LOCK

Genomic Testing Results

A guide to understanding genomic test results and exploring next steps

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★ Some parts of this booklet have been filled in by a healthcare provider. This information can be found under the headers marked with a star.

If you have any questions about your family's genetic testing results, please contact:

The Genomic Results Booklet was created by members of the Friedman lab and parent partners, with the support of the CHILD-BRIGHT Network.

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Version 20-10-2021

Results Summary ★

Date: today

Name:

Click on the page number to jump to that section

Genomic testing received: Whole Exome Sequencing (WES)

Page 4

WES reads the genetic instructions, also known as DNA, that directly code for protein. WES looks for differences in the spelling of the DNA that may explain your health concerns. These differences are known as variants.

Who received testing? Trio: the person with the health condition and family members.

Genomic testing result: There has been a finding linked to the medical condition.

Impacted area or gene: Page 5

DNA Variant(s): Page 5

Related Medical Conditions: Page 5

Inheritance: **Mitochondrial** Page 7

Most DNA is found in the nucleus, but some can also be found in the mitochondria. Mitochondrial variants can only be passed down from a mother to child, but can result in symptoms in both males or females.

Interpretation of the variant

Laboratory classification of the variant: **Pathogenic** Page 6

The lab found a difference in DNA that is most likely responsible for the medical condition.

Doctor's Interpretation Page 6

Based on your child's medical history and clinical picture, it is **uncertain if** this is the cause of a medical condition.

Incidental (secondary) findings

Page 7

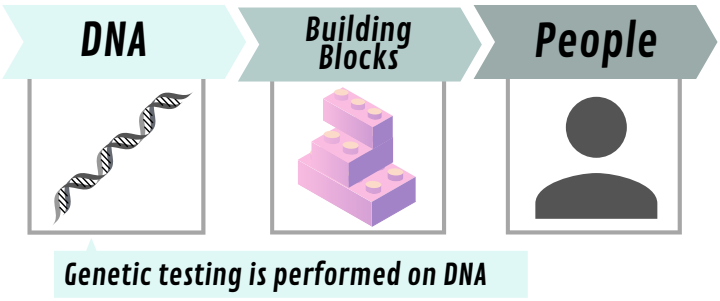
There was an incidental finding. Please refer to your child's doctor for more information.

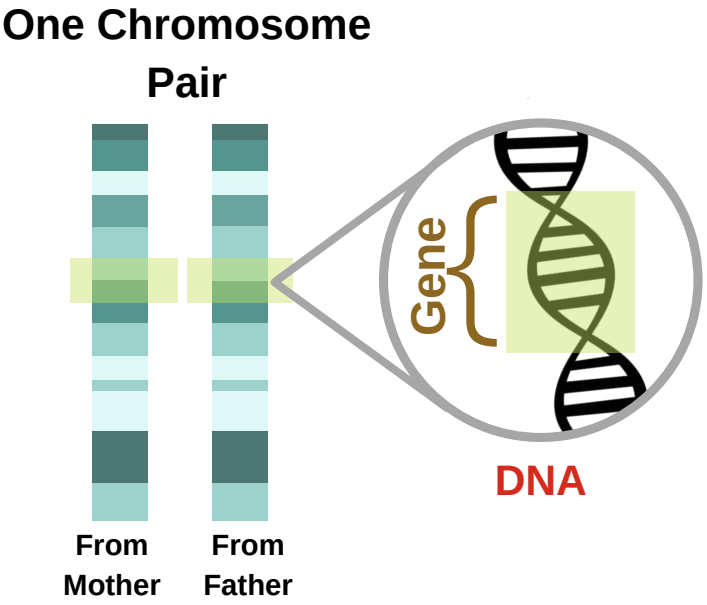
Notes from your child's healthcare provider

The rest of the booklet explains this information in more detail, and offers some resources.

Background Genomic Information

DNA is a long string of "letters." **Genes** are sections of DNA that have instructions for making proteins. **Proteins** are the building blocks of the body and play an important role in development and function.





Genes are packaged in groups, called **chromosomes.** Each person has 23 **chromosomes** from their mother, and another matching 23 from their father. Because **chromosomes** come in pairs, **genes** come in pairs too. We have two copies of each **gene**, one copy from each parent. This is why children have traits that are similar to those of their parents. The interaction between these two **gene** copies determines how a certain trait will show up.

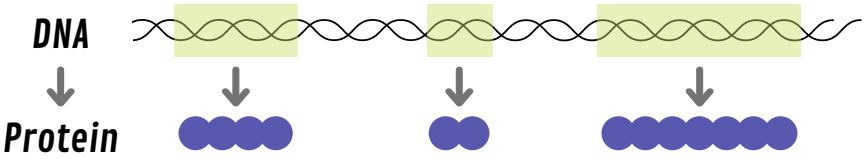
Everyone's unique set of DNA**,** including all of their genes, is called a **genome**. The **genome** contains thousands of **genes**!

Over the past few decades, scientists have been working to identify and understand these **genes**. There is still a lot of work to be done. We don't fully know the role of every part of the **genome**, which is why there can be uncertainty in genetic testing results.

Your Notes:

Genomic Testing Recieved ★

Differences in the DNA are known as **variants or mutations.** They occur frequently, and most are perfectly normal. Many **variants** account for traits that are shared between family members. However, sometimes a **variant** changes the instructions in a way that alters the **protein** product. This may cause a medical condition. Genetic technologies analyze **DNA** to find the **variants** that may cause medical concerns.



In the image above, the **DNA** that is in green boxes will be directly involved in making protein. This is called **protein-coding DNA**. There is still a lot of DNA in between. This is called **non-coding DNA**. **Non-coding DNA** can still have an impact on how **proteins** are made. For example, it may accelerate or slow down the creation of **proteins**.

Some tests look at all of the **DNA**, while others will only read the **protein-coding DNA**.

Your Notes:

The genomic testing received: Whole Exome Sequencing (WES)

WES only reads the DNA that directly codes for protein (protein-coding DNA). This is the DNA that is in green boxes in the diagram above. WES cannot detect variants in non-coding DNA (the DNA in-between the green boxed areas). WES looks at all of the protein-coding DNA in your genome. As a genetic test, it is quite powerful and comprehensive.

Who was tested?

Trio: the person with the health condition and family members.

Genomic Testing Results ★

A snapshot of the testing process:

Genomic testing results can be complex and hard to understand. You might receive both laboratory results and a doctor's interpretation. These may seem different. The doctor's interpretation is the most relevant to your child's care.

The lab looks for differences that may be causing health concerns. The lab classifies the DNA differences using computer tools and comparisons to other people's DNA. The lab does not have a full picture of patient's health concerns when making these classifications.

The doctor interprets the lab results based on your child's health concerns. The doctor decides if these DNA differences are really affecting their health. Genomic testing results are often a little "fuzzy" or uncertain. We are still learning to interpret all of the DNA variations that we see. We are working at the limits of our knowledge. This uncertainty can be difficult.

Here are some details about the DNA variant(s) that have been identified ★

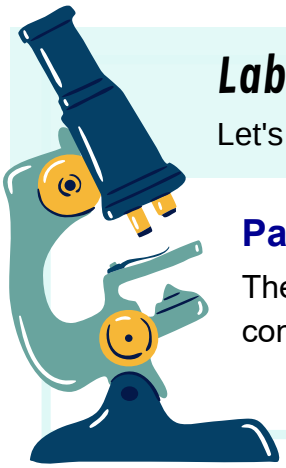
Affected Gene(s):

What does this gene do in our bodies?

Variant(s):

Are there known medical conditions that have been associated with changes in this gene?

Your child's health concerns may not perfectly match the health conditions that have been reported.



Lab Results - Classification of the Variant(s) ★

Let's take a look at the lab results first. This is not based on the doctor's interpretation.

Pathogenic

The lab found a difference in DNA that is most likely responsible for the medical condition.

Doctor's Interpretation: Is the DNA variant really causing the medical condition? ★

How does your child's doctor think the lab results fit into their medical picture?

Based on your child's medical history and your clinical picture, it is **uncertain if** this is the cause of their medical condition.

Are there any medical recommendations based on these results? **Yes**

In the future, different specialists may interpret these results in their own way. Each specialist may have unique suggestions.

As our knowledge increases and genetic testing technology improves, the variant interpretation might change. You are encouraged to check back with your child's doctor every few years to see if new information is available.

Inheritance ★

Inheritance, or heredity, refers to how DNA and traits can be passed on from parent to child. We have two copies of each gene. One copy comes from the mother, and one copy comes from the father.

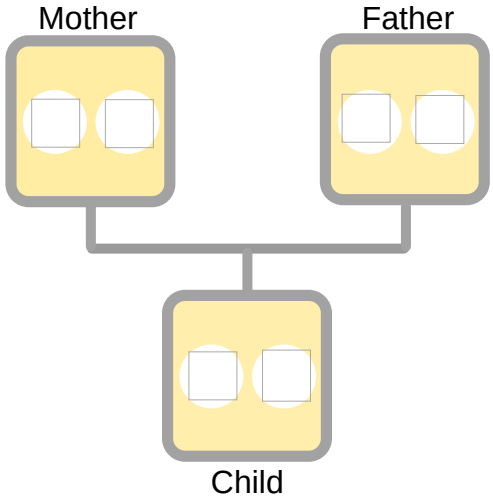
Because family members share some DNA, they also share some of the same traits. Information about inheritance may be important in family planning. We can sometimes evaluate the chance of certain health conditions being passed on from parent to child.

This DNA variant is: Mitochondrial

Most of our DNA is found in the nucleus of the cell. However, there is some DNA that is in different parts of the cell, called mitochondria. A mitochondrial variant is found here. Mitochondrial variants can only be passed down from mother to child, but can result in symptoms in males or females.

We have no control over our DNA, the variants that arise, or the variants we pass on.

Marks show which family members have the DNA variant(s):



Multiple family members were tested. We can identify all of the family members that have a certain variant because the DNA of the mother, the father, and the child was tested.

Incidental (Secondary) Findings ★

There was an incidental finding. Please refer to your child's doctor for more information.

While searching through the genome for variants that may be causing a patient's health condition, the lab may also report additional health-related DNA variants. These are called incidental (secondary) findings because they are not related to the reason for receiving genetic testing, but can be important nonetheless. You decided that you would want to be informed about incidental findings. Your child's doctor will give you more information about the incidental findings.

Next Steps

Your Questions

Navigating these genomic results is not something that needs to be done alone. Healthcare providers are there to provide support through this process. It is their job to make sure you understand what the genomic results mean for your family and help you through next steps. They are best able to help when they know about your family's needs. You can help them understand these needs by asking for the information that is most important to you. Here are a few questions that some families ask their healthcare providers, and some space for you to keep track of your own.

Were you able to find a change in DNA that explains the symptoms?

Yes / Possibly

- How do these DNA changes impact my family's health?
- Where did these changes in the DNA come from? Were they inherited?
- Is there anything we can change in our health management?
- Can this result change over time?
- How can we be sure of these results and/or this diagnosis?

Sharing Genomic Results

Whether you share your family's results and who you share them with is **entirely your decision.** These are some people you may choose to share the results with.

Family:
Genetic information might be important for other family members. They can use this information for their own health or family planning. Family and friends may be better able to offer support if they can inform themselves about the genetic results.

Doctors, therapists, caretakers, counsellors, other healthcare providers:
A genetic diagnosis might change health management or help your child's healthcare team better understand their medical condition. Only some doctors have access to the genetic results, therapists and caregivers likely do not. If you are unsure of how to explain your child's results to their healthcare team, you can share this booklet and the lab report with them.

Online platforms and genetic networks:
There are websites that connect families with similar genetic conditions. Posting information about your child's genetic results might also help to deepen scientists' understanding and advance research. More information about sharing genetic results with the online community can be found under the Resources and Support section of this booklet.

Resources and Support

Caring for your own health, or a family member's health, can be complex and challenging at times. While you might just be receiving a genetic diagnosis, we know that you have been putting in the hard work long before. You may already be well connected to resources that help you manage your child's medical concerns. Here are some other tips, websites and tools that can be helpful after receiving genetic testing results. These pages contain both general and case-specific resources.

Do not hesitate to reach out to your child's doctor or genetic counsellor if you need help in navigating options and resources.

When searching for resources, keep in mind that...

- Science literature can be very technical and hard to read. The way that papers are written may seem insensitive to patient-readers, or their family members. Patient websites are often more friendly when looking for information on a diagnosis.

- Each gene and every version of that gene can have unique effects. This is why your child's medical concerns may be quite different from "similar" patients who are in medical publications. If you are doing online research, you might also see that different variants of the same gene can cause different conditions. Do not be alarmed. Focus only on the diagnosis that the doctor shared.

- Your family's needs may change over time.

- The best support caters towards symptoms and specific needs, as opposed to a diagnostic label.

- You are not alone. Many of the resources below connect families who are facing similar health concerns.

General Organizations and Alliances

☐ Global Genes  https://globalgenes.org/

There is a resource search tool. RARE List: A list of rare diseases, including an overview of the disease, support groups, news, events and clinical trials. RARE Portal: A platform that connects families.

“Empower patients, build communities & drive forward momentum for rare disease globally”

"The RARE Portal is your place to connect, find events and share your story."

☐ Disability Alliance BC (DABC)  http://disabilityalliancebc.org

Among other services, they can provide free legal advice to those with disabilities, and they offer assistance in applying for disability benefits.

"DABC’s Advocacy Access Program has been a place of support, information and one-to-one assistance for people with all disabilities."

To make an appointment, call Advocacy Access at **1-800-663-1278** (toll free).

☐ Family Support Institute of BC  https://familysupportbc.com

Support Worker Central: This database connects families with support workers in their area. FamilyWORKs is an initiative to create employment opportunities for people with disabilities.

"The purpose of the Family Support Institute of BC is to strengthen, connect and build communities and resources with families of people with disabilities in BC."

☐ Inclusion BC  https://inclusionbc.org

The Ready, Willing & Able initiative encourages employers to hire people with intellectual disabilities.

"Inclusion BC is a non-profit provincial organization that advocates for the rights and opportunities of people with intellectual disabilities and their families."

☐ PLAN: Planned Lifetime Advocacy Network  https://plan.ca/

PLAN, or Plan Institute in BC, focuses on creating support networks, tools for future planning, and community initiatives.

"PLAN is non-profit organization founded in 1989 to help families secure the future for loved ones with disabilities."

☐ Contact a Family  https://contact.org.uk

This website contains advice and support written by parents for parents, an online parent community forum, and patient-friendly medical information on genetics and various diagnoses.

“We support families with the best possible guidance and information. We bring families together to support each other. And we help families to campaign, volunteer and fundraise to improve life for themselves and others.

Resources for Rare Diseases

☐ Rare Disease Foundation

https://rarediseasefoundation.org

This foundation has a Family Counselling Assistance Program and a Parent 2 Parent Resource Network. There are meetings and events in cities across Canada, including Vancouver.

Living Without a Diagnosis (a pamphlet):
https://cdn.shopify.com/s/files/1/0267/4688/0097/files/Living-Without-a-Diagnosis.pdf?v=1587664879

"The Rare Disease Foundation is focused on linking basic science and clinical practice to increase the efficiency of rare disease research. This model is called Translational Care. This model drives patient based, treatment focussed research projects from disease characterization to treatment with greater efficiency."

☐ National Organization for Rare Disorders

https://rarediseases.org

There is an extensive database of rare diseases and their corresponding resources, along with advocacy and educational information. There are webinars on important topics for patients.

"Reports are written in patient-friendly language and each report links to disease-specific patient organizations and other resources that provide further support for patients and their families."

☐ Rare Disease Information and Support Line

https://rqmo.org/rare-disease-information-and-resource-centre/

This is a support line you can call to receive help navigating a rare disorder. They can help you find more patient-friendly information and connect you with resources.

Toll-free number:
1-888-987-5539
Email: info@rqmo.org

This service is offered in English and French!

Organizations for Your Testing Outcome ★

Health Management Tools

Curatio *https://www.curatio.me/*
Connect to people with similar health conditions and keep track of health changes.

HealthVault, Medical Records, myPHR, Healthspek, My Medical *Free in your app store*
Track medical history, store results from medical tests, and share medical information.

MyBooklet BC *https://mybookletbc.com*
Design a personalized medical information booklet to share with healthcare providers.

Scientific Information Sources

These sites have information for doctors and researchers, so the language can seem very complex. They show previous research and medical cases for a specific gene or diagnosis. Remember that different changes to a gene can produce different health conditions. When using these sites, make sure to look at the health condition that matches your family's testing results.

Website:	How to use it:
Genetics Home Reference - National Institute of Health (NIH)	This content is detailed but targeted to a patient audience. The site also offers educational content if to learn more about genetics. 1. Go to https://ghr.nlm.nih.gov/ 2. Using the text box in the upper right corner, type in the gene (from this booklet) or the health condition. 3. Once you are on the disease page, you can find sections on health management and other resources.
Your NIH link ★:	
Orphanet	Go to https://www.orpha.net/consor/cgi-bin/index.php Instructions can be found in this video: https://www.youtube.com/watch?v=57VPhtS4nME&t=
OMIM: Online Mendelian Inheritance in Man	Go to https://www.omim.org/ and enter the gene name in the search box. **OR** Look over your lab report (if you received one) for an OMIM number (OMIM XXXXXX) and enter it into the search box.

Financial Resources and Subsidized Programs

Disability Tax Credit – *https://www.canada.ca/en/revenue/agency/services/tax/individuals/segments/tax-credits-deductions-persons-disabilities/disability-tax-credit.html*
"The disability tax credit (DTC) is a non-refundable tax credit that helps persons with disabilities or their supporting persons reduce the amount of income tax they may have to pay."

Child Disability Credit – *https://www.canada.ca/en/revenue-agency/services/child-family-benefits/child-disability-benefit.html*
"The child disability benefit is a tax-free monthly payment made to families who care for a child under age 18 with a severe and prolonged impairment in physical or mental functions."

Children and Youth with Special Needs (CYSN) Program BC – *https://www2.gov.bc.ca/gov/content/health/managing-your-health/child-behaviour-development/special-needs*

Registered Disability Savings Plan (RDSP) – *https://www.canada.ca/en/revenue-agency/services/tax/individuals/topics/registered-disability-savings-plan-rdsp.html*
"An RDSP is a savings plan that is intended to help parents and others save for the long term financial security of a person who is eligible for the disability tax credit (DTC)."
The government of Canada can contribute up to $3 for every $1 you put in.

Future Planning Tool by the Plan Institute – *https://futureplanningtool.ca/*
Build a plan to help you secure the future for you or anyone with a disability.

The Special Needs Planning Group – *http://www.specialneedsplanning.ca/index.html*
"This website will provide you with some basic information necessary to the understanding and implementation of plans for the future of your family member with a disability."
This parent-made website highlights legal and financial considerations for long term planning.

The At Home Program – *https://www2.gov.bc.ca/gov/content/health/managing-your-health/child-behaviour-development/special-needs/complex-health-needs/at-home-program*
"This program is intended to assist parents or guardians with some of the extraordinary costs of caring for a child with severe disabilities at home."

Nursing Support Services – *http://www.bcchildrens.ca/our-services/sunny-hill-health-centre/our-services/nursing-support*
"We are community-based registered nurses throughout BC who assist children and youth with medical complexities to live in their homes and in their communities."

Travel Assistance Program (for non-emergency medical services) – *https://www2.gov.bc.ca/gov/content/health/accessing-health-care/tap-bc/travel-assistance-program-tap-bc*

Finding a Community

People who have similar experiences can connect through support groups. These groups create a space for sharing experiences and feelings, building community, and learning from others. They can provide both emotional support and firsthand information. Support groups come in many different forms. Some are face-to-face while others are found on online platforms. They can be either private or open to the general public. Listed below are some platforms that may be helpful for findings support groups. **Make sure to check the privacy and security conditions for each platform before sharing your information online.**

- **Facebook** fosters many local and international support groups. In the Facebook search bar, type [Disease Name] followed by [Location]. For example, "Cerebral Palsy Vancouver."
    - For rare diseases, try removing the location and adding "Disease". For example, "Cerebral Palsy Disease."
    - Some of these groups may be closed to the public in order to create a more private setting for the disease community. In this case, you will have to request to join by clicking "join group".
    - **There are also more general support groups that are still helpful, supportive and informative. Try searching for "rare disease" or "complex kids" groups.**

- **RareShare** *https://rareshare.org/*
  Create an account to join closed support groups specific to rare genetic conditions.
    - Here's a guide on how to get started: *https://rareshare.org/articles/how-to-use-the-rareshare-network-for-rare-disease-patients*
    - RareShare also has podcasts on specific conditions, as well as general podcasts on living with rare diseases.

- **RareConnect** *https://www.rareconnect.org/en*
  This user-friendly site fosters many online international communities for rare diseases. This site is available in 12 languages.

- **MyGene2** *https://mygene2.org/MyGene2/*
  Create an account to publicly share your child's variants with other families, researchers and clinicians. You can also search for families with variants of the same gene.
    - Here is a guide to the website: *https://mygene2.org/MyGene2/downloadable/mygene2_flyer_families_2018-10-16.pdf*

Recommended Support Groups ★

Genetic Databases

There are big genetic databases that allow scientists to share information and improve the understanding of genetic conditions. These databases are created using information from families who have received genetic testing.

Your child's doctor might ask if would like to put their genetic results in a database. This usually means they will post details about your child's DNA and their health conditions. This will all be de-identified, so that there are no personal details. **Sharing your child's information is optional, and refusing to share will not impact their medical care.**

Pros of sharing:

- Contribute to the pool of knowledge for your genetic condition.
- This information may help doctors find a diagnosis for patients with similar concerns.
- Many databases, like DECIPHER, are secure and not open to the public.

Cons of sharing:

- In some databases, researchers may not need to gain your consent before using genetic information that was posted.
- Some databases are easily accessed by the general public.

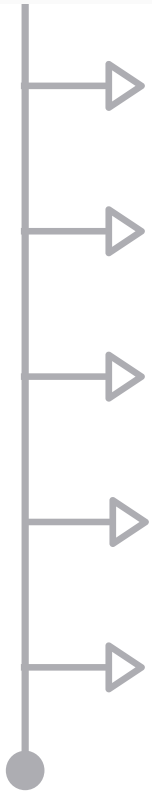
Be sure to check the terms of each database before sharing genetic information!

Databases that contain your family's genetic information:

Extra notes from your child's healthcare provider ★

Your Next Steps

There is a lot of information to process and consider. Take your time. Here is some space to keep track of actions you would like to pursue. This may include connecting with a certain resource, visiting your family doctor, searching for a specialist, or any other changes in health management. **If you need support with this process, or still have questions about your child's results, please contact a genetic counsellor or doctor.**



This booklet is designed to be a supplement for genetic counselling, not a replacement for it. You can find a genetic counsellor in your area by using:

- **The Canadian Association of Genetic Counsellors Find a Clinic tool:** *https://www.cagc-accg.ca/?page=225*
- **The National Society of Genetic Counselors Find a Genetic Counselor tool:** *https://findageneticcounselor.nsgc.org/*