Saint Mary's Hospital
Manchester Centre for Genomic Medicine

Information for Patients

Microarray Comparative Genomic Hybridisation (array CGH)

An array CGH test looks for small changes in a person's chromosomes, which might account for the problems they have been experiencing.

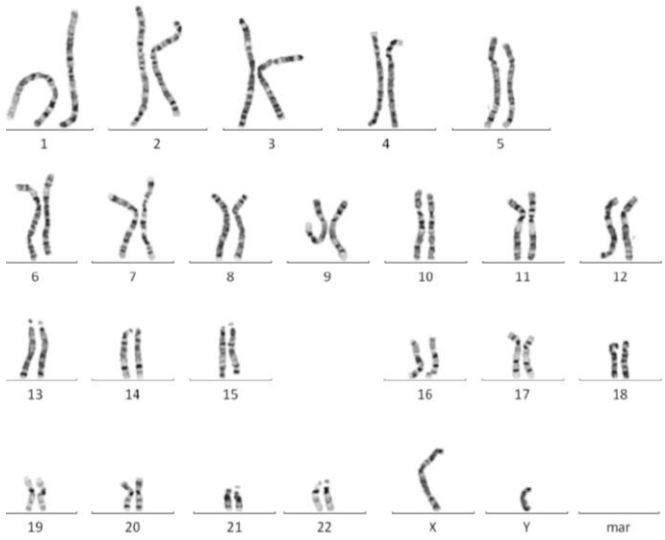
What are chromosomes?

Chromosomes are simply the small structures into which we package our genetic information, or DNA. Each segment of our DNA represents a single genetic instruction, also called a gene. A picture of chromosomes is shown below.

Many individuals will have had a standard chromosome test (or karyotype) carried out already. To perform a karyotype, scientists in the laboratory look by eye at the chromosomes down a microscope to check that there are the correct number of chromosomes.

Individuals with a normal karyotype have 23 pairs of chromosomes. 22 of these are given numbers and the final pair of chromosomes indicates the sex of the person, ie, XX for a girl and XY for a boy. The scientists are also trained to look at the stripey bands on the chromosomes to check that each pair match up and that there is no missing (deleted) or extra (duplicated) chromosome material.

Karyotype:



Why is an array CGH test being done?

Some people have genetic changes that are too small to be detected on a standard karyotype. The array CGH test has been developed to look in detail at thousands of separate points on a person's chromosomes for tiny missing or extra pieces that cannot be seen down the microscope. These tiny missing or extra bits of genetic information can often contain a number of genes. Each gene is an instruction that tells our body how to grow, develop or function. Therefore, if there are too few or too many instructions, then this can cause a person to have problems and a chromosome change may explain the problems the person has been experiencing.

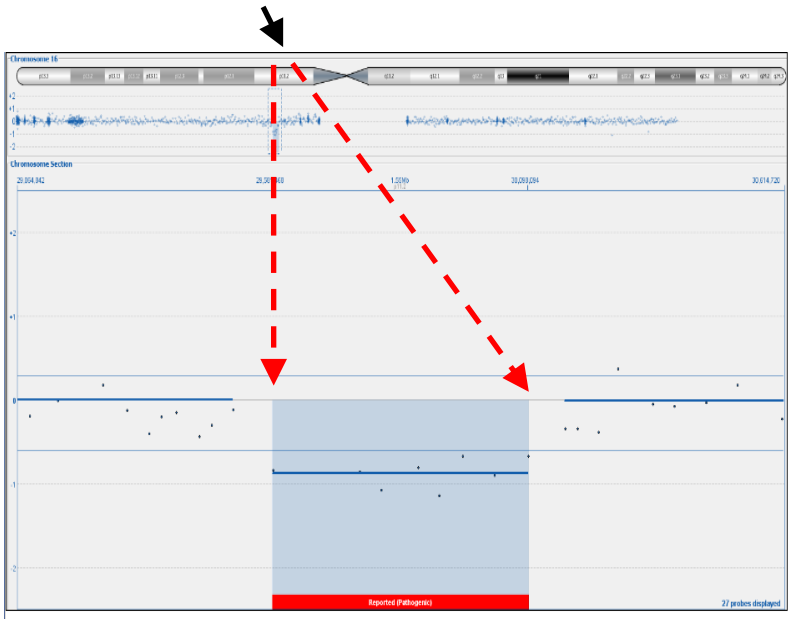
An array CGH test is a particularly useful test to try and find the underlying cause of unexplained problems with learning, physical development or behaviour. It can also be used to help find a diagnosis for people with unexplained birth defects or medical problems such as seizures. Recent studies have shown that around 15% of children with unexplained learning and/or developmental problems will have chromosome problems that were too small to be detected by a standard karyotype, but could be detected by array CGH testing. For this reason, your doctor may decide to proceed straight to an array CGH test rather than performing a karyotype.

What does the test involve?

To have an array CGH test the laboratory needs a blood sample from the patient to be tested. The sample is split into two parts, one is used to perform the array test and the other is stored in case further tests are needed once the result is known. These further tests are sometimes needed to help the laboratory to fully understand what the results might mean.

A picture of a genetic change found on array CGH:

Missing chromosome section



Possible Results:

1. The results of the test may be normal – no missing or extra pieces of DNA have been found. If this is the case your doctor will consider other possible reasons for the individual's health problems.

2. The test finds some extra or missing material which is thought to be the cause of the problems. Many of the changes found on the array CGH test are seen fairly often and so we may be familiar with the sort of medical problems they can cause. If the pattern of missing or extra material has been seen in other individuals who have had similar problems, the laboratory can be quite confident that this genetic change has caused the problems.

3. The test finds some extra or missing material, but the meaning of this is unclear. Sometimes when extra or missing material has been found in a patient, this particular change has never been seen before and the scientists need to do further tests to try and work out what this means. The laboratory would need a blood sample from the patient's biological parents to investigate whether they carry the same change. The parent's sample will be tested only for the change that was found in their child. One of the following may be found:

    i. If the change has not been inherited from either parent, then this suggests that the change may be responsible for the problems the individual has experienced.

    ii. A parent may carry a different but related change, with a high recurrence risk.

    iii. If a healthy parent is found to carry the same genetic change, then this often means that this is most likely a harmless genetic change that is running in the family (we all have a few harmless genetic changes – this is part of what makes us all unique).

iv. The genetic change may be inherited from a parent with similar problems.

You will be offered a clinic appointment to discuss the findings of the test.

Can anything else be found on an array CGH test?

In very rare circumstances, the array CGH result may find a change in the DNA, which may not be directly related to the reason why the patient's blood was sent for array CGH testing in the first place but which nevertheless would be a useful change for you to know about. Your Consultant Clinical Geneticist will explain and discuss this with you in the unlikely event that an unexpected result is found.

When will you receive the result?

If the result is normal, it will be back with your consultant in 4-6 weeks. If we ask for parental blood samples, the full result will usually be back with your consultant a month after the laboratory receives the parental samples.

It is very important for the laboratory to receive blood samples from both biological parents where possible, to allow them to fully interpret the change in their child. We understand that this is not always possible and if for any reason, you know that one parent will not be available for testing, please ask your consultant to let the laboratory know as soon as possible. If the laboratory has not been informed, there may be a delay in receiving your result as the laboratory may be waiting for the other parental sample before issuing the report.

Frequently asked questions

Question: **How often will array CGH testing find something wrong with a patient's genetic make up that will help to explain his/her clinical problems?**

Answer: Many laboratories throughout the world are finding genetic causes for clinical problems using array CGH in around 15% (around 1 in 6) of all the patients referred for genetic testing. This is at least three times higher than the detection rate we were previously able to achieve.

Question: **How often and for what reason does the laboratory also examine the parents' blood samples?**

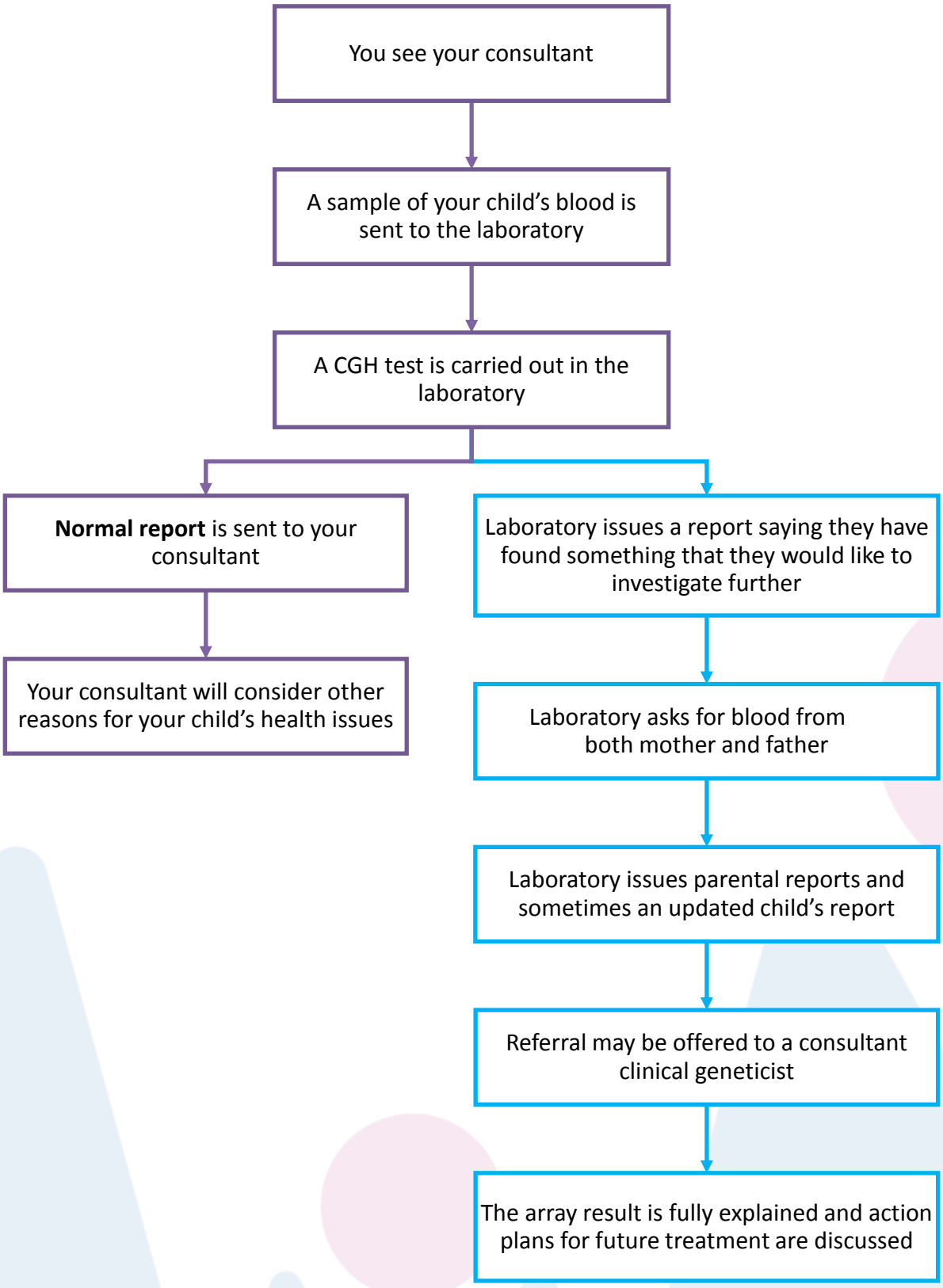
Answer: In approximately one quarter of cases, the array CGH test will show that an individual has some DNA (genetic material) either missing or present in extra copies. Examining the parent's blood gives us essential information which helps us to understand the array CGH result. In some cases, the array CGH test result may show that this is familial variation and may not therefore be related to an individual's clinical problems.

Question: **Why are patients recommended to discuss some array CGH results not only with their consultant but also with a consultant clinical geneticist?**

Answer: Array CGH testing is a relatively new technology but is increasingly being used worldwide. Manchester Genetic Medicine and the Manchester Regional Genetics Laboratory work closely together, and with scientists across the world, so that the very latest and most informed interpretation of an individual's array CGH result can be produced. The amount and quality of information is growing rapidly and so your consultant clinical geneticist and genetic counsellor are the best people to help explain the array CGH result, and discuss what the results mean, not only for the individual but potentially for their parents and other members of your family.

Question: **What happens next?**

Answer: The 'Patient Journey' diagram sums up what happens from the time the blood sample is taken to when you will know whether or not array CGH has helped in the diagnosis of that individual's clinical problems. It is important to realise that a normal array CGH result also gives useful information for your consultant, who may then consider other reasons for an individual's health issues.



For more information

If you need more advice about any aspect of array CGH tests, you are welcome to contact:

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We would like to acknowledge our colleagues at the Wessex Regional Genetics Laboratory for writing some of the information contained in this leaflet.

These questions are adapted from the booklet on array CGH testing produced by the Wessex Clinical Genetic Service which you may like to access at the following web address:

http://www.icid.salisbury.nhs.uk/Diagnostics/Genetics/Pages/ArrayComparativeGenomicHybridisation(aCGH)PI0924.aspx