



Genetically Engineered Models: Use of a 2D Barcode Mini Tag for Identification of Mice in an Automated Colony Management System

Steve Sansing

Sr. Client Portfolio Manager

Research Models and Services -GEMS



INTRODUCTION

To keep up with the growing complexity of managing GEMS animals, many labs are looking at automated systems to maintain data integrity and efficiency in breeding and generating study cohorts. We have continued to look at various identification methods which help us ensure the correct animals are shipped, mated, and euthanized. We evaluated current identification methods which are available to achieve this level of quality, meet our IACUC standards, and are also cost-effective. Our facilities currently use an Internet Colony Management application ICM™ which drives our colony management and embryology services. This is a web-based application where technicians input data using tablets, RFID, and keypads to manage our breeding operation. In collaboration with RapID Lab, a mini tag was developed to fit our operation needs. This ear tag has a 2D barcode and comes in an assortment of 10 colors. The current size of the mini tag which is 3.5mm enables us to identify a mouse at a minimum d12 pre-weaning. We have incorporated the barcode functionality into our current system and the various colors provide the technicians with a secondary method of identification helping to efficiently identify the correct animal. Integrating this mini-tag into our colony management system has reduced errors and increased efficiency. This presentation will go through the attributes of the RapID Lab mini tag and show how this can be incorporated into a colony management system for mice to fully automate data collection for a breeding operation and maintain the highest level of animal and sample integrity.

OPERATIONAL EXCELLENCE and IDENTIFICATION

Provide superior quality in the marketplace by ensuring clients receive the correct animals for research



Are there identification systems that are efficient to execute and meet our IACUC standards?



What tools are available to achieve this level of quality?



How do we ensure the correct animals are shipped, mated and euthanized?

OPERATIONAL EXCELLENCE and IDENTIFICATION

Provide superior quality in the marketplace by ensuring clients receive the correct animals for research



Are there identification systems that are efficient to execute and meet our IACUC standards?



What tools are available to achieve this level of quality?



How do we ensure the correct animals are shipped, mated and euthanized?



ANIMAL IDENTIFICATION IS EVOLVING

To keep up with growing complexity, labs are shifting from manual to automated ID systems.

Manual systems

(i.e., tattoos, ear notching/punching, toe clip, metal ear tags)

- Risk of compromised study data
- Unnecessary labor costs
- Under-utilized lab technician and PI time (deciphering data)
- Challenges in reading marks or tags
- Noisy data created by need for more animals per study group
- Costs of replacing compromised test animals
- Animal welfare concerns

Automated systems

(i.e., 2D barcode, RFID microchips, Transponders)

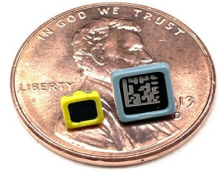
- Ensures administration of correct treatments
- Collects intended measurements
- Data storage is unified and stream-lined
- Increases technician efficiency
- Avoids significant hidden costs associated with manual methods
- Accurate



RAPID TAG®



Multiple colors allow rapid, secondary (visual) identification without scanning or disturbing caged animals



Humane (painless), secure, lightweight design

100% MRI and autoclave compatible

Made in the USA



2-D Matrix Barcode

- Easily and instantly scanned
- 100% reading accuracy
- Automated data collection
- Millions of unique codes

Biologically-inert, medical -grade, advanced polymer material. Virtually indestructible.

Quick and easy to apply or remove with nominal training



BENEFITS OF RAPID TAG

Benefits

- Unique Identification of each animal
- Process integrated within ICM application
- Traceability of animal use through 2D barcode during all touchpoints
- Secondary visualization using color coded tag
- Rapid scanning/identification process

Cost Savings and Project Improvements

- No animal identification issues since each animal has unique 2D barcode
- No reduction of cohort delivery due to incorrect animal ID or readability of ear marks.
- Correct shipment of animals
- Time savings in identifying animals for shipment, mating, cage move or euthanasia due to secondary color code of tags
- Use of RFID beneficial for ID import into excel through scanning
- Shipping crate reduction since animals would not need to be separated due to genotype
- Animal Welfare Benefit due to co-housing of animals of various genotypes.



KEY COMPONENTS



RapID Tags



Removal Tool



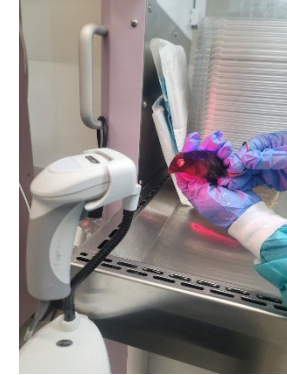
Bracket



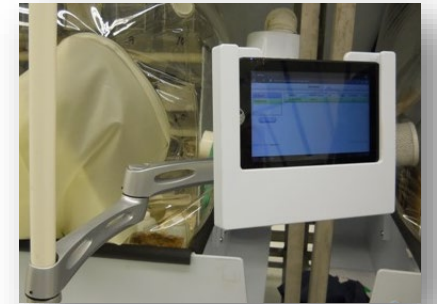
QR code



Scanner



Holder



Tablet



Applicator Tool



Battery Pack and Dongle



Keypad

OPERATIONAL EXCELLENCE and IDENTIFICATION

Provide superior quality in the marketplace by ensuring clients receive the correct animals for research



Are there identification systems that are efficient to execute and meet our IACUC standards?



What tools are available to achieve this level of quality?



How do we ensure the correct animals are shipped, mated and euthanized?



INTERNET COLONY MANAGEMENT


Colony Access, Data Integrity, and Visibility

- Data driven processes help to decrease errors and remove non-value-added steps
- Internal Systems are integrated to enhance exchange of information between departments (i.e., No transcription)
- 24-hour access through multiple devices (i.e., laptop, tablet and/or phone)
- Data captured in the vivarium is provided real-time through secure customer portal
- Monitor project progress at a high level, right down to specific animal details





CUSTOMER INTERFACE



Home Projects Requests

DemoUser | Wilmington | US | EST
[Change my Info](#) | [Logout](#)

Projects >

CR/ Customer/ Training

[Colony Management](#) · [Project Details](#) · [Incoming Shipments](#) · [Outgoing Shipments](#) · [Health Reports](#) · [Task Requests](#) · [Embryology Census](#)

All Isolators
CR/ Customer/ Training

Genetic Goal – (ABCXYZ) Breed HE x HE...
 Shipping Goal – (ABCXYZ) 20 HO females every ...

Gender: (Both Genders) ▼ Status: (In Colony) ▼ Filter [more filters ...](#) [clear filters](#)

Euthanize
Ship
Custom
Mate
Group

[Import Genetic Results](#)
✕ [Export to Excel](#)

List of animals (Animals: 15 Litters: 1)

	Cage	Isolator	Animal/Status	Gender	Color	Age (d/w)	Generation/Parents	Line/Zygotity	Mate Date
<input type="checkbox"/>	T	1 1	N=6 Active			1d	N5F3 100 x 101	ABCXYZ T.B.D./T.B.D.	
<input type="checkbox"/>	R	1 1	100 Active	M	Brown	149d	N5F2 50 x 51	ABCXYZ HE/HE	05-Jun-2012
<input type="checkbox"/>		1 1	101 Active	F	Brown	149d	N5F2 50 x 51	ABCXYZ HE/HE	05-Jun-2012
<input type="checkbox"/>		2 1	102 Active	M	Brown	88d	N5F3 100 x 101	ABCXYZ WT/WT	
<input type="checkbox"/>		2 1	103 Active	M	Brown	88d	N5F3 100 x 101	ABCXYZ HE/HE	



CUSTOMER INTERFACE

1	2	3	4	5	16	17	18	19	20
6	7	8	9	10	21	22	23	24	25
11	12	13	14	15	26	27	28	29	30

Gender: (Both Genders) Status: (All Status) [less filters ...](#) [Clear filters](#)

Age d w to d w Mated Without task

Not Mated With phenotype

[Line/Mutation/Zygoty \(set filter\)](#)

[Import Genetic Results](#)
 [Export to Excel](#)








List of animals (Animals: 34 Litters: 1)

<input type="checkbox"/>	Cage	Animal/Status	Gender	Color	Age (d/w)	Generation/Parents	Line/Zygoty	Mate Date	Comments
<input type="checkbox"/>	4	9 <small>i</small> Active	F	Black	445d	NOFO not defined	CBE-11 KI HO	(S) 28-May-2013 (E) 02-Nov-2013	
<input type="checkbox"/>	4	10 <small>i</small> Active	F	Black	445d	NOFO not defined	CBE-11 KI HO	(S) 28-May-2013 (E) 02-Nov-2013	
<input type="checkbox"/>	4	N=2 <small>i</small> Active			26d	F1 3 x 9, 10	CBE-11 KI HO		
<input type="checkbox"/>	5	53 <small>i</small> Active	F	Black	83d	F1 2 x 7, 8	CBE-11 KI HO	(S) 02-Nov-2013	
<input type="checkbox"/>	5	63 <small>i</small> Active	M	Black	79d	F1 1 x 5, 6	CBE-11 KI HO	(S) 02-Nov-2013	
<input type="checkbox"/>	5	71 <small>i</small> Active	F	Black	69d	F1 3 x 9, 10	CBE-11 KI HO	(S) 02-Nov-2013	
<input type="checkbox"/>	7	81 <small>i</small> Active	M	Black	41d	F1 2 x 7, 8	CBE-11 KI HO		



TECH INTERFACE

Workload

	Location	Isolator Name	Size	# Cages	# Animals	# Tasks
 All Tasks >	 16-B(CC-1)2	CR/Customer/Demo	6 foot - mouse	3	12	2
 Euthanasia >	 16-B(TT-10)1	CR/Customer/Training	3-foot mouse	3	9	2
 Husbandry >	 16-B(JJ-1)2	CRL/Client Demo	6 foot - mouse	10	28	1
 16-B(AA-20)1	CR/Project/Demo	15 Cage - mouse	6	16	1	

Scan Isolator

Samples

OPERATIONAL EXCELLENCE and IDENTIFICATION

Provide superior quality in the marketplace by ensuring clients receive the correct animals for research



Are there identification systems that are efficient to execute and meet our IACUC standards?



What tools are available to achieve this level of quality?



How do we ensure the correct animals are shipped, mated and euthanized?



TAGGING PROCEDURE and TOUCHPOINTS

Process

- At weaning or sampling Rapid tag is applied
- Animal is scanned into ICM
- Confirm 2D barcode is accepted
- Color of tag is verified
- Biopsy collection is performed

Touchpoints

Validation on Specific Animal Tasks Requires Scanning

- Mating
- Clinical Observation
- Euthanasia
- Shipment
- Cage move
- Sampling/Genotyping





VALIDATION

Weaning

Please SCAN the Animal RFID
Scan the Animal RFID Code

1		M	52	Active	Black	ABCXYZ	21 d
			KK4938				HO / T.B.D.
2		M	53	Active	Black	ABCXYZ	21 d
							HO / T.B.D.
3		M	54	Active	Black	ABCXYZ	21 d
							HO / T.B.D.
4		M	55	Active	Black	ABCXYZ	21 d
							HO / T.B.D.

Cage 9



1		M	52	Active	Black	ABCXYZ	21 d
			KK4938				HO / T.B.D.
2		M	53	Active	Black	ABCXYZ	21 d
			PP6274				HO / T.B.D.
3		M	54	Active	Black	ABCXYZ	21 d
							HO / T.B.D.
4		M	55	Active	Black	ABCXYZ	21 d
							HO / T.B.D.

Cage 9



VALIDATION

Shipments

Animal(s) 52,53 need to be SHIPPED.
Are these animals HEALTHY and ACCOUNTED for?
Scan animal(s) or press No

1		M	52	Active	Black	ABCXYZ	21 d
			KK4938				HO / T.B.D.
2		M	53	Active	Black	ABCXYZ	21 d
			PP6274				HO / T.B.D.
3		M	54	Active	Black	ABCXYZ	21 d
			AA3847				HO / T.B.D.
4		M	55	Active	Black	ABCXYZ	21 d
			2587AA				HO / T.B.D.

Cage 9

Animal(s) 52,53 need to be SHIPPED.
Are these animals HEALTHY and ACCOUNTED for?
Scan animal(s) or press No

Animal scanned is not a part of this task please scan correct animal(s)

1		M	52	Active	Black	ABCXYZ	21 d
			KK4938				HO / T.B.D.
2		M	53	Active	Black	ABCXYZ	21 d
			PP6274				HO / T.B.D.
3		M	54	Active	Black	ABCXYZ	21 d
			AA3847				HO / T.B.D.
4		M	55	Active	Black	ABCXYZ	21 d
			2587AA				HO / T.B.D.

Cage 9



1			M	52	Active	Black	ABCXYZ	21 d
			KK4938				HO / T.B.D.	
2			M	53	Active	Black	ABCXYZ	21 d
			PP6274				HO / T.B.D.	
3			M	54	Active	Black	ABCXYZ	21 d
			AA3847				HO / T.B.D.	
4			M	55	Active	Black	ABCXYZ	21 d
			2587AA				HO / T.B.D.	

Cage 9



DATA SHARING

Cage cards are generated including both tag number and a picture of the color tag as secondary identification

Having the color noted on the cage card provides immediate identification of animals. This can be used to separate animals quickly upon receipt or removal of specific genotypes if animals are cohoused. The tag number indicates the unique ID of the individual animal.

Identifier	Date of Birth	# of Days old	RFID	RFID Color	Gender
16397	11/30/2022	321d	RF9376	Blue	Male
16396	11/30/2022	321d	2220AL	Black	Male
16479	12/22/2022	299d	1663AJ	Gray	Female
16490	12/27/2022	294d	LT7579	Orange	Female
16534	1/12/2023	278d	BJ4895	Yellow	Female
16532	1/12/2023	278d	6342AO	Lavender	Male
16749	4/20/2023	180d	WL0136	Green	Female
16882	5/21/2023	149d	5262AN	Red	Female
16881	5/21/2023	149d	3682AN	Black	Female
16880	5/21/2023	149d	RD7086	Blue	Female

1A		CRL/AA Crl/Smith/rAA WILM						
ID #	RFID	Sex	Clr	Mark	DOB	Gen	Parents	Line/Zygoty
14553	KR8255	F	BL	n/d	13-May-2021	N1F13	13701 x C57BL/6E	AAHE
14554	VC6594	F	BL	n/d	13-May-2021	N1F13	13701 x C57BL/6E	AAHE
14555	PX3468	F	BL	n/d	13-May-2021	N1F13	13701 x C57BL/6E	AAHE
14556	9125AA	F	BL	n/d	13-May-2021	N1F13	13701 x C57BL/6E	AAHE

1B		CRL/AA Crl/Smith/rAA WILM						
ID #	RFID	Sex	Clr	Mark	DOB	Gen	Parents	Line/Zygoty
14558	7085AA	F	BL	n/d	18-May-2021	N1F13	13709 x C57BL/6E	AAHE
14559	2097AA	F	BL	n/d	18-May-2021	N1F13	13709 x C57BL/6E	AAHE
14573	KR8257	F	BL	n/d	01-Jun-2021	N1F13	13703 x C57BL/6E	AAHE
14575	PX4293	F	BL	n/d	01-Jun-2021	N1F13	13711 x C57BL/6E	AAHE

SUMMARY

Ensuring the right animals go into RESEARCH



Best Tools

Complete evaluation of identification methods including; usage, duration, and application increases success and adoption rates



Improved Accuracy

Digital colony management solutions can streamline data storage, increase process efficiency, and reduce errors



Verified Animal Selection

Reliability of animal usage through a 2D barcode during all touchpoints