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NUVetNA
Nottingham University Veterinary Nutritional Analysis

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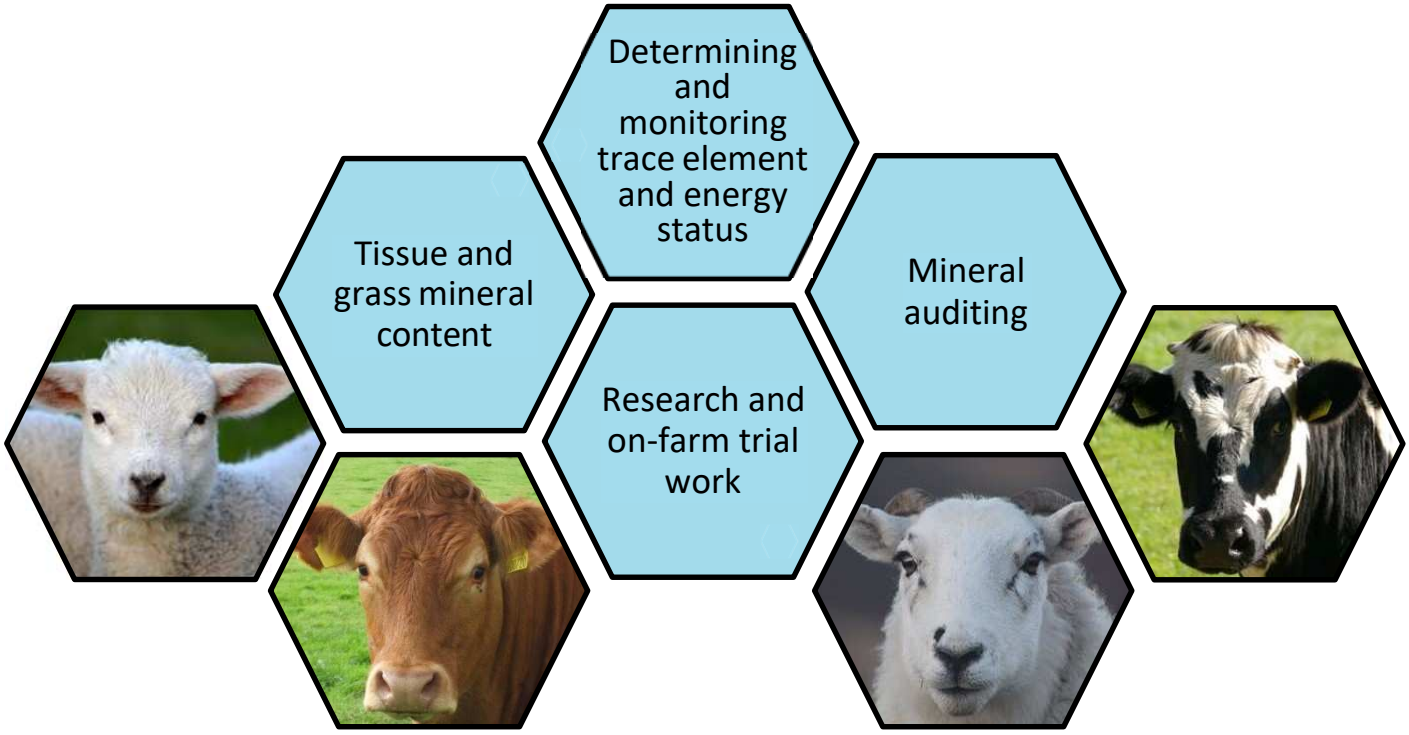
Providing
Nutritional laboratory support
for:



Evidence to enable decisions and determine risk

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Contents

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Background

NUVetNA was founded in 2006 by Dr Nigel Kendall at the newly formed School of Veterinary Medicine and Science, University of Nottingham. The laboratory service utilises his in-depth knowledge of mineral nutrition and livestock production to offer animal health professionals a range of services.

NUVetNA has now grown from a blood basic trace element service to offer a much wider range of analysis including mineral analysis of tissues, urine, water, feed and forage as well as blood energy, protein and liver metabolite packages.

These analyses provide results which give quality information about the mineral status of livestock and the feed, forage and even water inputs. Results are provided for animal health professionals to interpret on farm using the on-farm information including actually looking at the animals. Remote interpretation misses this key point. It allows informed treatment plans for the animal production cycle to be devised incorporating seasonal risk awareness and enabling proactive prevention of conditions rather than diagnosing them when production and profits have already suffered.

Whilst NUVetNA is a specialist laboratory analytical service, routinely analysing samples from cattle, sheep and goats, we also have experience in analysing samples from a much wider range of animals including deer, horses, llamas and alpacas, chicken and ducks and zoo animals.

As well as providing commercial analysis services, the laboratory also supports Dr Kendall's research group. The group have carried out work investigating the sample numbers required for nutritional analysis, the seasonality of trace elements in grazing and the liver mineral status of UK cattle and sheep. The mineral composition of trees, use of willow to supply cobalt requirements for weaned lambs and duration of effective selenium and cobalt supplementation from drenches have been amongst the more recent work. The relationship between the research and commercial analysis allows both to flourish and also informs the teaching of students at Nottingham. We are always open to supporting research and case studies of mutual interest that are to be published.



Why use an integrated service?

Poor production and productivity in livestock can be multifactorial and all areas should be considered when investigating animal health. On farm management is key in making sure that enough food is available, and this food has enough quality or is supplemented appropriately to meet macronutrient requirements. Trace elements along with parasitism and animal health (infection and disease status) are the major causes of poor production in grazing, and even housed, ruminants, once lack of feed (total grazing dry matter, energy, protein) and an adequate potable water sources have been confirmed.

To promote the best health and production, mineral status needs to be optimum. Trace elements require a balanced approach and giving more when you have already achieved adequate status is not only wasteful in terms of cost but also could prove detrimental to animal health and production, hence the importance of being able to determine mineral trace element status.

Understanding:

Macro and micro supplementation of livestock should always be approached by first considering the balance by comparing the daily intakes to the requirements of the animals to meet target production responses. Then we need to check that the animals are able to fully utilise the intakes to maintain an appropriate status within tissues (blood, liver etc). NUVetNA's range of services are offered to gain an awareness of all inputs (feed, forage and water) as well as livestock status (bloods, liver and urine). Gaining an understanding of the whole system will enable balanced recommendations, eliminate waste and protect against over supplementation which can even lead to death of stock.

Outcome:

Long term planning across the production cycle with a cycle of monitoring inputs, animal status and utilising targeted supplementation and/or changes in management to correct issues with continued check monitoring should lead to increased profit.

Blood trace element and metabolite analysis

Blood trace element and metabolite analysis allows for routine monitoring of animal status to indicate when diet is not optimum and generally reveals and short to medium term imbalances.

We offer 2 trace element packages which analyse the nutritionally relevant trace minerals. There are also a wide range of options for assessing additional nutritional status including energy, protein and liver function profiles and a selection of individual analytes including macro-minerals.

Please note: multiple tests can be carried out on the same sample. It is not necessary to submit a separate tube for each test.

Trace elements

Our blood trace element packages contain a panel of tests combined to give you an indication of the current copper and selenium status of the animals as well as the plasma zinc and cobalt concentrations, and basic haematology parameters. We also offer a package including plasma inorganic iodine for Iodine supply.

Tests included in the trace element package are:

Copper status: plasma copper concentration (PlCu), erythrocyte superoxide dismutase activity (SOD) serum caeruloplasmin activity (CP) and CP:PlCu ratio
Selenium status: plasma selenium (PlSe) and erythrocyte glutathione peroxidase activity (GSHPx)

Other minerals: plasma zinc (PlZn) and plasma cobalt (PlCo)

General haematology parameters: haemoglobin concentration (Hgb) and packed cell volume/haematocrit (HCT)

Additional:
Iodine supply: Plasma Inorganic Iodine concentration (PII)

The blood trace element profile requires a heparinised plasma tube (green top) **and** a serum tube (red top) however, not SST (serum separator/gel tube).
***Please note**: Plasma must not be separated prior to submission.*

Plasma Inorganic Iodine (PII)

Test included:

Plasma Inorganic Iodine concentration

The test requires a heparinised plasma tube (green top) or a serum tube (red top)

We can run this on pooled samples but need clear pooling instructions and there is a pooling fee of £3.

Vitamin B12

Test included:

Vitamin B12 concentration.

The vitamin B12 test requires a heparinised plasma tube (green top) **or** a serum tube (red top).

Energy

Tests included in the energy package are:

NEFA, BHB, Urea.

The energy profile requires a serum tube (red top).

Protein

Tests included in the protein package are:

Urea, Total Protein, Albumin and Globulin (by difference).

The protein profile requires a serum tube (red top).

Combined energy and protein

Tests included in the combined energy and protein package are:

NEFA, BHB, Urea, Total Protein, Albumin and Globulin (by difference).

The combined energy and protein profile requires a serum tube (red top).

Liver function

Tests included in the liver function package are:

GGT, AST, GLDH, T-bilirubin.

The liver function profile requires a serum tube (red top).

Individual analytes

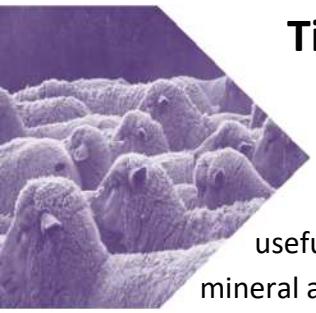
Individual analytes can be requested singly or added to the above packages.

Analytes include**:**

NEFA, GLDH, CK, T-Bilirubin, Na, K, Total Protein, Albumin, Urea, AST, GGT, ALP, ALT, Ca, Mg, P, Cl, Glucose, Creatinine, BHB.

Note: Other analytes may be available upon request

The individual analytes all require a serum tube (red top) apart from glucose which requires a sample collected in a fluoride tube (grey top).



Tissue mineral and iodine analysis

Liver/ kidney mineral analysis

Tissue minerals are a good indicator of long-term status and can be especially useful for monitoring accumulation which is potentially harmful for the animal. Tissue mineral analysis is primarily used as a herd monitoring tool.

Elements included in the tissue mineral package are:
Cu, Mn, Se and Co.
Other elements are analysed and can be added to the package on request (e.g. **Pb, As, Mo, Zn and Fe**). These are charged per request, not per element.

Analysis can be run in **singleton** or **duplicate**. Both tests can be run on the same sample. Singleton analysis is appropriate where there is sufficient biological replication from the number of animals analysed and where results are to be used on a herd basis. For individual or small group numbers (<4 per management group) then duplicated analysis is recommended.

Tissue analysis requires a minimum of 0.6g (ideally around 1g) of biopsied liver or 5-50g of slaughter recovered/trauma cull liver and samples may be frozen prior to dispatch to allow for batching for analysis. Samples should be fresh or frozen NOT fixed (fixed samples can not be run).

Thyroid iodine analysis

The thyroid actively stores iodine and therefore thyroid tissue iodine analysis can be used as an indicator of iodine status.

Elements included in the urine iodine package are:
Iodine

Analysis can be run in **singleton** or **duplicate**. Both tests can be run on the same sample. Singleton analysis is appropriate where there is sufficient biological replication from the number of animals analysed and where results are to be used on a herd basis. For individual or small group numbers (<4 per management group) then duplicated analysis is recommended.

Tissue analysis requires a minimum of 0.6g (ideally around 1g) of tissue or a whole thyroid and samples may be frozen prior to dispatch to allow for batching for analysis. Samples should be fresh or frozen NOT fixed (fixed samples can not be run).

Water, grass, forage and feed analysis

Analysing water, grass, forage and feed is essential for monitoring mineral intakes and calculating inputs for dietary formulations. Water is often a forgotten nutrient but is a major dietary component and so should always be considered when looking at mineral intake, especially if the source is not from a mains supply.

Both multi-minerals and iodine can be run on water, grass, feed and forage and can be run in **singleton** and **duplicate**. Both tests can be run on the same sample.
Singleton analysis is appropriate where there is sufficient biological replication eg a number of similar fields/areas (>4) otherwise we would recommend duplicate analysis.

Grass, forage and feed:

Elements included in the multi-mineral package are:
Ca, Mg, P, Na, K, Cl, S, Al, Fe, Mo, Pb, Mn, Zn, Cu, Co, Se, Cd, B

Elements included in the iodine package are:
Iodine

Each sample type only requires around ~50g of fresh/frozen material. Grass, forage and feed samples can be frozen prior to sending to allow for batching. Samples can also be sent pre-dried if iodine analysis is not required. Please use gloves when collecting the samples to avoid contamination.

Water

Elements included in the multi-mineral package are:
Ca, Mg, P, Na, K, Cl, S, Al, Fe, Mo, Pb, Mn, Zn, Cu, Co, Se, Cd, B

Elements included in the iodine package are:
Iodine

Analysis requires a 25ml sample of water taken into a clean tube from mid flow. Water samples can be frozen prior to sending to allow for batching.

Urine analysis

Urine iodine gives an indication of dietary iodine supply similar to plasma inorganic iodine.

Measuring macro-minerals in urine is much more useful in indicating dietary excess (as they increase in urine) or dietary deficiency (as urine levels will be low as the animals try to retain the consumed minerals). Urine macro-minerals also allow you to establish or monitor Dietary Cation Anion Balance (DCAB).

Elements included in the urine macro-mineral package are:
Ca, Mg, P, Na, K, Cl.

Elements included in the urine iodine package are:
Iodine

Both macro-minerals and iodine can be run on water, grass, feed and forage and can be run in **singleton** and **duplicate**. Both tests can be run on the same sample.
Singleton analysis is appropriate where there is sufficient biological replication from the number of animals analysed and where results are to be used on a herd basis. For individual or small group numbers (<4 per management group) then duplicated analysis is recommended.

Urine analysis requires ~ 4ml of clean urine. The same sample of urine can be used for both macro-mineral and iodine analysis. Samples may be frozen prior to dispatching to allow for batching of the samples. Creatinine standardised results are supplied to take account of differential dilutions found in different urine samples.

Please note: *As urine sampling can be tricky in sheep, a harness collection technique has been developed. Please contact us for advice and instructions.*

Trial services

We are always open to supporting case studies of mutual interest that are to be published.

The laboratory will carry out analytical and statistical support for studies as well as advising on study design. We may also be able to carry out certain studies on a contract basis.

Please contact Nigel on 0115 9516447 or NUVetNA@Nottingham.ac.uk to discuss.

Sampling hints and tips

1. It is important that the correct type of tubes are used for each test/profile. Using the wrong type of tubes may affect the results/interpretation of the test. Please use CAT or z tubes (red top) for serum and not serum separator (gel) tubes as these can affect the results.

2. Taking biopsies and urine samples from sheep can be tricky and we can offer advice and guidance to help you take appropriate samples.

3. One of the best ways to monitor herd status in through analysis of abattoir recovered samples or even casualty culls. These will give a good indication of the general status of the herd/flock.

4. For grass/forage/feed ~ 50g is required, however larger amounts can be subsampled in the lab.

5. Make sure grass samples are representative of the grazing of the field. Take multiple small samples at regular intervals avoiding areas or faecal spoil or urine contamination and not too close to troughs, gates or hedges.

6. For conserved forage, try to make the sample as representative as possible. Avoid taking only one sample from one place on the clamp face. Try digging into bales in a few places or across a number of bales.

7. Tissue mineral analysis can NOT be run on fixed samples. Samples can be sent fresh or frozen. Freezing samples is ideal if sending of samples is delayed for any reason, such as an impending bank holiday weekend.

Frequently asked questions

Lab closure over holiday periods

Due to the University closing over holiday periods, the lab is closed each year for 2 weeks over Christmas, from a couple days before Christmas until usually the first Tuesday in the New Year, and over Easter, from good Friday until the following Wednesday. Please contact the lab for exact timings of when we are able to receive samples and when the batches will be run around these periods each year.

Batch analysis

The services are run on a **batch system of analysis**, which currently takes place every **fortnight**. Please contact us if you wish to know batch timings. Results are reported 3-4 days after the commencement of the batch analysis. This means that time from receipt of samples to sending of results is likely to vary from 3 to 19 days, dependent on sample arrival and batch times.

Sample submission

Please submit the samples using the submission proforma supplied. If you do not have one then please e-mail NUVetNA@Nottingham.ac.uk and we will send you one or visit http://www.nottingham.ac.uk/vet/nuvetna to download.

Please make sure the submission proforma is filled in **fully and legibly**. This is crucial for us to be able to process your samples, send you results and bill you efficiently. Results may be delayed if we do not have the appropriate information.

Will I get a written report?

No, the service is run on a non-interpretative basis, therefore there is no report written and results are sent as an PDF by e-mail. However, you will receive guideline values with your results to help with your interpretation. If you are still unsure of interpretation, then we may be able to direct you to appropriate professionals who can interpret results for you. However, we cannot control the terms and conditions of this or be held accountable for what they say.

How should the samples be packaged and sent?

Please make sure your packages conform to current regulations for animal samples (UN 3373, P650) and are labelled as 'Biological specimen' and have the UN3373 sign (summarised on next page with example labels).

Samples should reach the laboratory within 48 hours of dispatch, ideally within 24 hours. We recommend that you use guaranteed next day delivery services. Blood samples over 7 days old will not be viable for processing and hence **will not be processed**.

Summary of packaging instructions (PI650)

All samples sent to the lab must adhere to regulations for packaging of biological substances.

(full information on these regulations can be found at https://www.un3373.com/category-biological-substances/category-b/)

In short

1. Blood tubes or sample containers (primary receptacles) must be well sealed and able to withstand transport without leakage.
2. Absorbent material (cotton wool, paper towel) should surround the blood tubes or sample containers so that it is sufficient to absorb full contents if broken, without any liquid reaching the outer packaging. **Do not** use bubble wrap as it is not absorbent.
3. Blood tubes or sample containers should be individually wrapped and should not be touching during transit.
4. Wrapped blood tubes or sample containers should be sealed into a secondary container (either a bag or pot).
5. If using ice packs in your parcel, please make sure they are not directly touching blood tubes (this can increase haemoloysis). Also we recommend not using liquid based cold packs as these can be punctured in transit which may compromise the samples, submission forms or outer packaging.
6. The completed submission form should be included in a separate bag (in case of leakage).
7. Samples should be packed into outer packaging capable of withstanding transit, labelled with the senders address, lab address and 'biological specimens' and UN3373 logo. (Available to cut out below).

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Price list

Please note: *all prices do not include VAT*

Blood services

Analysis costs include a submission fee per batch of samples and a process cost per sample and then a charge for each package. Individual analytes can be added to packages or preformed separately.

Packages	Cost per animal (ex VAT)
Submission fee: £30	
Processing cost	£3
Trace elements (Cu status, Se status, Zn, Co, Hgb and Hct) **with Plasma Inorganic Iodine (PII)**	£25 £37
Plasma Inorganic Iodine (PII) **samples can be pooled**	£18 (£21 per pool)
Vitamin B12	£12
Energy (NEFA, BHB, urea)	£8
Protein (urea, total protein, albumin, globulin by difference)	£5.50
Combined energy and protein	£13
Liver function (AST, GGT, GLDH, T-bilirubin)	£9
Individual analyte: NEFA	£5
Individual analytes: Tier 1 **GLDH, CK, T-bilirubin, Na, K**	£3 ea
Individual analytes: Tier 2 **Total protein, albumin, Urea, AST, GGT, ALP, ALT, Ca, Mg, inorg P, Cl, glucose, creatinine, BHB**	£2 ea
*** Additional ICP elements (e.g. total phos, Fe, Mn, Ca, Na, Mg, K, Pb)**	£2 per request

** Note: these can only be added to a trace element package. Other elements may be available. Please contact us for more details.*

Urine analysis

Analysis costs include a submission fee per batch of samples and a process cost per sample and then a charge for each package. There will be no submission fee charged on urine analysis when co-submitted with bloods from the same animals at the same time.

Package	Cost per sample (ex VAT)
Submission fee: £15	
Macro-mineral - singleton	£14
Macro-mineral - duplicate	£22
Iodine - singleton	£15
Iodine - duplicate	£25

Tissue analysis

Analysis costs include a submission fee per batch of samples and a process cost per sample and then a charge for each package. There will be no submission fee charged for tissue analysis when tissues co-submitted with bloods from the same animals at the same time. Analysis can only be carried out on fresh or frozen tissue (NOT fixed).

Package	Cost per sample (ex VAT)
Submission fee: £30	
Multi-mineral - singleton	£24
Multi-mineral - duplicate	£34
Additional elements	£2 per request
Iodine - singleton	£24
Iodine - duplicate	£34

Grass, forage and feed analysis

Analysis costs include a submission fee per batch of samples and a process cost per sample and then a charge for each package. There will be no submission fee charged for grass, forage or feed analysis if co-submitted with bloods or tissues at the same time.

Package	Cost per sample (ex VAT)
Submission fee: £30	
Multi-mineral - singleton	£28
Multi-mineral - duplicate	£40
Iodine - singleton	£28
Iodine - duplicate	£40
Multi-mineral + Iodine - singleton	£52.50
Multi-mineral + Iodine - duplicate	£70

Water analysis

Analysis costs include a submission fee per batch of samples and a process cost per sample and then a charge for each package. There will be no submission fee charged for water analysis if co-submitted with bloods, urines, tissues or forage at the same time.

Package	Cost per sample (ex VAT)
Submission fee: £15	
Multi-mineral - singleton	£12
Multi-mineral - duplicate	£22
Iodine - singleton	£15
Iodine - duplicate	£25

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Submission Form
Blood and Urine

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Practice Details	**Sample Information**
Veterinary Surgeon: Vet mobile: Practice Name: Practice Address (for invoicing):	Farm ID:
	Species: bovine/ ovine/ other (please state):
	Sample type: blood/ urine
Post Code: Practice Tel Number:	Sampling date:
Email Addresses (**For Results**):	Posting date:

Select analytical tests required using ✓ For any individual variations, please state in the boxes below.

	Blood analysis packages
	Trace elements
	Trace element + PII
	Energy (NEFA, BHB, urea)
	Protein (urea, TP, Alb, glob)
	Combined energy and protein
	Liver function (GGT, GLDH, AST, T-bil)
	Vitamin B12
	Plasma Inorganic Iodine (PII)

	Urine
	Macro-minerals - singleton
	Macro-minerals - duplicate
	Iodine - singleton
	Iodine - duplicate

	Blood analysis: Individual analytes (in addition to selected package)				
	total protein		GGT		Na
	albumin		AST		K
	urea		GLDH		Cl
	NEFA		T-bil		Ca
	BHB		ALP		Mg
	glucose		ALT		inorg P
	creatinine		CK		

***Note**: additional icp element requests should be included in the individual variations column below.*
Tube requirements for the tests can be found in the service details booklet.

Sample ID	Individual variations	notes	Lab use only
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

For additional samples, please add on the back of the submission form

Lab use only
Laboratory reference: _____
Received date: _____ Processed date: _____ Initial_____

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Submission Form

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Tissue, Grass, Feed and Water

Practice Details	**Sample Information**
Veterinary Surgeon: Vet mobile: Practice Name: Practice Address (for invoicing):	Farm ID: Sample type: tissue/ grass/ feed/ water/ other
Post Code: Practice Tel Number: Email Addresses (**For Results**):	Tissue type and species: Sampling date: Posting date:

Select analytical tests required using ✓ For any individual variations, please state in the boxes below.

Singleton	Duplicate	Sample type	Analysis
		Tissue	Multimineral
		Tissue	Iodine

Singleton	Duplicate	Sample type	Analysis
		Water	Multimineral
		Water	Iodine

Singleton	Duplicate	Sample type	Analysis
		Grass/Forage/Feed	Multimineral
		Grass/Forage/Feed	Iodine

***Please note**: we advise running analysis in duplicate where the number of a sample type is less than 4, and singleton where there are 4 or more.*

Sample ID	Individual Tissue/Sample type	notes	Lab use only
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

For additional samples, please add on the back of the submission form

Lab use only
Laboratory reference: _____
Received date: _____ Processed date: _____ Initial_____

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