we are aiming to provide value that is only possible through open innovation that is centered on a chemical company like JSR, rather than a pharmaceutical manufacturer.



JSR BiRD



Head of JSR Bioscience
and informatics
R&D Center (JSR BiRD)
Hideo Hashimoto