

FAN offers a simple device for carrying out

# <sup>13</sup>C breath tests

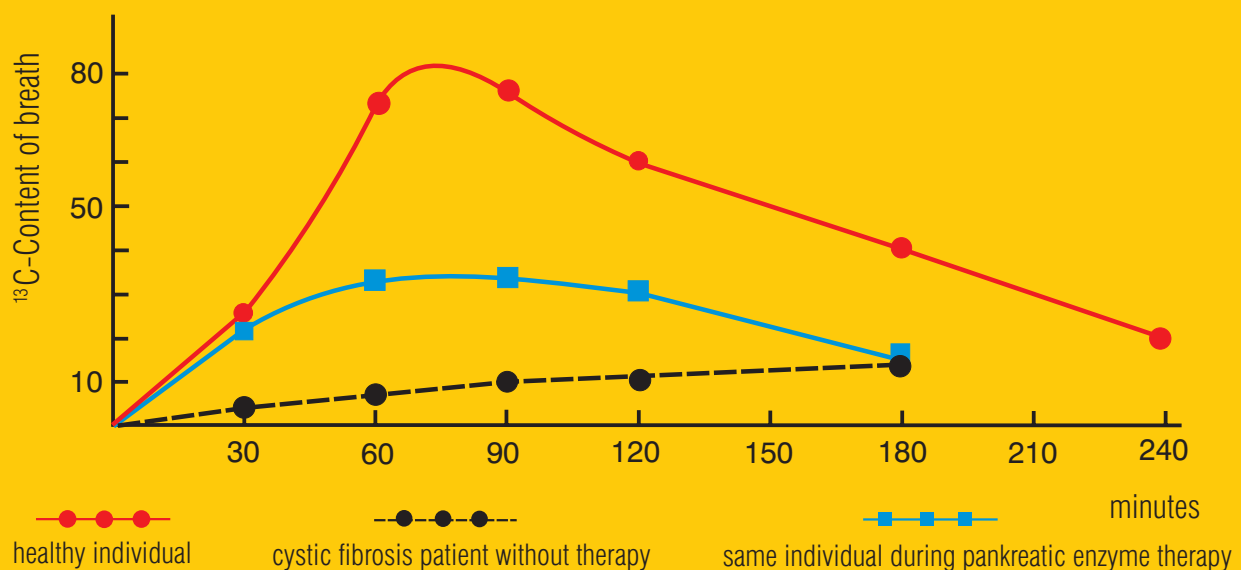
Many metabolic or infectious diseases can be diagnosed by administering a substance labelled with the stable isotope carbon-13 (<sup>13</sup>C) and measuring the rate at which the <sup>13</sup>C of this substrate is broken down to form <sup>13</sup>CO<sub>2</sub> in the course of metabolism and exhaled.

Thus a patient suffering from cystic fibrosis excretes <sup>13</sup>CO<sub>2</sub> much slower than healthy individuals after he has ingested

a certain amount of <sup>13</sup>C-labelled trioctanoin. Enzyme therapy gives rise to an acceleration of his <sup>13</sup>CO<sub>2</sub> exhalation (see diagram).

Diagnosis and evaluating therapeutic efficiency by means of such <sup>13</sup>C-breath tests does not stress the patient at all nor does it imply any radiation risks such as <sup>14</sup>C-breath tests.

## Kinetics of <sup>13</sup>CO<sub>2</sub> excretion after uptake of <sup>13</sup>C-trioctanoin



### stomach

Using <sup>13</sup>C-labelled **urea** as a substrate one can decide with unsurpassable certainty whether or not a *Helicobacter pylori* infection is present. This infection is the most frequent reason for gastric and duodenal diseases (gastritis, gastric and duodenal ulcer, gastric carcinoma etc.). It has also been reported that coronary disease and migraine may be associated with *Helicobacter pylori* infection. In developed countries about 50 % of the population is infected and in developing countries the rate is generally higher.

By means of the <sup>13</sup>C-**octanoic acid** breath test the gastric retention time of solid food can be determined which is important for optimising diabetes mellitus-therapy. With other methods for measuring this value the application of radioactive isotopes is unavoidable. For determining gastric retention times of liquid and semi-solid food <sup>13</sup>C-labelled **acetic acid**, **acetates**, **hydrogen carbonates** and **glycin** as substrates has proved successful. **Sucrose** or **lactose**, respectively, as substrates of <sup>13</sup>C-breath tests are used for diagnosis of sucrase- or lactase-deficiency in children with gastrointestinal symptoms.

## pancreas

Substrates of  $^{13}\text{C}$ -breath tests consisting of **mixed triglycerides** as well as **maize starch** are effective tools for investigating and diagnosing exocrine pancreatic insufficiency, particularly for measuring the therapeutic efficacy of pancreatic enzymes. **Triolein** and **hiolein** as substrates can be applied for investigating pancreatic lipase activity. Further effective substrates of  $^{13}\text{C}$ -breath tests already used for investigating exocrine pancreatic function are **maize oil, soy oil, trioctanoyl glycerol, distearoyl octanoyl glycerol, triolein, tripalmitin, trioctanoin and other triglycerides**.

## liver

**Methacetin** and **aminopyrin** are suitable substrates of  $^{13}\text{C}$ -breath tests for diagnosing liver diseases, for testing the demethylation and decarboxylation function of the liver and studying hepatic microsomal biotransformation.

Alcoholic hepatic steatosis can be diagnosed using **keto-isocaproic acid** as a substrate, while aldehyde dehydrogenase deficiency can be diagnosed by the  $^{13}\text{C}$ -**ethanol** as well as the  $^{13}\text{C}$ -**acetate** breath test.

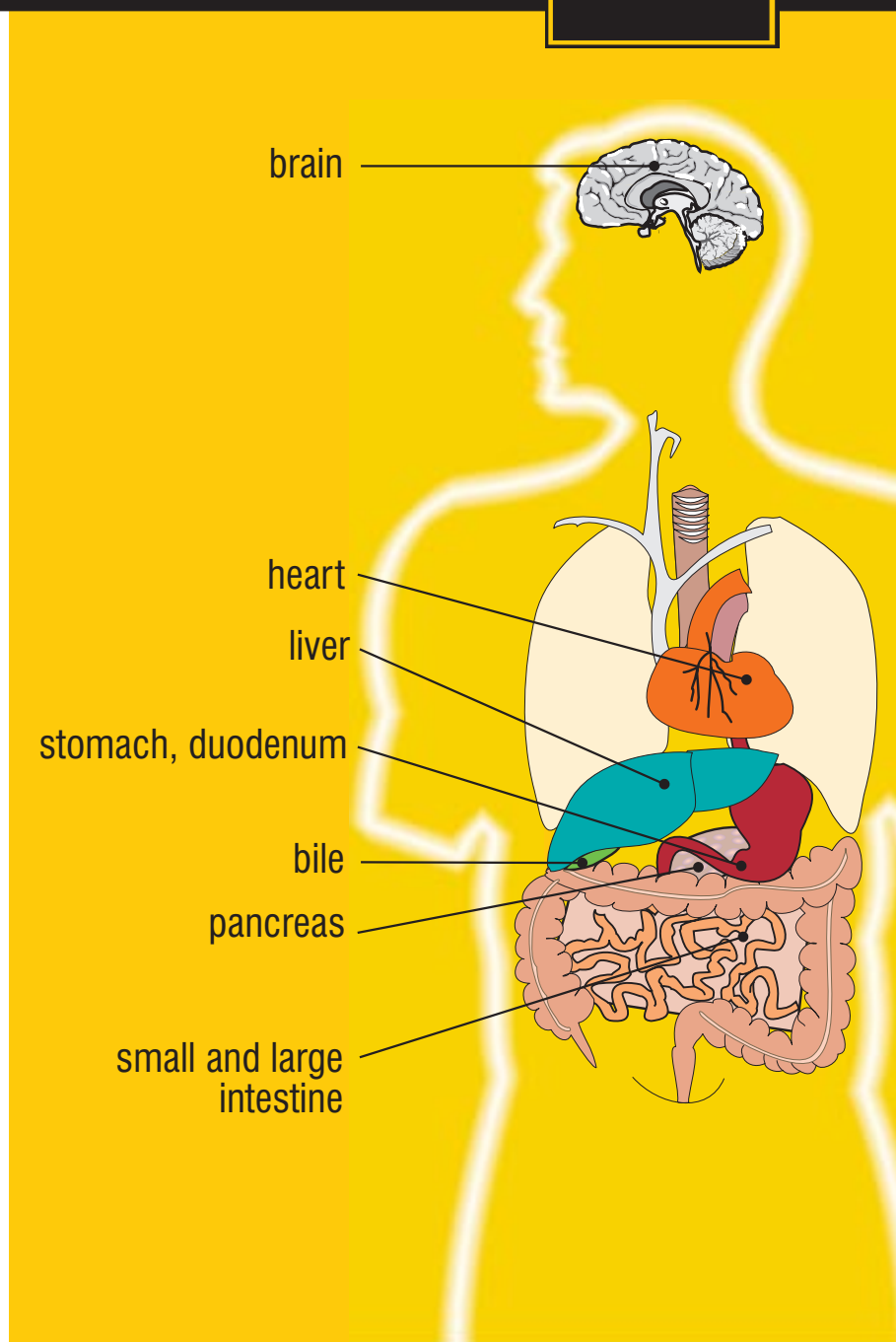
Enterohepatic circulation of bile acids can be studied by the  $^{13}\text{C}$ -**glycocholic acid** breath test. Leucine as a substrate has proved to be an effective tool for studying phenylketonurea-diet-therapy. Further substrates of  $^{13}\text{C}$ -breath tests so far applied for studying liver function and microsomal hepatic biotransformation are **methyl caffeine, erythromycin, ethanol, glucose, fructose, maltose, galactose, starch and other glucose polymers** as well as many amino acids and their polymers including **casein, egg white, milk products and algal biomass**.

## small and large intestine

The  $^{13}\text{C}$ -**glycocholic acid** breath test enables diagnosis of intestinal bacterial overgrowth. In connection with the  $\text{H}_2$ -breath test  $^{13}\text{C}$ -**sucrose** or **lactose** breath tests may indicate intestinal bacterial overgrowth. **Lactose ureide** as a substrate is a tool for diagnosing colonic fermentation and coecal retention time.

## heart

Myocardial metabolic studies can be performed using  $^{13}\text{C}$ -labelled **fatty acids** as substrates of  $^{13}\text{C}$ -breath tests.



## brain

The  $^{13}\text{C}$ -**valproic acid** breath test proved to be an effective means of studying epileptic diseases.

presented by: