



iReceptor

Unraveling the mysteries of our immune system,
millions of molecule sequences at a time

Many academic labs, biomedical research institutions, and pharmaceutical companies are working hard to better understand infectious diseases and autoimmune disorders such as AIDS, multiple sclerosis, and lupus. Five to six years ago, researchers were able to sequence hundreds of immune-system molecules (like antibodies) in the human body. Today they can sequence tens of millions.

The data from this next-generation “deep sequencing” is making the human immune system less of a black box as it reveals the construction of the immune system along with the how, why, and when our body responds to various diseases. This is critical for studying autoimmune diseases and developing medical techniques that augment or use our immune system such as vaccines, therapeutic antibodies, and cancer immunotherapies, to name a few. However, storing, organizing, and analyzing these data has become a rapidly escalating big-data challenge.

Metadata and security

To facilitate this study of immunogenetics, researchers at Simon Fraser University have created a Research Software Platform called iReceptor. A secure, distributed database, iReceptor enables researchers to share and analyze huge datasets. What makes this platform particularly exciting is its ability to include metadata (such as gender, ethnicity, treatment, and outcome), allowing researchers to understand which conditions activate or suppress various immune system genes.

To ensure patient privacy while maximizing research utility, iReceptor supports multiple levels of data access. It allows data stewards at each participating lab, institution, or company to assign access controls to individual data in order to tightly control confidentiality, based on local ethics and confidentiality agreements.

A secure distributed database, iReceptor enables researchers to share and analyze huge datasets.

Researchers benefit tremendously from the distributed structure that iReceptor provides. Previously, privacy concerns around patient data meant that most immunogenetic research data were not tagged with metadata, requiring a painstakingly slow understanding of medical context – when it was even possible. Researchers were also hampered by the lack of meaningful sample sizes. Because iReceptor pools scarce data in a secure way, research from multiple angles of a specific condition can illuminate immune system failures, pointing to clinical treatments for rare conditions as well as commonly occurring diseases.

Canadian content

Leading the charge in creating this publicly accessible database are researchers at Simon Fraser University, with colleagues at the University of Toronto and the Michael Smith Genome Sciences Centre playing an important role in quality testing. The iReceptor team is also working to integrate the system with international efforts, such as VDJServer at University of Texas Southwest Medical Center, and NIH genomic repositories such as dbGap and SRA. This will not only increase sample sizes but will also help the worldwide immunogenetics community in their pursuit of new vaccines, therapeutic antibodies, and cancer treatments.

In addition to the iReceptor Platform itself, four reusable software Services used within it have been made available to other researchers via the CANARIE Software Registry, including its database model and web interface. Other researchers may reuse these software tools in their pursuit of new public health discoveries.

Technical Details

Platform: iReceptor

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|---|---|
| Description | A Distributed Data Management System and Scientific Gateway for Mining Sequence Data from Immune Responses. iReceptor provides a technology platform that lowers the barrier to immune genetics researchers who need to federate large, distributed, immune genetics databases in order to answer complex questions about the immune response. The focus of the iReceptor project is to leverage existing capabilities and technologies to build a new scientific platform for the immune genetics research community. |
| Creator(s) | IRMACS/Simon Fraser University |
| Collaborator(s) | Texas Advanced Computation Centre (TACC), Compute Canada, McGill University |
| Research Subject | Immunology |
| Managed Versionⁱ | Yes |
| Self-deployed Versionⁱⁱ | No |
| Cloud Support | N/A |
| Host OS | N/A |
| Licence | Access to the iReceptor Scientific Gateway available upon request to Simon Fraser University. |
| URL | canarie.ca/software/ireceptorsystem |

Contributed Services:

| | iReceptor – Authentication Service | iReceptor – Computation Service | iReceptor – Data Migration Service | iReceptor – Database Service |
|---|--|--|--|--|
| Description | Provides the ability to authenticate to the iReceptor platform, using the Agave framework authentication. | Provides access to iReceptor compute jobs via a RESTful interface. | Provides the ability to link external data sources to the iReceptor system. | Provides access to sequence data stored in the iReceptor federated database system. |
| Category | User Management/Authentication | Data Manipulation | Sensor Management/Data Acquisition | Data Storage and Retrieval |
| Research Subject | Immunology | Immunology | Immunology | Immunology |
| Managed Versionⁱ | Yes | Yes | Yes | Yes |
| Self-deployed Versionⁱⁱ | No | No | No | No |
| Cloud Support | N/A | Provides access to Compute Canada jobs via AGAVE. | Provides access to the iReceptor cloud. | N/A |
| Host OS | N/A | N/A | N/A | N/A |
| Licence | See terms of use for the Agave Platform – agaveapi.co/terms-of-service | See terms of use for the Agave Platform – agaveapi.co/terms-of-service | See terms of use for the Agave Platform – agaveapi.co/terms-of-service | See terms of use for the Agave Platform – agaveapi.co/terms-of-service |
| URL | canarie.ca/software/authentication | canarie.ca/software/computation | canarie.ca/software/migration | canarie.ca/software/database |

Funding for the development of iReceptor was provided through CANARIE's Research Software Program.

ⁱ Managed version: Creators host a live instance of the software on their infrastructure, available for use by others

ⁱⁱ Self-deployed version: Users host a private instance of the software on their own infrastructure