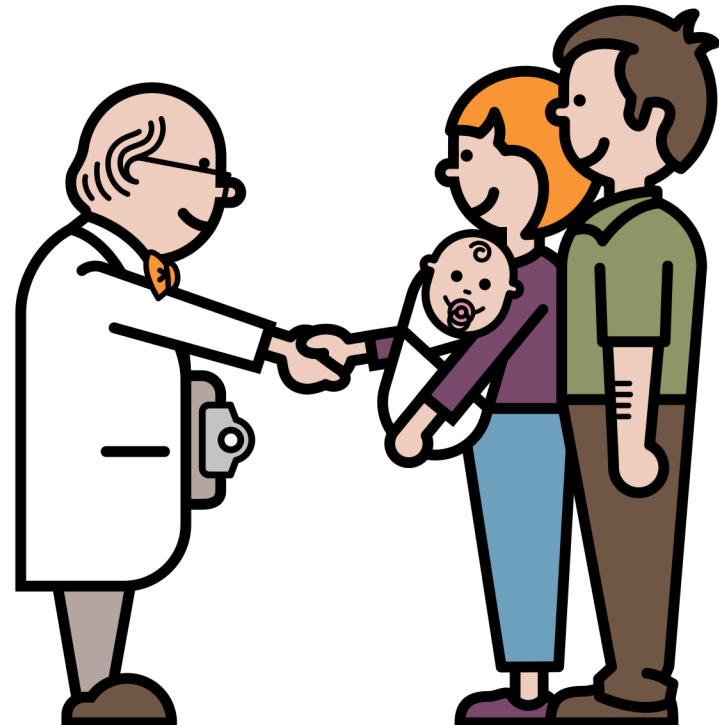


# Phenylketonuria

# PKU

Information for families after a  
positive newborn screening



Adapted by the Dietitians Group BIMDG

**BIMDG**

British Inherited Metabolic Diseases Group



BASED ON THE ORIGINAL TEMPLE WRITTEN BY  
BURGARD AND WENDEL

Reviewed & revised for North America by: A. Huber

This version of the TEMPLE tool, originally adapted by the Dietitians group of the BIMDG for use within the UK and Ireland, has been further adapted by Nutricia North America for use within United States and Canada. This version no longer represents clinical or dietetic practice in the UK or Ireland.

**TEMPLE**

Tools Enabling Metabolic Parents LEarning



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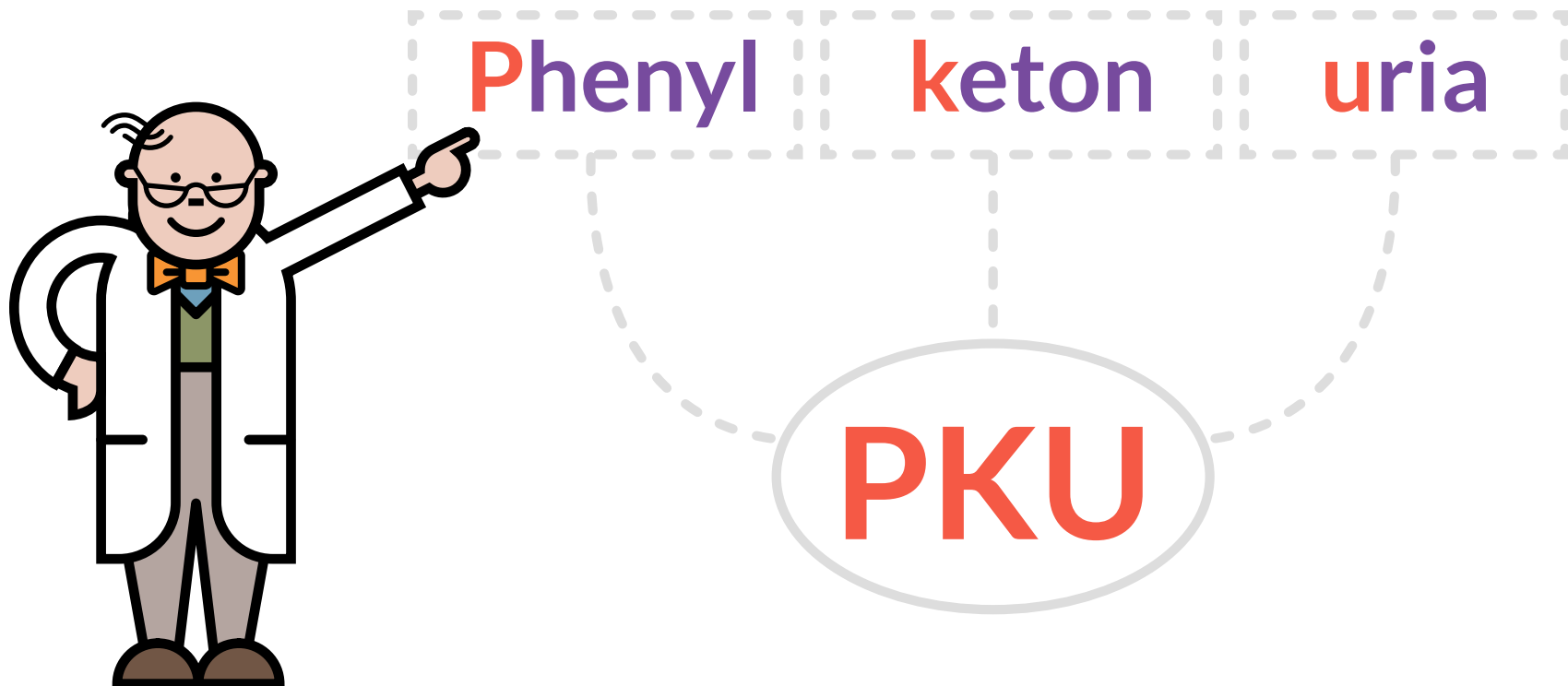


# What is PKU?

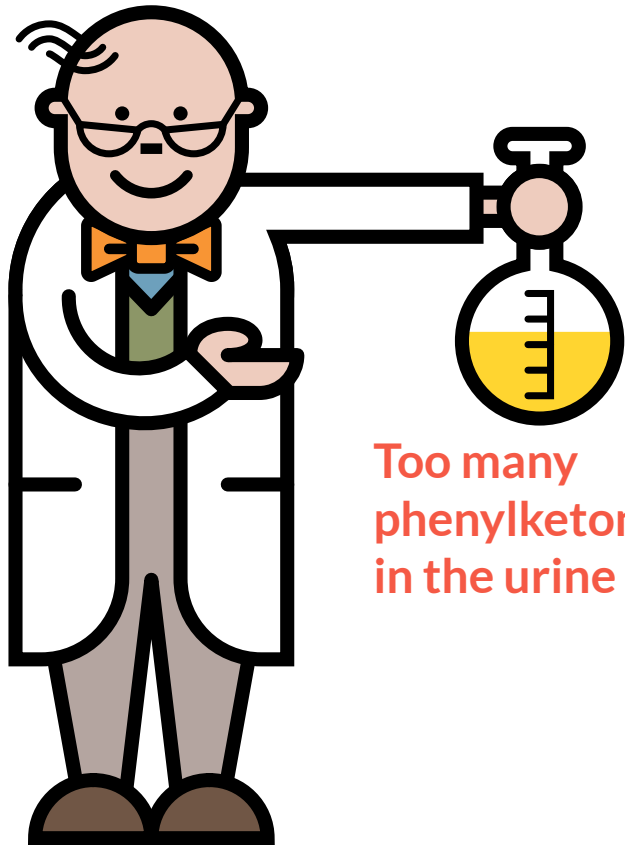
PKU stands for phenylketonuria.

It is pronounced fee-nile-ke-ton-urea.

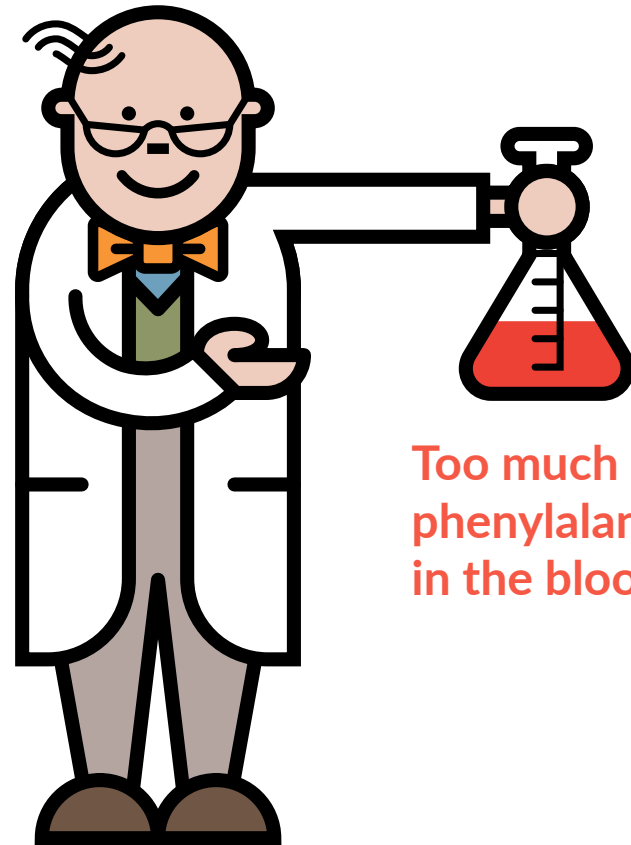
**It is an inherited metabolic condition.**



# What is PKU?



Too many  
phenylketones  
in the urine

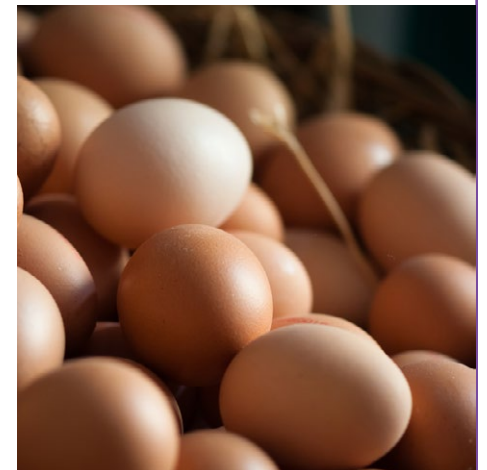
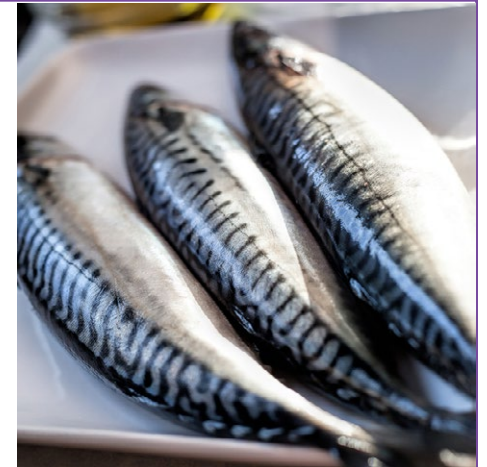


Too much  
phenylalanine  
in the blood

# How does PKU affect the body?

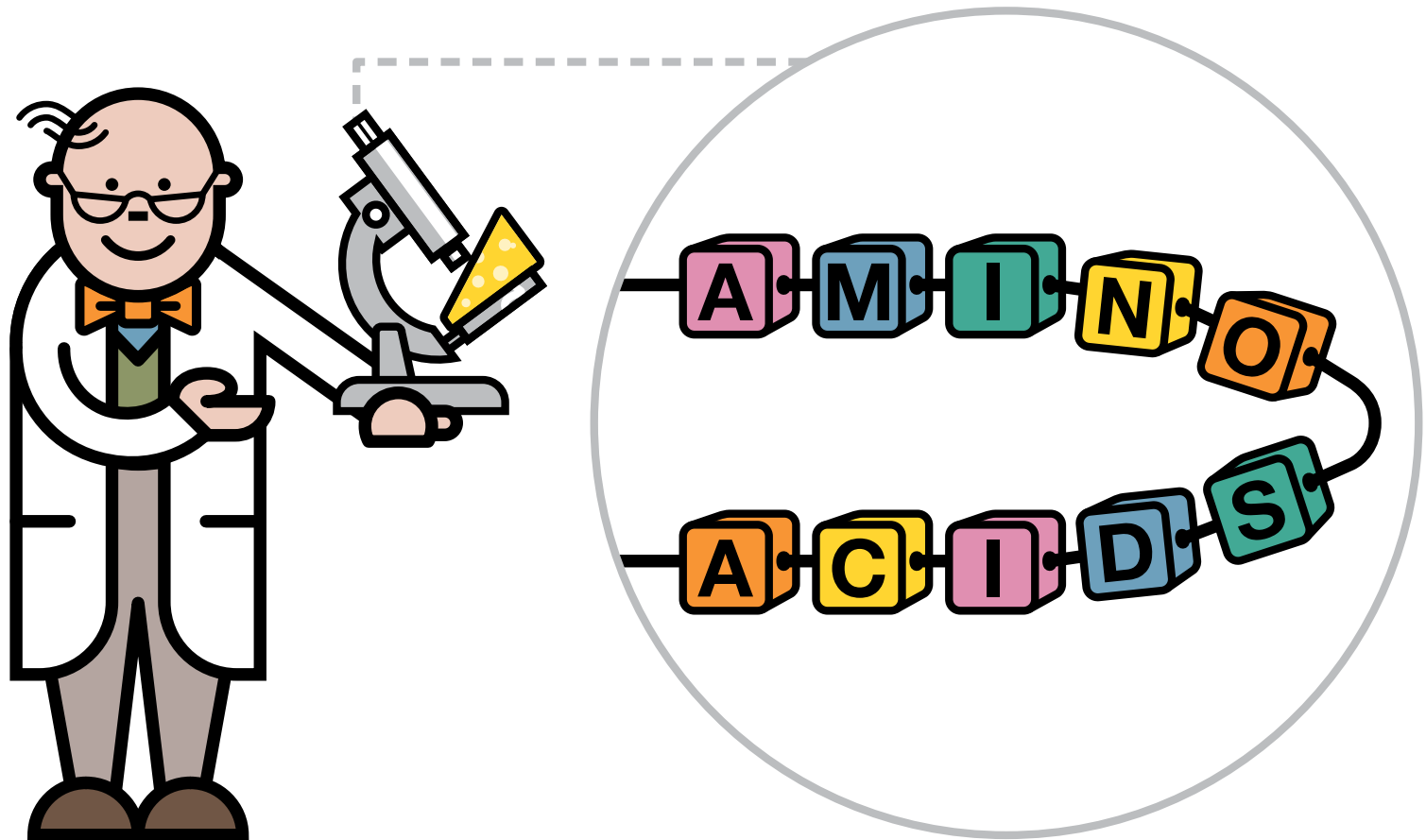
PKU affects the way the body breaks down protein.

Protein is found in our bodies and in many foods. The body needs protein for growth and repair.



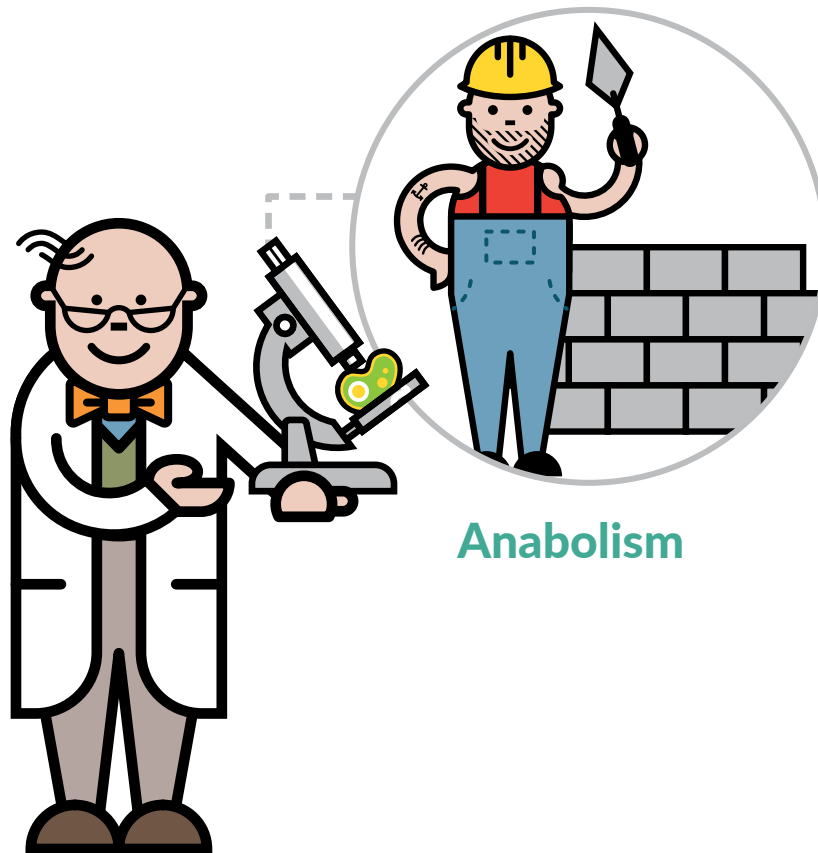
# What is protein?

Protein consists of chains of many smaller units called amino acids.

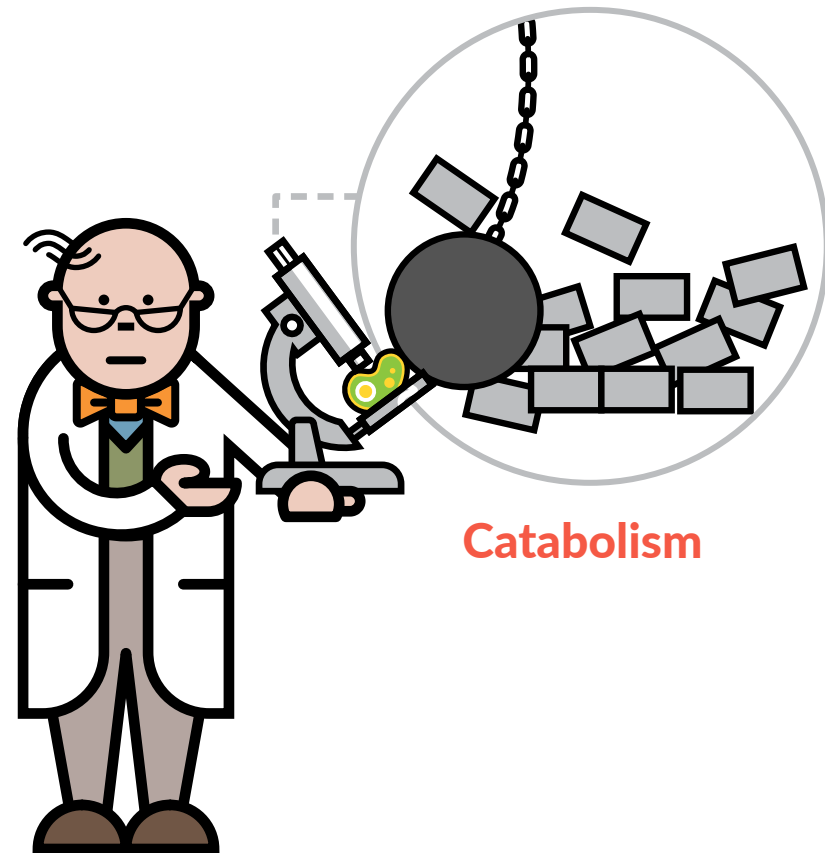


# Protein metabolism

**Metabolism** refers to the processes that occur inside the cells of the body.



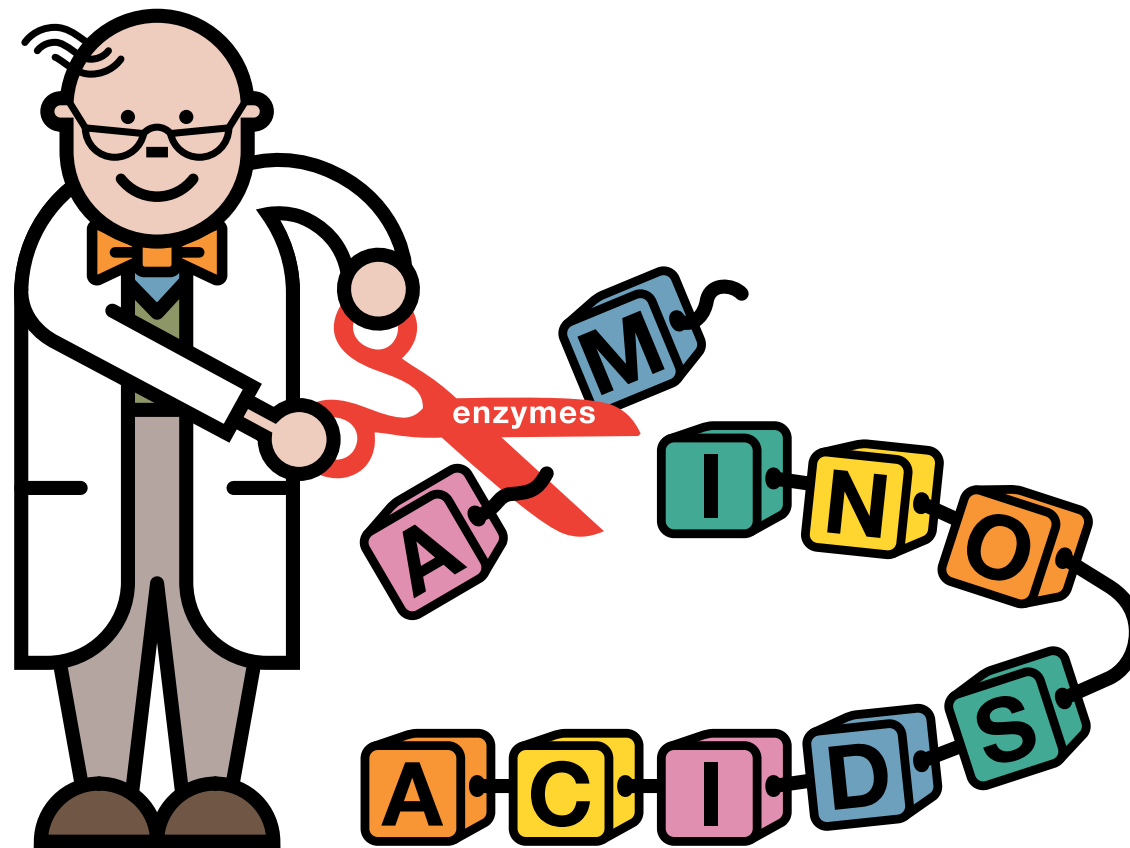
Anabolism



Catabolism

# What do enzymes do?

Enzymes help with metabolism by functioning like scissors. They break down proteins into smaller parts, including amino acids.



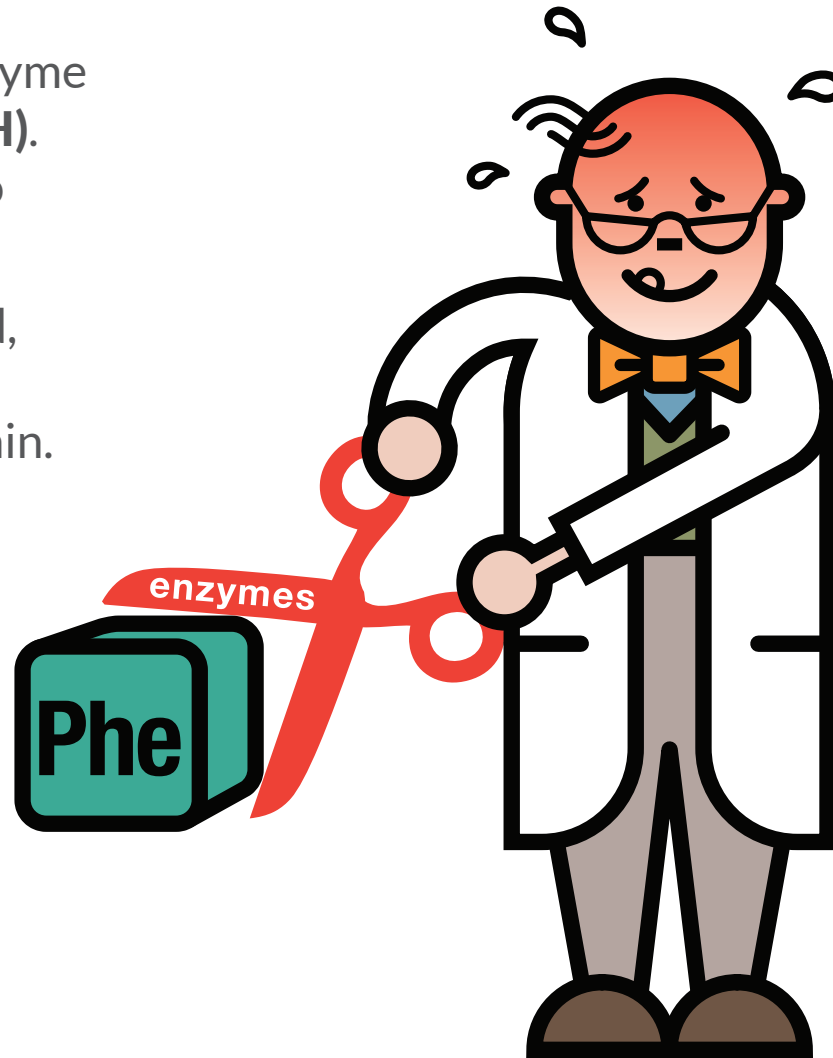


# What happens in PKU?

PKU is caused by a deficiency of an enzyme called **phenylalanine hydroxylase (PAH)**. PAH converts phenylalanine (PHE) into tyrosine (TYR).

The deficiency results in the amino acid, phenylalanine, not being converted, so instead it builds up in the blood and brain.

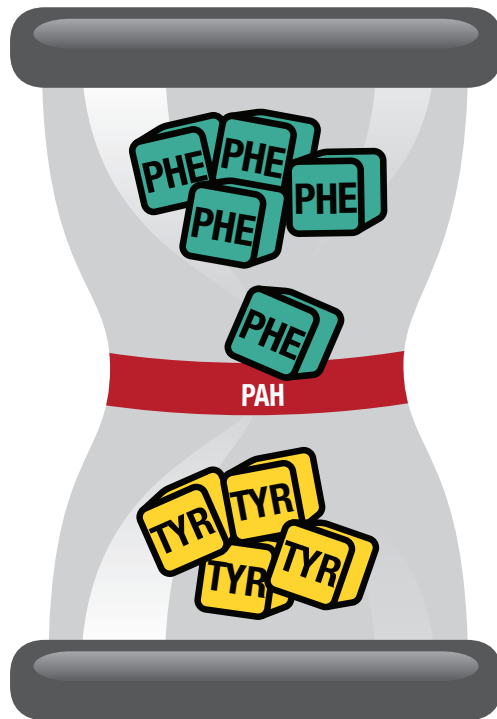
Blood tyrosine levels are low as phenylalanine cannot be broken down to tyrosine, and phenylketones are found in the urine.



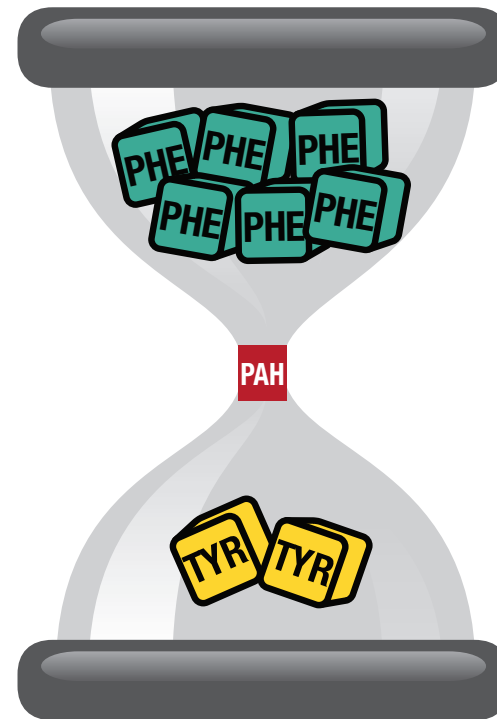
# What happens in PKU?

For example:

For someone without PKU,  
PAH converts PHE into TYR



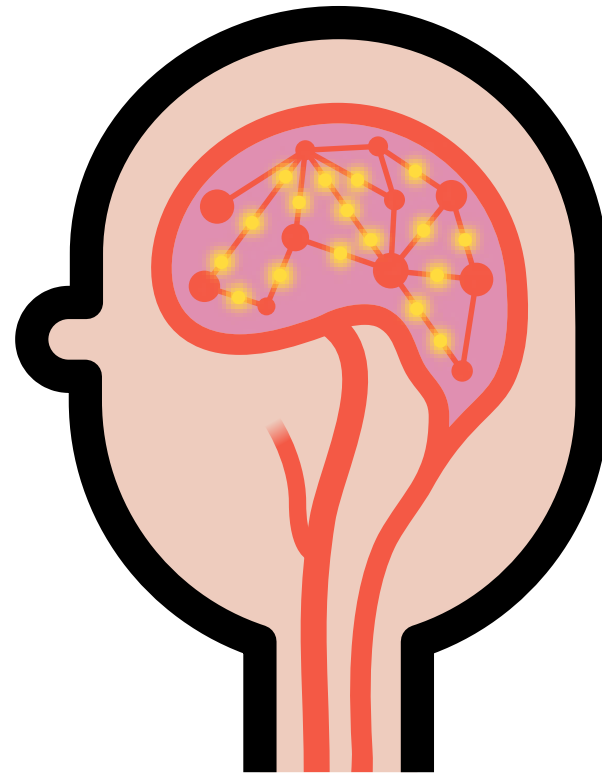
For someone with PKU, there  
is not enough PAH to convert  
PHE into TYR



# What are the effects of high phenylalanine levels?

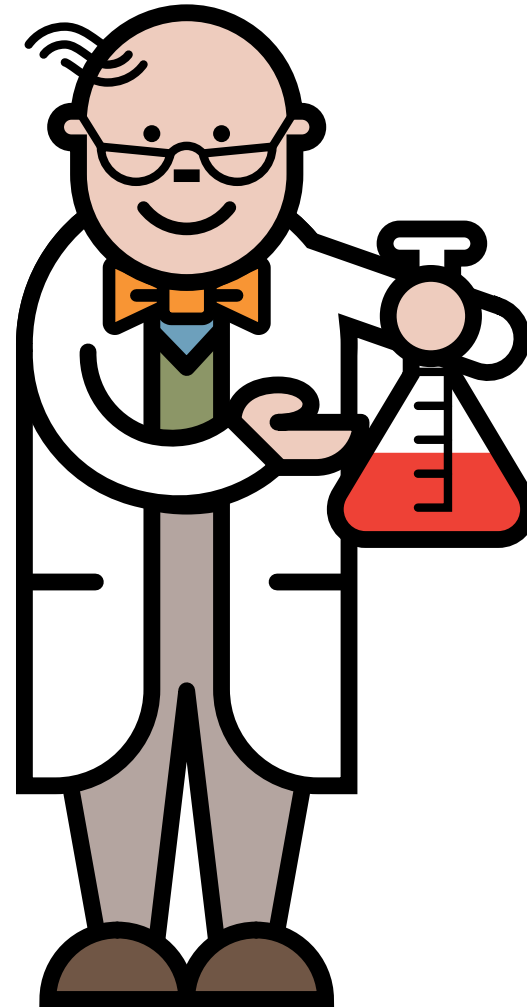
Without management, over time, the buildup of phenylalanine causes irreversible brain damage and poor intellectual development.

With management, the buildup of phenylalanine is controlled to support normal growth and development.



# What about other symptoms?

If blood levels of phenylalanine are poorly controlled, it is likely to lead to learning difficulties and behavior problems.



# How is PKU diagnosed?

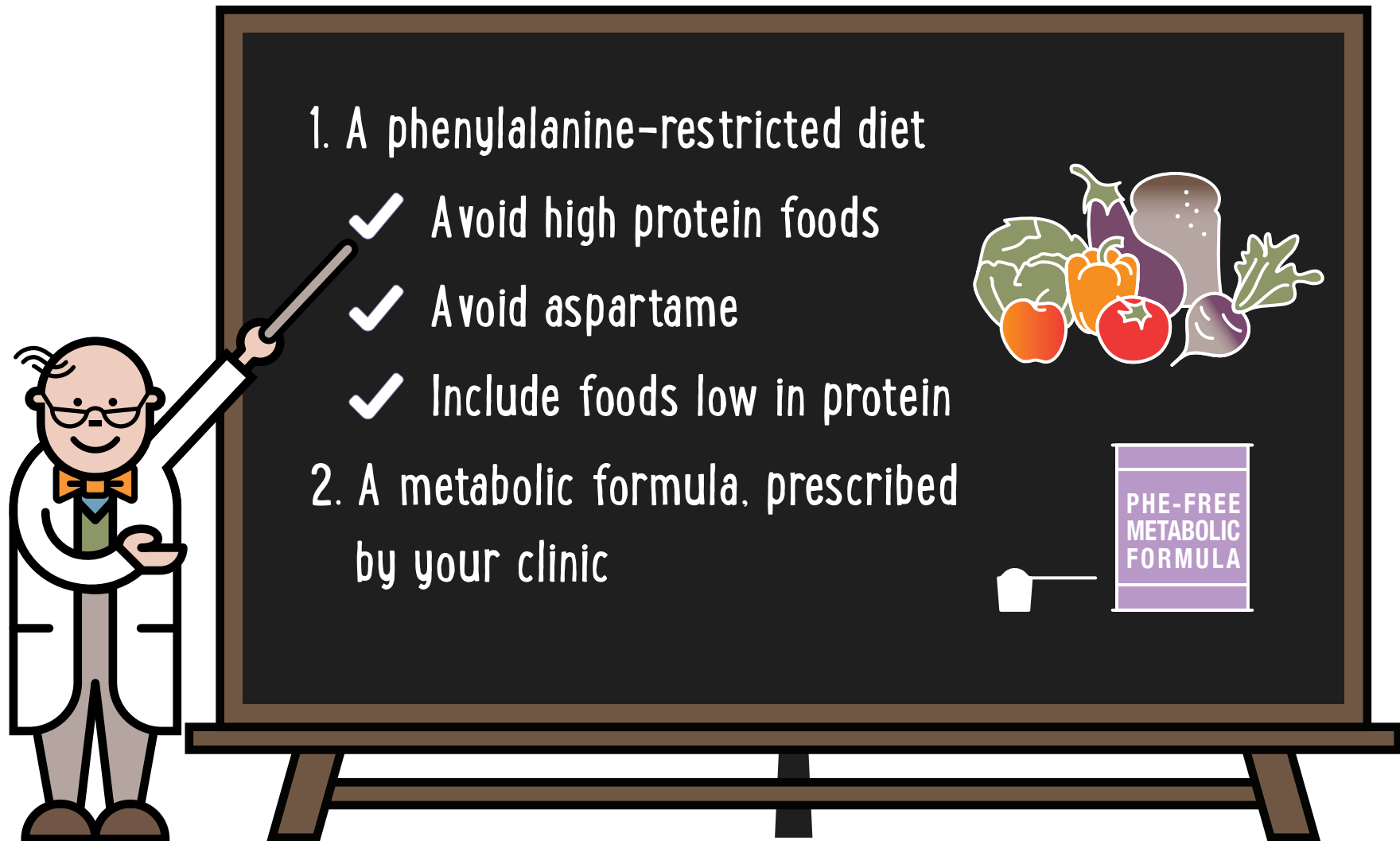
As part of newborn screening, a few drops of blood are collected.

The blood sample is then analyzed and the phenylalanine level is measured.

A high phenylalanine level could mean your child has PKU which will prompt your clinician to do further testing to confirm the diagnosis.



# How is PKU managed day-to-day?



1. A phenylalanine-restricted diet

- ✓ Avoid high protein foods
- ✓ Avoid aspartame
- ✓ Include foods low in protein

2. A metabolic formula, prescribed by your clinic

PHE-FREE METABOLIC FORMULA

# Avoid high protein foods

Foods rich in protein, and therefore phenylalanine, should be avoided. This includes **meat, fish, eggs, cheese, milk, bread, pasta, nuts, soy and tofu.**

Any food or drink containing **aspartame** should also be avoided.



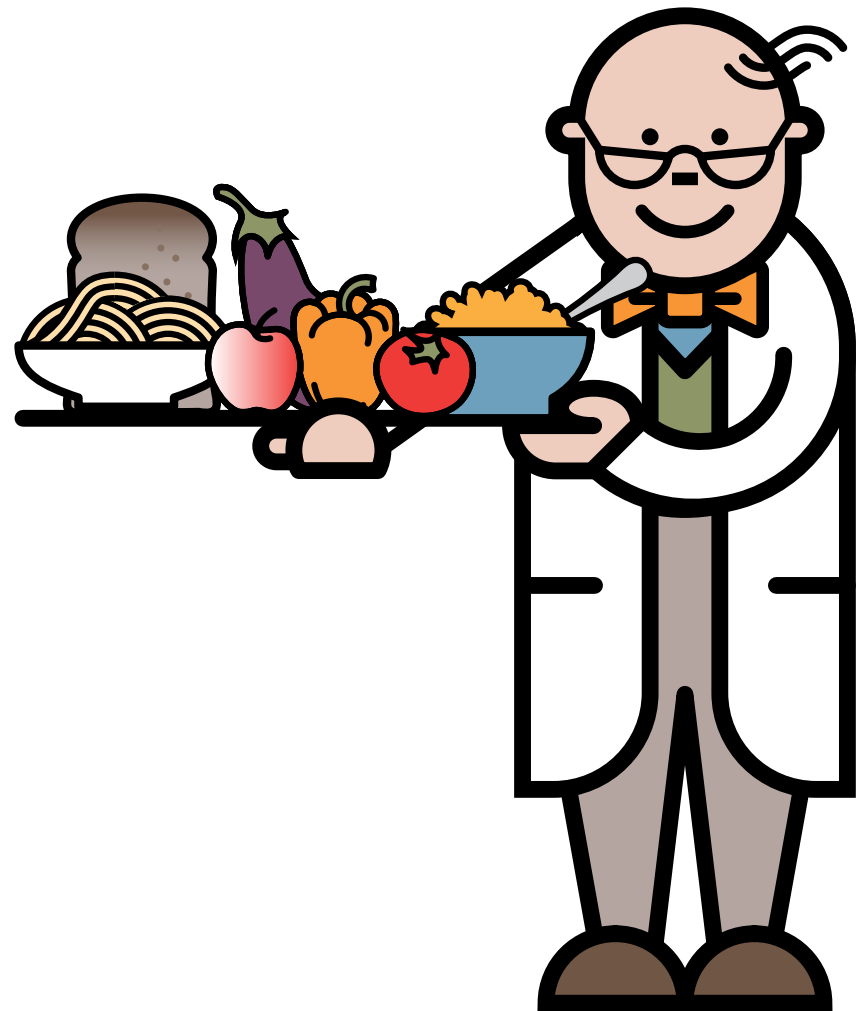
# Include foods low in protein

These are foods that contain small amounts of phenylalanine which can be used in typical quantities.

They include many fruits and vegetables, and special low protein foods.

They provide:

- An important source of energy
- Variety in the diet





# Low protein cooking

Cooking low-protein meals for your child can still be appealing to the eye and taste good.

There are many low protein cookbooks, some even created by PKU families. Your dietitian may be able to recommend a few favorites.



# Feeding your baby with metabolic formula

Phenylalanine is essential for normal development and therefore a limited and controlled amount must be taken daily.

Breast milk or standard infant formula will provide the phenylalanine required by your baby prior to the introduction of solids, generally around 4-6 months of age.

Your baby will also need a special metabolic formula to provide protein without phenylalanine.

Your dietitian will determine how much breast milk or standard infant formula and metabolic formula to offer.



# Phenylalanine-free metabolic formula

Phenylalanine-free metabolic formula is an essential part of meeting your baby's nutritional requirements.

Like breast milk or standard infant formula, metabolic formula has carbohydrate, fat, vitamins, minerals and protein in the form of amino acids without phenylalanine.

Metabolic formula, plus the prescribed amount of phenylalanine, allows your baby to get all the nutrients he or she needs to grow.





# Tracking phenylalanine

As your baby starts to eat solids your clinic will work with you to track phenylalanine.

Foods must be weighed or measured using household measures (1 cup, 1 tablespoon, etc.) to determine phenylalanine content.

Your clinic can help you find the best tools to help determine the phenylalanine content of foods.

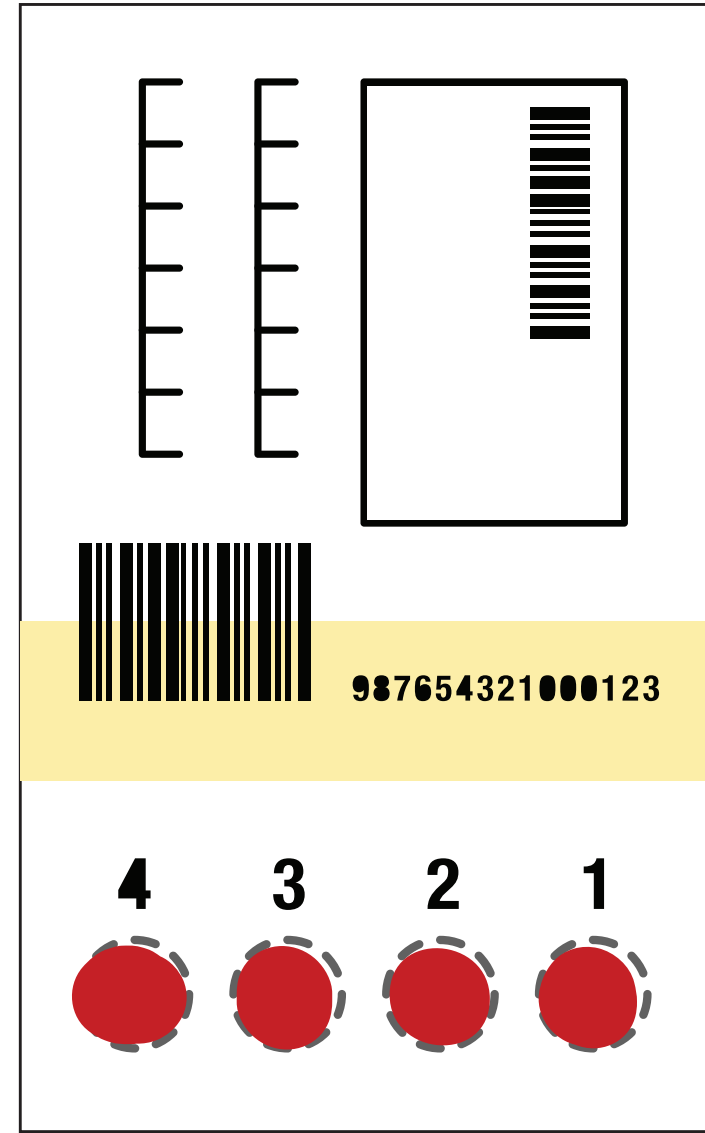


# How is PKU monitored?

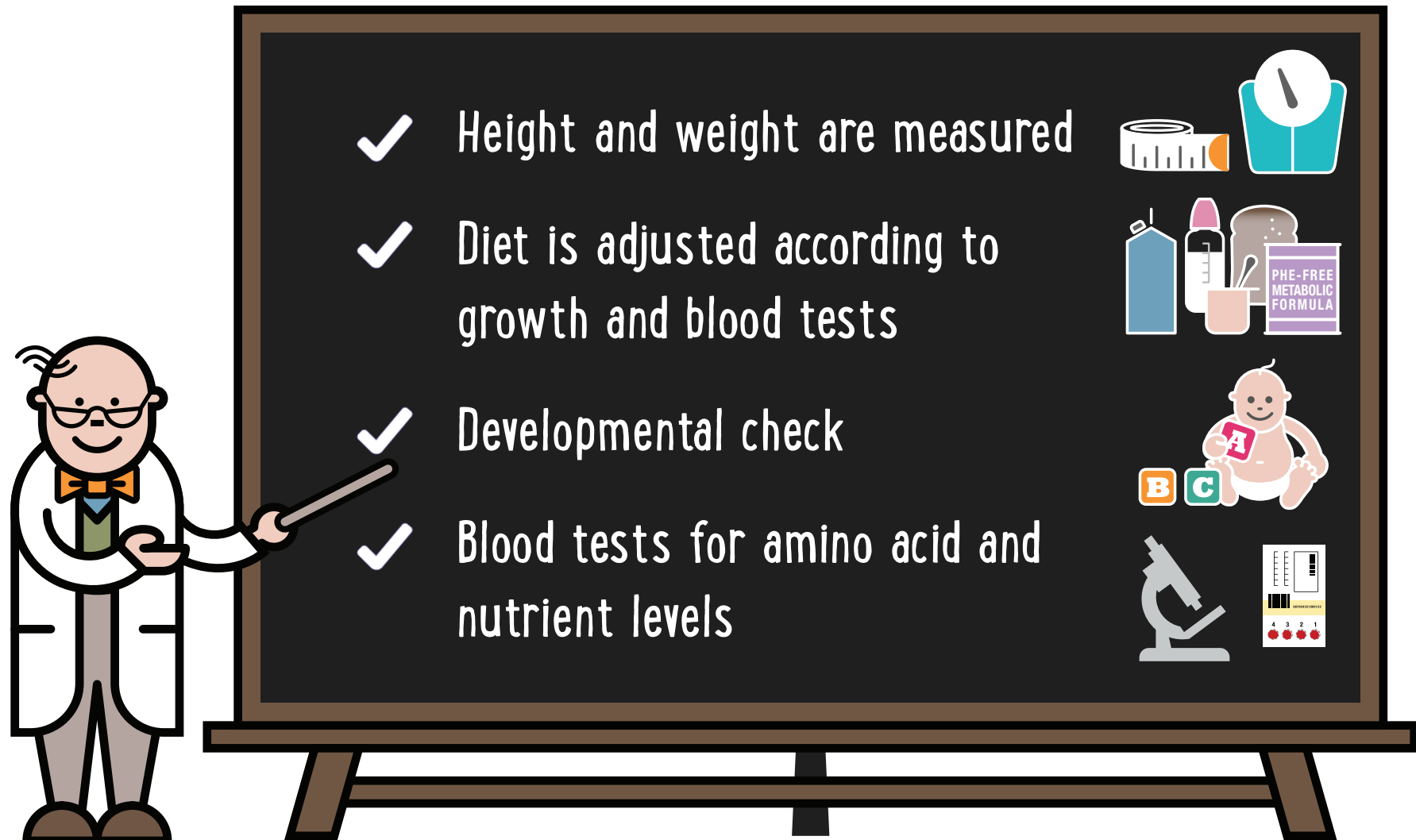
Regular blood tests are taken at home or in the clinic and reviewed by a dietitian.

The sample is tested for the amount of phenylalanine it contains.

The metabolic dietitian will contact you with the result and discuss any changes in management.



# What happens during a clinic check-up?



# How is PKU managed during illness?

During any illness, our bodies need extra energy. The body will start breaking down cell protein, causing blood phenylalanine levels to increase. This process is also referred to as catabolism.

It is important to continue with the usual diet as much as possible.

Metabolic formula can help keep blood phenylalanine levels down by providing phenylalanine-free protein and energy.

Your clinician will determine the best course of action.

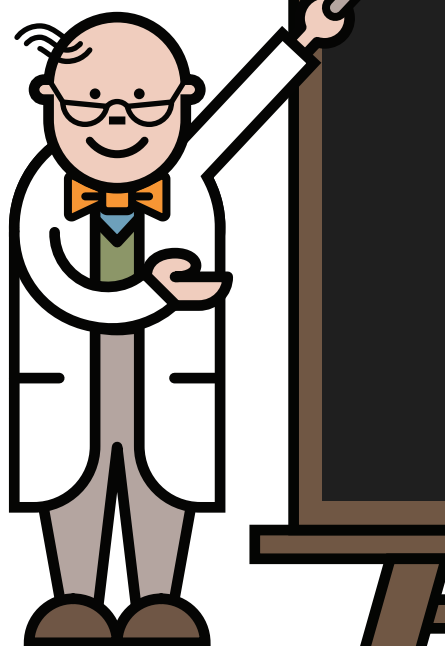
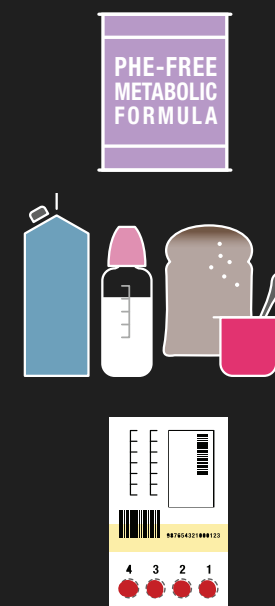


# How is PKU managed during illness?

Always follow your medical team's guidance.

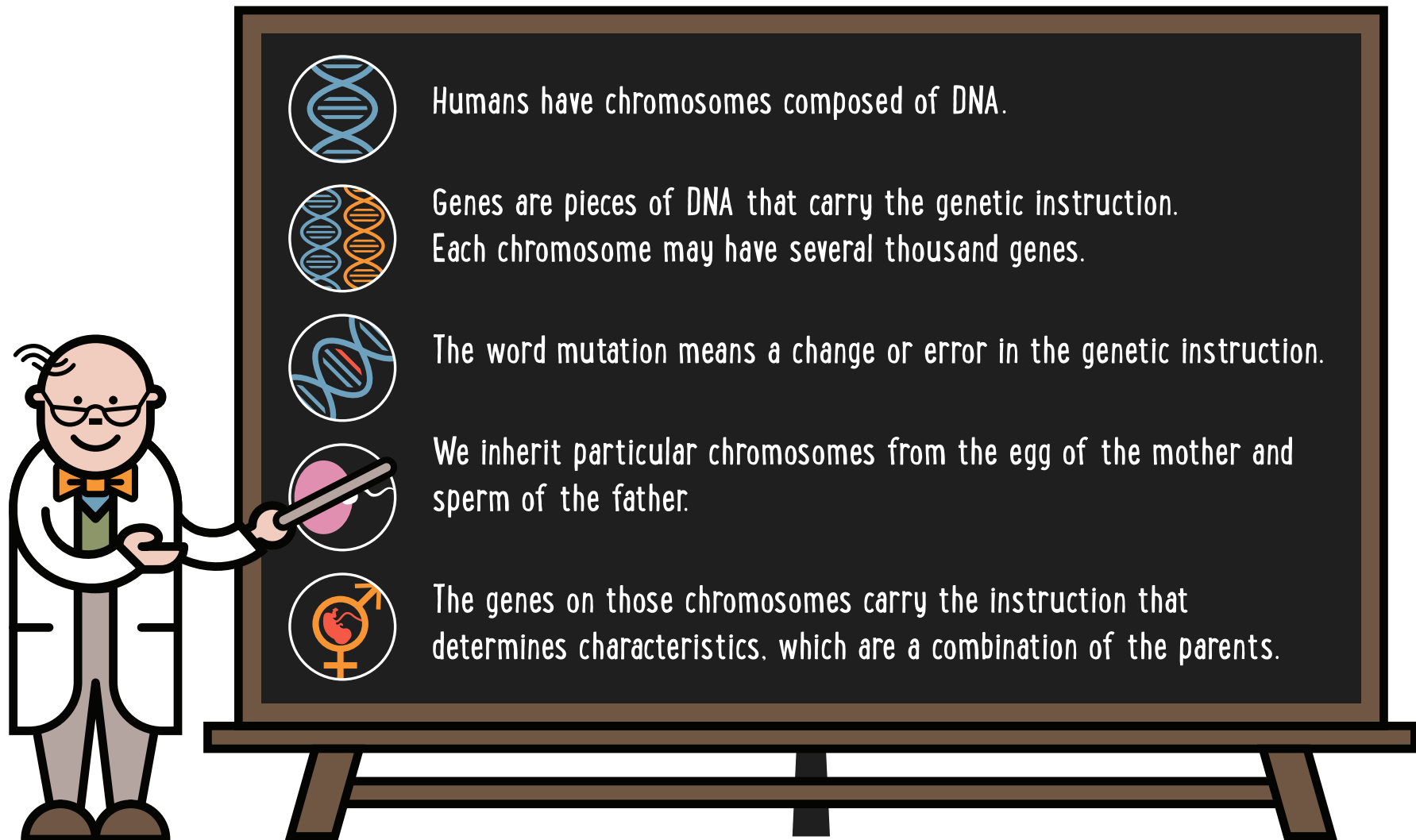
As tolerated:






- ✓ Continue to take metabolic formula
- ✓ Continue current diet
- ✓ Note any illness when taking a blood sample



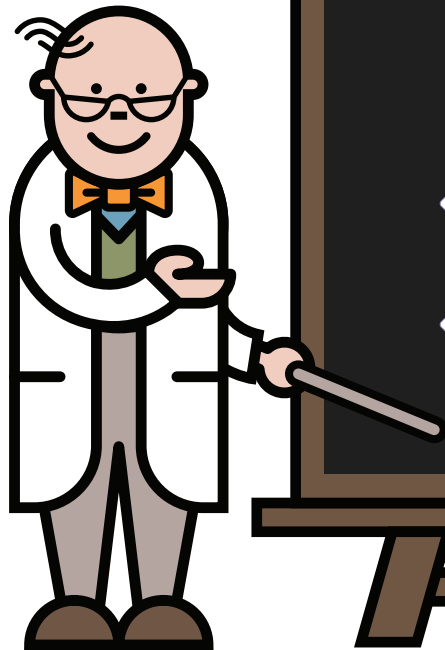


# What happens in human genetics?



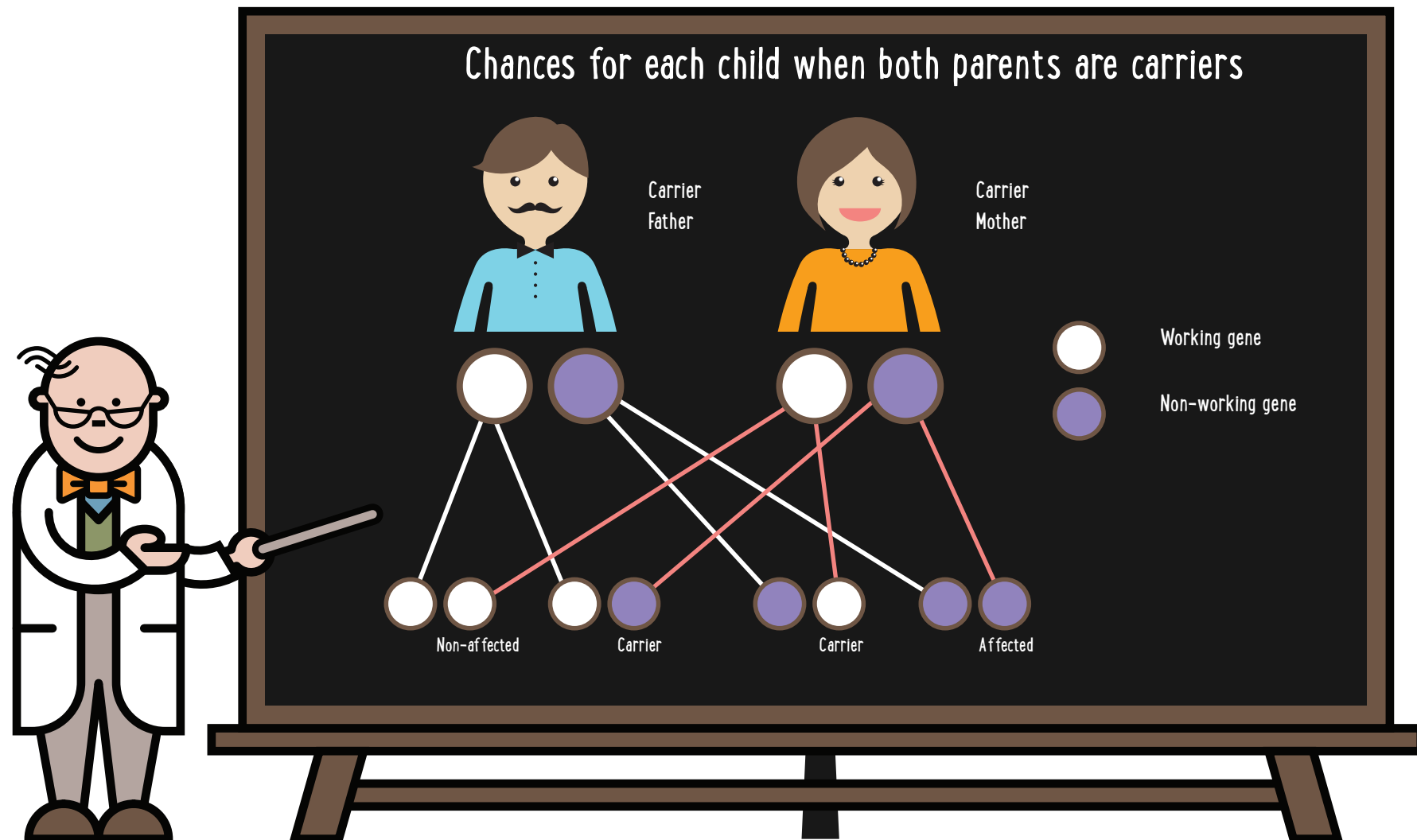
-  Humans have chromosomes composed of DNA.
-  Genes are pieces of DNA that carry the genetic instruction. Each chromosome may have several thousand genes.
-  The word mutation means a change or error in the genetic instruction.
-  We inherit particular chromosomes from the egg of the mother and sperm of the father.
-  The genes on those chromosomes carry the instruction that determines characteristics, which are a combination of the parents.

# How does one inherit PKU?



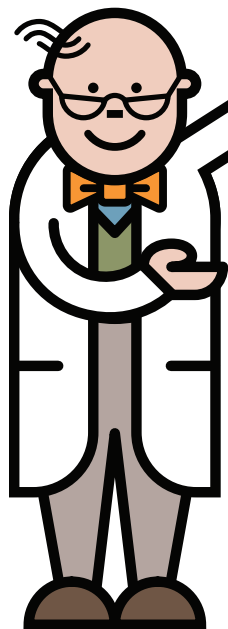
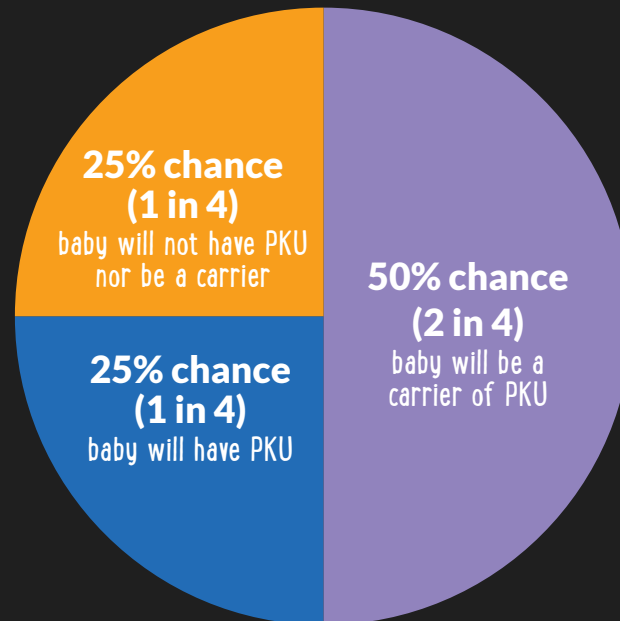
- ✓ PKU is an inherited condition. There is nothing that could have been done to prevent the child from having PKU.
- ✓ Everyone has a pair of genes that make the phenylalanine hydroxylase enzyme. In children with PKU, neither of these genes works correctly. These children inherit one non-working PKU gene from each parent.
- ✓ Parents of children with PKU are carriers of the condition.
- ✓ Carriers do not have PKU because the other gene of this pair is working correctly.

# Inheritance – Autosomal-recessive – possible combinations

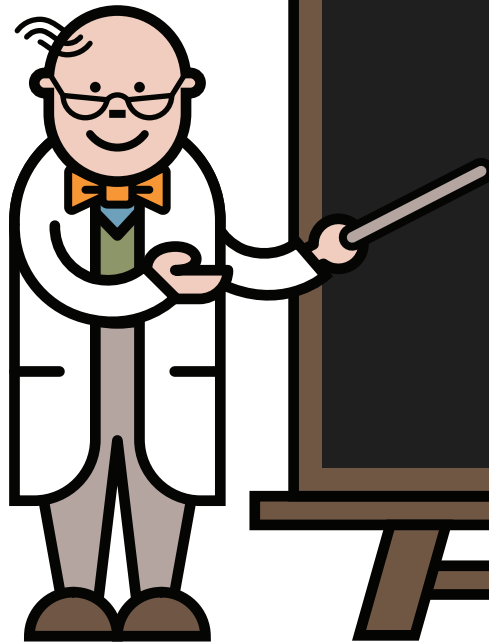


# Future pregnancies

When both parents are carriers, *in each pregnancy*  
the risk to the baby is as follows:



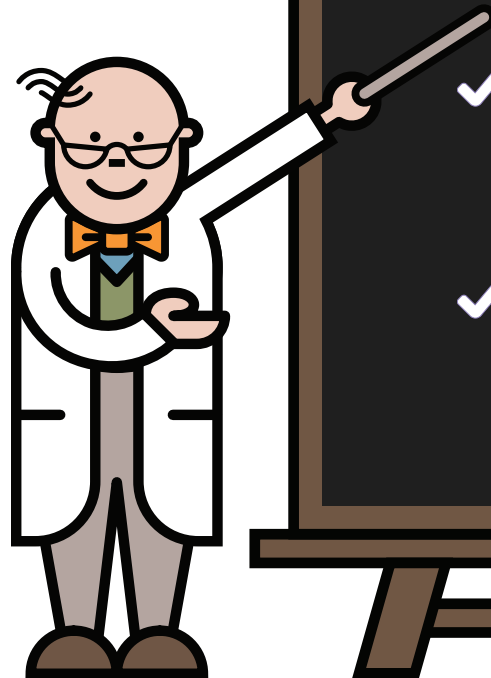
# Take home messages



- ✓ PKU is a serious inherited metabolic disorder.
- ✓ Damage can be prevented with a diet low in phenylalanine and a special metabolic formula.
- ✓ Remember to always give the correct amount of phenylalanine and metabolic formula as prescribed by your metabolic clinic.
- ✓ Regular blood spot tests are essential to monitor blood phenylalanine levels.

And remember, when correctly managed, your child can enjoy normal growth and development.

# Helpful hints



- ✓ Always ensure you have a good supply of your low protein foods, phenylalanine-free metabolic formula and that they are not expired.
- ✓ Your special dietary products and phenylalanine-free metabolic formula are prescribed by your metabolic clinic.
- ✓ Always ensure you have sufficient blood testing equipment and to send samples on a regular basis.

# Who's who (contact details)

## My dietitian

Name: .....

Phone #: .....

Email: .....

## My nurse

Name: .....

Phone #: .....

Email: .....

## My doctor

Name: .....

Phone #: .....

Email: .....

# TEMPLE



Tools **E**nabling **M**etabolic **P**arents **L**earning

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