ERNDIM
QUALITY ASSURANCE IN LABORATORY TESTING FOR IEM

ERNDIM Administration Office
Manchester Centre for Genomic Medicine
6th Floor, St Mary's Hospital, Oxford Road,
Manchester M13 9WL, United Kingdom.
Tel: +44 161 276 6741
Fax: +44 161 850 1145
Email: admin@erndim.org

Lysosomal Enzymes in fibroblasts

Scientific Advisor
Ms Marie Jackson
Biochemical Genetics Laboratory
Viapath Genetics Laboratories,
5th Floor Guys Tower, Guys Hospital,
London SE1 9RT
United Kingdom
Email: Marie.Jackson@viapath.co.uk

Scheme Organiser
Dr. E.A.E. van der Hagen
Queen Beatrix Hospital
MCA Laboratory
P.O. Box 9005
NL – 7100 GG Winterswijk
Netherlands
Email: E.vanderHagen@skbwinterswijk.nl

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1. Scheme Design
The scheme has been designed, planned and coordinated by Ms Marie Jackson (as Scientific Advisor) and Dr Eline van der Hagen as Scheme Organiser (sub-contractor on behalf of MCA Laboratory); appointed by and according to procedures laid down by the ERNDIM Board.

1.1. Sub-contracted activities:
The fibroblasts used as the EQA materials were cultured by Centre de Biotechnologie Cellulaire, CHU de Lyon. The fibroblasts were prepared and aliquoted by MCA Laboratory, Netherlands, which also hosts and manages the results submission website (www.erndimqa.nl) on behalf of ERNDIM.

2. Samples
All EQA materials are lyophilised samples of human fibroblasts. All samples were obtained following local ethical and consent guidelines.

Table 1: Samples included in the EQA scheme

Sample	Disorder	Enzyme Defect	Reporting deadline
LEFB2020.01	Normal control	All enzyme activities normal	26th June 2020
LEFB2020.02	Wolman disease	Lysosomal acid lipase deficiency (LAL-D)	
LEFB2020.03	NCL1	Palmitoyl protein thioesterase deficiency	
LEFB2020.04	Fabry disease	Alpha-galactosidase deficiency	28th August 2020
LEFB2020.05	Gaucher disease	Beta-glucosidase deficiency	
LEFB2020.06	Wolman disease	Lysosomal acid lipase deficiency (LAL-D)	

3. Shipment
One shipment of six samples was dispatched 11th February 2020, to the 73 laboratories, from 30 countries, which registered for the scheme.

4. Receipt of results
There were two submission deadlines for the 2020 scheme: (LEFB2020.01, 02 & 03 on 26th June) and (LEFB2020.04, 05 & 06 on 28thAugust).

Laboratories were asked to submit results for each EQA sample by the relevant submission deadline using the results website www.erndimqa.nl. All submitted results are treated as confidential information and are only shared with ERNDIM approved persons for the purposes of evaluation and reporting.

Laboratories were asked to report the total protein in mg/vial and the activities for 10 enzymes in:

- Absolute units
- As the percentage of activity in sample *LEFB 01*.

See Table 2 for details. Laboratories could submit results for as many, or as few, of these 10 enzymes as they wished and were asked to select an 'interpretation' of the results from a dropdown list on the results website.

[1] **If this Annual Report is not Version 1 for this scheme year, go to APPENDIX 2 (page 15) for details of the changes made since the last version of this document.**

Table 2: Analytes to be measured

Analyte	Parameter 1	Parameter 2
Protein	mg/vial	-
α -Galactosidase	nmol/h/mg protein	% of sample LEFB 01
α -N-acetylglucosaminidase	nmol/h/mg protein	% of sample LEFB 01
β -Galactosidase	nmol/h/mg protein	% of sample LEFB 01
α -Glucosidase	nmol/h/mg protein	% of sample LEFB 01
β -Glucosidase	nmol/h/mg protein	% of sample LEFB 01
Arylsulphatase A	nmol/h/mg protein	% of sample LEFB 01
Lysosomal acid lipase (LAL)	nmol/h/mg protein	% of sample LEFB 01
Palmitoyl protein thioesterase	nmol/h/mg protein	% of sample LEFB 01
beta-Glucuronidase	nmol/h/mg protein	% of sample LEFB 01
Galactosylceramidase	nmol/17h/mg protein	% of sample LEFB 01

5. Reports

All data-transfer, the submission of data as well as request and viewing of reports is via the interactive website www.erndimqa.nl which can also be reached through the ERNDIM website (www.erndim.org). The results of each laboratory are confidential and only accessible by password protected laboratory accounts. The anonymised mean results of all labs are accessible to all participants. Statistics of the respective reports are explained in the general information section of the website.

Short-term reports on the six individual specimens are available two weeks after the submission deadline and provide up-to-date information on analytical performance. Although it is technically possible to produce reports immediately there is a delay of 14 days to enable the scientific advisor to inspect the results and add comments to the report when appropriate.

A second important characteristic of the website is the different levels of detail of results which allows individual laboratories the choice of fully detailed and/or summarised reports.

The “Analyte in Detail” is the most detailed report and shows the results of a specific analyte in a specific sample. Thus for the 10 enzymes in the year 2020 cycle, 6 x 10 (60) such Analyte-in-Detail-reports can be requested.

The “Cycle Review” summarises the performance for all enzymes in a specific sample (6 such Cycle Reviews can be requested in 2020).

6. Scoring scheme and Poor performance policy

It was approved by the Scientific Advisory Board at their meeting in November 2019 that scoring of interpretation would be formally introduced for the 2020 scheme.

For the 2020 Scheme the %CV for each enzyme will be provided as participants indicated that they find this information useful. However, this will **not** continue after 2020; also please note the % CV for each enzyme will not be scored for the 2020 scheme.

If the interpretation of a result is incorrect for a specific enzyme a performance support letter may be issued, but only **for that particular enzyme assay**. This is to initiate a dialogue between us, the EQA scheme advisor/organiser and you, the participating laboratory, in order to solve any particular analytical problems and to help you improve performance.

***Comments box*:** Participant comments may be taken into account by the Scientific Advisor. Please use this box to note any issues noted regarding the sample or assay, or to note further relevant information.

The **diagnostic proficiency** was scored for each enzyme: i.e. is the interpretation correct or incorrect. One point was awarded for a correct diagnosis.

For the protein value a maximum of 2 points could be scored depending on the %CV.

Table 3: Scoring criteria

	Criteria		Score
Protein	**CV**	CV<35%	2
		CV= 35%<CV<60%	1
		CV>60%	0
Enzymes	**Diagnosis**	Diagnosis correct	1
		Diagnosis incorrect	0
	CV	Not scored from 2020	

Laboratories could participate in as many of the ten enzymes offered in the scheme plus the protein assay as required. Each enzyme is assessed individually, the emphasis being on the correct interpretation of the result. Making the correct interpretation / diagnosis for each enzyme/ sample is the priority: i.e. identifying a deficiency in an affected patient and reporting normal activity in unaffected samples.

If a laboratory misinterprets a result then a performance support letter is sent relating to **that specific enzyme only**. The letter is intended to instigate dialogue between the EQA Scientific Advisor and the participating laboratory in order to solve any particular analytical problems in order to improve quality of performance of labs in the pursuit of our overall aim to improve quality of diagnostic services in this field.

6.1. Diagnosis

The participants must select an interpretation from the dropdown list on the results website.

Diagnosis correct: correct interpretation and correct measurement of enzyme activity level.

Diagnosis incorrect: incorrect interpretation and incorrect enzyme activity level.

6.2. Coefficient of variation

Results submitted for samples 2020.02 and 2020.06 were used to calculate the coefficient of variation (CV) according to the following formula: *CV = Activity LF6-activity LF2/mean.*

From 2020 these results will **not** contribute to the scoring in this scheme.

NB: For laboratory information only these are quoted in the results (Appendix 1)

6.3. Appeals

If your laboratory has been sent a performance support letter for the 2020 scheme and you wish to appeal against this classification please email the ERNDIM Administration Office (admin@erndim.org)), with full details of the reason for your appeal, within one month receiving your Performance Support Letter.

7. Results

Seventy-three laboratories were registered in the 2020 scheme. Sixty-five laboratories (89% of registered laboratories) submitted sufficient results for their performance to be assessed.

Four laboratories (5.5% of registered laboratories) did not submit enough results for their performance to be assessed.

Four laboratories did not submit any results, of which two were educational participants (5.5% of registered laboratories)

Table 4: Results returns for the 2020 scheme

	Submission Deadline					
	26th June 2020			28th August, 2020		
Sample Numbers:	**2020.01**	**2020.02**	**2020.03**	**2020.04**	**2020.05**	**2020.06**
No. of labs that submitted results:						
By the submission deadline	68 *(93.2%)*	68 *(93.2%)*	68 *(93.2%)*	68 *(93.2%)*	68 *(93.2%)*	68 *(93.2%)*
Within 7 days of the submission deadline	1 *(1.4%)*	1 *(1.4%)*	1 *(1.4%)*	0	0	0
Within 2 weeks of the submission deadline	0	0	0	0	0	0
Did not submit	4 *(5.5%)*	4 *(5.5%)*	4 *(5.5%)*	5 *(6.8%)*	5 *(6.8%)*	5 *(6.8%)*

The results for each sample were published on the results website 14 days after the relevant submission deadline.

Full details of the results for each participant's results (for labs that submitted results) are given in Appendix 1 but summaries are presented here:

- 86% of all laboratories submitted results for 5 or more enzymes, see Table 5.
- The proficiency per analyte is given in Table 6.
- Reproducibility of enzyme assays was good for the majority of participants as indicated by the % achieving CV<35.
- The majority of participants made the correct interpretation.
- **83.1% of laboratories achieved >90% of their maximum possible score (i.e. of enzymes plus proteins). See Table 7 which shows the percentage of the maximum possible score for the laboratories that submitted results.**

Table 5: Number of enzymes for which laboratories submitted results (excluding non/partial submitters)

Number of Enzymes for which results were submitted	Number of laboratories
0	0
1	0
2	3
3	1
4	5
5	5
6	5
7	9
8	6
9	13
10	18
Total number of labs	**65**

Table 6: Proficiency per analyte

Analyte	No of returns	Participants with CV < 35	Correct interpretation* (diagnostic proficiency)
Protein	64	89.6%	n/a
α -Galactosidase	62	91.9%	90.3%
β -Galactosidase	61	83.6%	98.4%
α -Glucosidase	52	84.6%	100%
β -Glucosidase	63	95.2%	98.4%
α-N-acetylglucosaminidase	45	88.9%	100%
Palmitoyl protein thioesterase	34	73.5%	100%
β-glucuronidase	51	92.2%	100%
Galactosylceramidase	41	75.6%	100%
Arylsulphatase A	59	86.4%	98.3%
Lysosomal acid lipase (LAL)	35	94.3%	94.3%

*** = percentage of maximum possible score (for laboratories that submitted results)**

Table 7: Percentage of maximum possible scores for laboratories that submitted results (excluding partial submitters)

%age of maximum possible score	No of submitting labs	%age of submitting labs
0% – 9%	0	0%
10% – 19%	0	0%
20% – 29%	0	0%
30% –39%	0	0%
40% – 49%	0	0%
50% –59%	1	1.5%
60% –69%	0	0%
70% –79%	1	1.5%
80% –89%	9	13.8%
90% –99%	8	12.3%
100%	46	70.8%
Total	**65**	**100%**

Table 8: Number of enzymes for which submitting laboratories had satisfactory performance

Anon. Lab No	No of enzymes for which: results were submitted by lab	No of enzymes for which: lab had satisfactory performance
1	8	8
2	7	7
3	8	7
4	8	8
5	9	9
6	8	7
7	9	9
8	6	0 (partial submitter
9	9	7
10	8	8
11	9	9
12	10	10
13	10	10
14	5	5
15	10	9
16	2	2
17	10	10
18	4	0 (partial submitter
19	10	10
20	6	6
21	10	9
22	10	10
23	6	6
24	10	10
25	8	7
26	4	4
27	2	2
28	10	10
29	10	10
30	10	10
31	4	4
32	10	10
33	3	3
34	9	9
35	8	8
36	10	10
37	9	9
38	10	10
39	6	6
40	10	10
41	5	5
42	9	9
43	10	9
44	6	6
45	9	9
46	9	9
47	4	4
48	10	10
49	7	7
50	9	8
51	10	10
52	5	5
53	5	5
54	7	7
55	10	10
56	6	5
57	4	0 (partial submitter)
58	4	4
59	2	1
60	10	10
61	9	9
62	7	7
63	6	6
64	10	9
65	9	9
66	7	7
67	7	0 (partial submitter)
68	5	4
69	8	8

8. Certificates of Participation

As for other schemes, the performance for this scheme is summarised in the annual Certificate of participation. The certificate lists the total number of enzymes in the scheme, the number for which results have been submitted and the number for which satisfactory performance has been achieved. It is important to bear in mind that the certificate has to be backed up by the laboratory's individual on-line reports in the case of internal or external auditing.

9. Comments on Overall Scheme Performance.

The majority of participants made the correct interpretation: that is, the correct enzyme deficiency was observed in the samples from affected patients and normal activity was observed in the unaffected samples.

Further information on the affected samples provided for testing can be found in Table 9 below.

Table 9: Cultured fibroblast samples included in the EQA scheme:

Sample	Diagnosis & enzyme deficiency	Age at diagnosis	Clinical information	Other information
LEFB2020.01	Normal control *All enzyme activities normal*			All 10 enzymes in 2020 scheme were assayed prior to distribution and confirmed to have normal levels of enzyme activity
LEFB2020.02	Wolman disease *Lysosomal acid lipase (LAL) deficiency*	Female aged 2months	Parents consanguineous, hepatomegaly noted at 2 months, cytological abnormalities of blood cells, thrombocytopenia, abnormal liver function (anicteric cholestasis, cytolysis, hepatic failure) hyperlipidaemia, bilateral adrenal calcification, vacuolated cells in medullogram	
LEFB2020.03	NCL1 (infantile neuronal ceroid lipofuscinosis) *Palmitoyl protein thioesterase deficiency*	Female aged 56 years	Dementia, extrapyramidal syndrome, blindness/bilateral optic neuropathy and visual hallucinations.	Arylsulphatase A noted to have low activity in addition to deficiency of PPT (when validating enzyme activities for scheme). Probable ASA pseudodeficiency? ,
LEFB2020.04	Fabry disease *α-galactosidase deficiency*	Male aged 28 years	No clinical information available	
LEFB2020.05	Gaucher disease *β-glucosidase deficiency*	Female aged 2 years	Hepatosplenomegaly, hypochromic anaemia, bone marrow abnormality, mental retardation, muscle hypotonia, strabismus.	
LEFB2020.06	Wolman disease *Lysosomal acid lipase (LAL) deficiency*	35 years		**Duplicate sample of LEFB2020:02** (for calculation of %CV data)

LEFB 01 was included as a control to enable an improved comparison of overall results from all participants, and to include laboratories that do not use fibroblasts.

Participants were asked to express enzyme results as a percentage of sample LEFB 01: all participants must enter this data correctly.

LEFB 02 & 06 were duplicates of a sample affected with Wolman's; Lysosomal Acid Lipase (LAL) deficiency. These duplicate results were also used to calculate the % CV data.

LEFB 03 was a patient affected with **infantile neuronal ceroid lipofuscinosis (NCL1): palmitoyl protein thioesterase deficiency.** Fewer laboratories participated in this enzyme but 100% provided the correct diagnosis.

Seven participants who did not assay palmitoyl protein thioesterase entered results for this sample as being a potential arylsulphatase A (ASA) deficiency.

Three of these laboratories mentioned this could possibly be due to a pseudodeficiency for ASA (PDASA) and that further investigations should be carried out.

These seven laboratories were still recorded as good performers for this enzyme, as this was a genuine observation.

Note: Individuals with pseudodeficiency of arylsulphatase A can have results in the affected range, but are otherwise unaffected with metachromatic leucodystrophy (MLD). Abnormal results can be confirmed by looking for the presence of sulphatides in the urine and/or DNA testing to check for the presence of the pseudodeficiency variant.

Table 10: Arylsulphatase A levels in sample LEFB2020.03

Laboratory	% of LEFB2020.01	Substrate used	Comment
1	31%	colorimetric	PDASA
2	12%	colorimetric	none
3	18%	colorimetric	none
4	19%	colorimetric	none
5	9%	fluorometric	PDASA
6	15%	colorimetric	Suspect MLD
7	12%	colorimetric	none

LEFB 04 was a patient with an alpha-galactosidase deficiency (Fabry disease). Sixty-two laboratories entered results for this enzyme test; fifty-six of these participants entered the correct diagnosis (90.3%).

LEFB 05 was a patient with a beta-glucosidase deficiency (Gaucher disease). Most laboratories offer this enzyme test and had no problems achieving the correct diagnosis (98.4%).

However, thirteen laboratories who did not participate for the assay lysosomal acid lipase (LAL) noted low levels of beta glucosidase in one or both of samples 2020: 02 and 2020:06. This seemed to provide complications in making an interpretation for these participants, and samples 2020.02 and /or 2020.06 were indicated as being an affected patient.

As the correct diagnosis was made in the affected Gaucher patient (*ERN 2020:05*) these laboratories are still recorded as good performers for this enzyme.

Table 11: variable beta-glucosidase levels submitted by participants who did not assay lysosomal acid lipase (LAL)

Laboratory	*LEFB2020:02*	*LEFB2020:05*	*LEFB2020:06*
1	26%	8%	44%
2	31%	8%	41%
3	31%	5%	11%
4	33%	5%	26%
5	22%	10%	35%
6	38%	4%	19%
7	45%	15%	87%
8	35%	7%	37%
9	30%	5%	60%
10	31%	6%	28%
11	48%	8%	38%
12	38%	27%	97%
13	26%	8%	43%

Substrates used by participants

Overall, the majority of participants use fluorimetric substrates in their laboratories (the exception being arylsulphatase A): see Table 12 below.

Table 12: Substrates used

Enzyme	Colorimetric	Fluorimetric	Radiolabelled	MS/MS	Other
Alpha-galactosidase A	1.5%	93.8%			4.7%
Alpha-glucosidase	3.8%	88.7%		1.8%	5.7%
Arylsulphatase A	78.7%	18%			3.3%
Beta-galactosidase	3.2%	93.6%			3.2%
Beta-glucosidase		93.9%		1.5%	4.6%
Galactosylceramidase	2.3%	83.7%	7%	2.3%	4.7%
Beta glucuronidase	1.9%	92.3%			5.8%
Lysosomal acid lipase (LAL/ acid esterase)	19.4%	69.4%	5.6%		5.6%
Palmitoyl protein thioesterase (PPT)	2.9%	94.2%			2.9%
Alpha-NAc-glucosaminidase	6.5%	89%			4.5%

10. Preview of the scheme in 2021.

a) There will be two submission deadlines for the 2020 scheme:
- Samples 01, 02 & 03 to be submitted by 28 June 2021
- Samples 04, 05 & 06 to be submitted by 27 August 2021

b) **Some changes have been made to the enzymes included in the 2021 LEFB scheme: see Table 13 below for comparison. For purposes of laboratory accreditation there is an increasing demand for the inclusion of further & different enzymes in the scheme. In order to address this requirement, it is intended that ERNDIM continue to provide regular rotation of the enzymes included each year.**

Table 13: Analytes to be measured in 2021

Analyte	2018	2019	2020	2021
Protein	✓	✓	✓	✓
α -Galactosidase	✓	✓	✓	✓
Galactose-6-sulphate sulphatase	✓	×	×	×
β -Galactosidase	✓	✓	✓	✓
α -Glucosidase	✓	✓	✓	✓
β -Glucosidase	✓	✓	✓	✓
β -glucuronidase	×	×	✓	×
β -Hexosaminidase A	✓	×	×	✓
β -Hexosaminidase A+B	✓	×	×	✓
α-fucosidase	×	×	×	✓
α-mannosidase	×	×	×	✓
α -Iduronidase	✓	×	×	×
Galactosylceramidase	✓	✓	✓	×
Sphingomyelinase	✓	×	×	✓
Arylsulphatase A	×	✓	✓	×
Arylsulphatase B	×	×	×	✓
Iduronate-sulphatase	×	✓	×	×
α-N-Ac-glucosaminidase	×	×	✓	×
Lysosomal acid lipase (LAL/acid/esterase)	×	✓	✓	×
Palmitoyl protein thioesterase	×	✓	✓	×
Tripeptidyl peptidase	×	✓	×	×

11. Questions, Comments and Suggestions

If you have any questions, comments or suggestions in addition to specific user comments please address these to the either the ERNDIM Administration Office (admin@erndim.org), the scientific advisor of the scheme, Ms Marie Jackson, (Marie.Jackson@viapath.co.uk) or the scheme organiser Dr Eline van der Hagen (E.vanderHagen@skbwinterswijk.nl).

12. Confidentiality Statement

This annual report is intended for participants of the ERNDIM Lysosomal Enzymes in fibroblasts scheme. The contents should not be used for any publication without the permission of the Scientific Advisor and Administration Office.

Marie Jackson
Scientific Advisor

APPENDIX 1. **Results per laboratory (part 1)**

(see page 11 for key)

Anon. Lab No	Protein/vial		LAL		α-Galactosidase		β-Galactosidase	
		Score		Score		Score		Score
	CV	CV	CV	Diagnosis	CV	Diagnosis	%CV	Diagnosis
1	33	1			11	1	10	1
2	3	2			7	1	34	1
3	0	2			5	1	7	1
4	4	2	1	1	17	1	1	1
5	9	2			8	1	4	1
6	0	2			19	1	4	1
7	64	0	0	1	29	1	40	1
8		0 (PS)		0(PS)		0 (PS)		0 (PS)
9	14	2	40	0	18	1	178	0
10	4	2	0	1	5	1	14	1
11	24	2			2	1	13	1
12	18	2	0	1	11	1	22	1
13	5	2	5	1	6	1	19	1
14	9	2			4	1	3	1
15	9	2	0	1	7	0	47	1
16	42	1						
17	R0	0	1	1	48	1	31	1
18	7	2				0 (PS)		0 (PS)
19	66	0	4	1	4	1	30	1
20	18	2			1	1	17	1
21	22	2	28	0	10	1	26	1
22	9	2	1	1	2	1	3	1
23	0	2	24	1	21	1	3	1
24	R0	0	2	1	16	1	17	1
25	0	2			0	0	7	1
26	4	2			4	1		
27	7	2			21	1		
28	10	2	3	1	0	1	6	1
29	4	2	6	1	6	1	2	1
30	0	2	0	1	3	1	9	1
31	9	2			3	1	33	1
32	R0	0	12	1	11	1	15	1
33	16	2			14	1	1	1
34	7	2	1	1	6	1	45	1
35	0	2	4	1	3	1	17	1
36	8	2	0	1	2	1	4	1
37	14	2	1	1	8	1	62	1
38	12	2	1	1	4	1	5	1
39	3	2	1	1	11	1	18	1
40	14	2	5	1	21	1	45	1
41	21	2			30	1	10	1
42	12	2			15	1	19	1
43	14	2	0	1	54	0	101	1
44	0	2			6	1	8	1
45	4	2	2	1	15	1	10	1
46	26	2			10	1	9	1
47	0	2	98	1	7	1	6	1
48	3	2	1	1	1	1	3	1
49	6	2	0	1			6	1
50	2	2	5	1	27	0	2	1

Anon. Lab No	Protein/vial		LAL		α-Galactosidase		β-Galactosidase	
	CV	Score CV	CV	Score Diagnosis	CV	Score Diagnosis	%CV	Score Diagnosis
51	9	2	0	1	7	1	10	1
52	25	2			17	1	12	1
53	32	1			4	1	3	1
54	11	2			77	1	49	1
55	7	2	20	1	38	1	52	1
56	7	2			0	0	4	1
57						0 (PS)		0 (PS)
58	12	2			20	1	1	1
59	60	0						
60	0	2	0	1	29	1	36	1
61	6	2			26	1	20	1
62	6	2	3	1	6	1	26	1
63	15	2			13	1	7	1
64	22	2	4	0	16	1	16	1
65	11	2			11	1	12	1
66	9	2			15	1	18	1
67	11	0 (PS)				0 (PS)		0 (PS)
68	14	2			62	0	11	1
69	0	2			10	1	4	1

Key

green cells = correct interpretation

red cells = incorrect interpretation

R0 = CV calculation not possible as one or both of LF2 and LF6 (duplicate samples) were not measured

PS = partial submitter

APPENDIX 1. Results per laboratory (part 2)

(see page 11 for key)

Anon. Lab No	α-Glucosidase		β-Glucosidase		α-N-Acetyl-glucosaminidase		PPT	
	CV	Score Diagnosis	CV	Score Diagnosis	CV	Score Diagnosis	CV	Score Diagnosis
1			13	1	0	1	13	1
2	25	1	10	1	0	1		
3	31	1	36	0	9	1	6	1
4	5	1	6	1	2	1		
5	11	1	1	1	36	1	5	1
6	1	1	2	1	1	1		
7	16	1	31	1	5	1		
8				0 (PS)				
9	34	1	7	1	3	1		
10	0	1	1	1	14	1		
11	35	1	7	1	8	1	36	1
12	17	1	4	1	3	1	0	1
13	28	1	15	1	15	1	23	1
14			7	1				
15	4	1	7	1	3	1	16	1
16	4	1	0	1				
17	21	1	4	1	32	1	61	1
18				0 (PS)				
19	22	1	28	1	16	1	20	1
20	30	1	17	1				
21	36	1	4	1	7	1	16	1
22	3	1	2	1	3	1	2	1
23	7	1	11	1				
24	22	1	0	1	69	1	35	1
25	9	1	3	1	1	1	5	1
26	14	1	1	1				
27			19	1				
28	36	1	4	1	4	1	1	1
29	9	1	2	1	10	1	15	1
30	6	1	1	1	0	1	7	1
31			5	1				
32	30	1	3	1	52	1	48	1
33								
34	19	1	4	1	124	1		
35	18	1	2	1			29	1
36	1	1	1	1	5	1	3	1
37	13	1	2	1	29	1		
38	9	1	1	1	0	1	3	1
39	14	1	0	1				
40	49	1	21	1	12	1	60	1
41	6	1	59	1				
42	14	1	5	1	5	1	25	1
43	75	1	11	1	20	1	94	1
44	2	1	7	1	0	1		
45	30	1	3	1	17	1	32	1
46	8	1	11	1	5	1	14	1
47								
48	2	1	3	1	3	1	6	1
49			11	1	6	1	35	1
50			7	1	8	1	14	1

Anon. Lab No	α-Glucosidase		β-Glucosidase		α-N-Acetyl-glucosaminidase		PPT	
	CV	Score Diagnosis	CV	Score Diagnosis	CV	Score Diagnosis	CV	Score Diagnosis
51	7	1	5	1	2	1	19	1
52	5	1	20	1				
53			7	1				
54			3	1	26	1		
55	7	1	12	1	10	1	1	1
56			3	1	4	1		
57				0 (PS)				
58			10	1				
59			20	1				
60	42	1	142	1	131	1	47	1
61	14	1	18	1	2	1	130	1
62	15	1	9	1				
63	1	1	3	1				
64	11	1	5	1	9	1	19	1
65	1	1	2	1	14	1	2	1
66	44	1	14	1				
67		0 (PS)		0 (PS)				0 (PS)
68	41	1	19	1				
69	10	1	8	1	8	1		

APPENDIX 1. **Results per laboratory (part 3)**

(see page 11 for key)

Anon. Lab No	β-glucuronidase		Galactocerebrosidase		Arylsulphatase A	
	CV	Score Diagnosis	CV	Score Diagnosis	CV	Score Diagnosis
1	1	1	8	1	2	1
2	1	1			1	1
3	5	1			5	1
4	2	1			7	1
5	2	1	4	1	1	1
6	14	1	41	1	54	0
7	2	1	19	1	10	1
8		0 (PS)				0 (PS)
9	12	1	0	1	33	1
10	5	1			4	1
11	216	1	R0	1	9	1
12	9	1	24	1	11	1
13	1	1	7	1	0	1
14			42	1	1	1
15	24	1	2	1	27	1
16						
17	6	1	4	1	11	1
18						0 (PS)
19	0	1	37	1	7	1
20	1	1			24	1
21	4	1	6	1	19	1
22	3	1	0	1	6	1
23					43	1
24	12	1	539	1	R0	1
25	9	1			7	1
26	3	1				
27						
28	13	1	13	1	5	1
29	11	1	16	1	42	1
30	5	1	1	1	12	1
31					114	1
32	12	1	0	1	17	1
33					2	1
34	38	1	3	1	44	1
35	2	1			4	1
36	4	1	12	1	2	1
37	5	1	33	1	84	1
38	3	1	14	1	2	1
39			9	1		
40	7	1	45	1	25	1
41					7	1
42	4	1	55	1	9	1
43	40	1	30	1	23	1
44	29	1				
45	9	1			15	1
46	15	1	25	1	5	1
47					1	1
48	6	1	5	1	3	1
49	0	1			5	1
50	6	1	2	1	5	1
51	0	1	2	1	1	1

Anon. Lab No	β-glucuronidase		Galactocerebrosidase		Arylsulphatase A	
	CV	Score Diagnosis	CV	Score Diagnosis	CV	Score Diagnosis
52			7	1		
53	13	1			14	1
54	21	1	73	1	6	1
55	64	1	45	1	69	1
56	4	1			4	1
57						0 (PS)
58					1	1
59					4	1
60	33	1	25	1	24	1
61	15	1	34	1	11	1
62			0	1	9	1
63	10	1			21	1
64	12	1	19	1	1	1
65	5	1	14	1	2	1
66	8	1	98	1	20	1
67		0 (PS)				0 (PS)
68					2	1
69	10	1	10	1	3	1

APPENDIX 2. Change log (changes since the last version)

Version Number	Published	Amendments
1	18 February 2021	• 2021 annual report published
2	28 April 2021	• Page 5, table 8: Lab 21, number of satisfactory enzymes changed from 10 to 9 • Page 10, Appendix 1: Lab 21, colour for LAL CV changed from green to red
3	17 May 2021	• Page 10, Appendix 1: Lab 21, diagnosis score for LAL CV changed from 1 to 0

END OF REPORT