Bi-Colored Rats

Gina Stewart, e-mail

Q I recently bred a Fawn female carrying Blue to a Russian Blue male carrying Blue. The litter contains lots of exciting colors, but one pup in particular is a mystery to me. She is basically a Black Hooded, but has a large grey patch over one eye. I've been doing research since I discovered this and cannot find any information about other bi-colored (or tri- if you include white) rats, and am seeking any information you may have. Here is a picture of Gene, who is around 15 days old. My guesses are either mosaic genetic changes or chimerism, but I can't find info about either in rats.

A It looks like it is probably a somatic mosaic on a Black Variegated. They can come in various combinations—beige spot on black, gray spot on black, fawn spot on agouti, black spot on beige, black spot on Blue/Russian Blue, etc. Somatic mosaics are not capable of reproducing themselves. We had an article in the 2011 newsletter with this same question and is online for you to read **www.afrma.org/c-c_oddcolorspotvelvet.htm**.

I've found a few things on rats on the Internet regarding this:

- "Mosaicism in mammals," Roy Robinson, *Genetica,* 1959, Volume 29, Issue 1, pp. 120–145
  http://link.springer.com/article/10.1007%2FBF01535705
- "An Independent Recurrence of the Blue Mutation in the Norway Rat and a Blue-Black Mosaic," M. R. Curtis and W. F. Dunning, *Journal of Heredity,* (1940) Vol. 31, Issue 5, pp. 219–222
  http://jhered.oxfordjournals.org/content/31/5/219.extract
  (this has diagrams and photos on the second and third pages of a Dilute [Russian Blue] Hooded with a black patch).
- A Google search lists some forums with pictures
  www.google.com/search?q=tri+color+rat&ie=utf-8&oe=utf-8&aq=t&rls=org.mozilla:en-US:official&client=firefox-a
- On a reptile forum are pics of one:
  www.reptileforums.co.uk/forums/other-pets-exotics/429580-tri-colour-rats-4.html

Chimeras can give the same type of look from two different genes fusing, but again won't reproduce the two colors onto one animal.

Mosaic is from 1 egg that has different cell make-up caused from a spontaneous mutation or error in the cell during embryo development; chimera is the fusion of 2 eggs with different cell lines (e.g. Seal Point with Blue Point so parts are brown and parts are blue).

You should try a repeat breeding of the parents to see if they produce another one and try breeding this one back to dad or to a brother just to see if she will reproduce this color anomaly. Keep us posted if you do.

Genetics of "Tri-Colored" Mice

Vasko Arosemena, e-mail

Q Would you please explain to me the genetics behind tricolor mice? How are you able to come up with three different colors? Is it natural selection or is there some genetic engineering involved?

A The "tri-colored" mice many breeders on the East Coast and in Europe are working on are merely the combination of the spotted gene and usually the Splashed (Transgenic) gene plus usually Siamese or Beige to get the third color (more on the AFRMA web site about these in the following articles: "Splashed Mice; 'Tri-Color' Mice; Tri-Color/Calico Mice'" **www.afrma.org/c-c_splashed.htm** and "Transgenic Mice & Tricolors" **www.afrma.org/tgtris.htm**). These are basically poorly marked Splashed (have big spots plus splashes) that have been selected for this, that when combined with white, you get patches of three or more colors. Many will still have areas that are splashed along with clear spots so it is just a matter of selection to get what looks like a "tri-color." This could also be done with the Sable color or poorly marked Brindle that also had the spotted gene to get orange, black, and white. So far there is no known true "tri-color/calico" gene in mice like in cats. We call this Broken-Multi since there are several different ways to get a "tri-color" looking mouse and it is not a true "tri-color" gene **www.afrma.org/miceunstdnonrec.htm#brknmltimse.**

Black & White + Brown = Spotted Tan Mouse

Chloe Wells, Facebook

Q Can someone please help me identify the correct name for the color of my new female? You can see she is black and white but she has a couple small brown spots on her. Thanks in advance.

A She is what we call a Spotted Tan—a spotted mouse with the addition of the tan gene. Where the colored spots run onto the belly, those become tan in color. Our Marked Mice page has a photo of a Rump White Tan and a Broken Merle Tan, both are types of Spotted Tans **www.afrma.org/micemkd.htm#rumpwhite**. These mice are commonly mistaken for tri-color since they have three colors on them. A true tri-colored mouse would have the orange spots on the back along with the black (or other color) spots plus the white. Spotted Tans can be in any marking and any color that can be Tanned (Black, Blue, Champagne, Chocolate, Lilac, Dove, Silver, Agouti, Argente, Blue Agouti, Cinnamon, Silver Black, Silver Blue, Silver Chocolate, Silver Grey, Pearl, Merle, Roan, and Splashed). You can read more about Spotted Tans in the article "Inherited Calico Traits; Tri-Colored Mouse?; Making Two-Colored Mice" **www.afrma.org/c-c_wssf2004.htm.**

Bi-Colored "Siamese" Rats

Gina Stewart, e-mail

Q I emailed you about the tri-colored rat I found in a litter recently. Today, I discovered two more. Due to the lighting in the room I hadn't noticed previously, but two females out of the same father and a related mother have pale gold hoods and dove grey nose tips and tail bases (like Siamese patterning) with clear hood and spine delineation. I'm not sure what could be going on.

Given the non-heritable nature of the genetic anomalies we had talked about, I'm beginning to doubt this could be the cause since the rats are all related. Again, any information would be appreciated. I'm stumped!

A They look like Russian Blue Point Siamese that are in the process of molting out baby coat into adult coat. Siamese are one of those colors that when they molt as kittens into their first adult coat, it is quite dramatic and has the very distinct pattern you are seeing. The "hood and spine delineation" will disappear once the adult coat fills in there. You can read more on Siamese in these articles on our web site:

"The Siamese Rat" **www.afrma.org/siameserat.htm**

"Breeding Blue Point Siamese Rats" **www.afrma.org/c-c_bpsrats.htm**

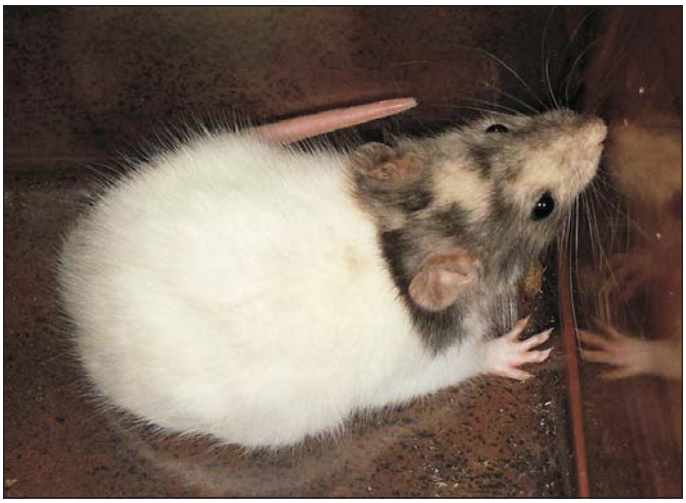
and on molting read this article:

"Color Change Rats; Color Variations in Rats; What Color Rat?" **www.afrma.org/c-c_colorchange.htm.**

Tortoiseshell/Tri-Color Rat

Courtney Smith, MI, Facebook

Q I am trying to find more info on my rat Spot. I've been doing research on this mutation and I'm coming up empty handed. I cannot find any info on this color. If you guys could help me at all, I'd appreciate it a lot. I don't have his parents or any of his siblings but I do have babies from him.



A baby picture of Spot. Photo from Courtney Smith.

A Great to see this mutation pop up again here in the U.S.! It looks like a Tortoiseshell/Tri-color or somatic mosaic. This mutation has shown up in Alaska, Russia, and the U.K. To my knowledge, none of the ones in the past were able to reproduce their color which would indicate a somatic mosaic. If you had mom and sisters, breeding to them would be ideal as they would be from the same gene pool. Also, if you had the parents, a repeat breeding would be recommended to see if another one could be made. Since you have kids from him, the next step would be to breed daughters back to him. My suggestion would be to keep more than one daughter so in case something happens to one, you have others to use.

To read more on somatic mosaics, see the following articles on the AFRMA web site (most are mouse articles but the info would still pertain to rats):

- "An Explanation of Somatic Mutations and why they do not breed true" **www.afrma.org/mk-somatic.htm**
- "Odd Color Spot On Rat" **www.afrma.org/c-c_oddcolorspot-velvet.htm**
- "Tri-Color/Calico Mice" **www.afrma.org/c-c_splashed.htm**
- "Colored Mice" **www.afrma.org/c-c_fawnratcoloredmice.htm**
- "Tri-Colored Mouse?" **www.afrma.org/c-c_wssf2004.htm**

Also, in the article "An independent recurrence of the blue mutation in the Norway rat and a blue-black mosaic." Curtis, M. R.; Dunning, W. F. *Journal of Heredity,* 1940 Vol. 31 pp. 219–222. **http://jhered.oxfordjournals.org/content/31/5/219.extract**, it has a photo of a "blue" Hooded rat with a couple black patches.

Keep us posted on your results—maybe you will have the one that is reproducible!

Questions On Tri-Colored Rats

Alex Smith, Facebook

Q What do you know about tri colored rats? I don't know what I have, it popped out of one of my litters. He has a light brown cap and some black dots on his head. I've

Plague: Gerbils To Blame

For centuries, rats and their fleas have been the blame for the Black Death which first happened in the 14th century medieval Europe. This was widely believed to have been caused by bacterium transported by fleas attached to black rats. Warm weather was thought to be connected to the outbreaks. In a new study though, researchers didn't find a relationship between the climate changes and the outbreaks in Europe. Instead, they found evidence that the weather in Central Asia—ideal conditions for gerbils—where the plague originated, matched the outbreaks. Plague among gerbils is affected by the weather and correlates with the population density of the gerbils and fleas themselves.

Study published in *PNAS* (Proceedings of the National Academy of Sciences), 2015 Mar 10; 112(10): 3020–3025, "Climate-driven introduction of the Black Death and successive plague reintroductions into Europe" **www.pnas.org/content/112/10/3020.full.pdf.**

One article "A Promising Moment for Rat-Human Relations" by Emily Epstein in *The Atlantic* **www.theatlantic.com/international/archive/2015/02/rats-in-black-death-plague-gerbils/385952/** (many other articles done as well on this study). Thanks to Emily for letting us know about this.

Send in your amusing story, short tale, news note, or other item of interest to the Editor or e-mail **editor@afrma.org.**

"Funny Funny," a Black Tan Standard mouse owned by Angelina Artero, CA. Photo ©2013 Angelina Artero.

been breeding rats for about 2 years and I've never seen it before, neither have my breeder friends. Do you know if it's anything special?

The baby rat with black spots on his head from Alex Smith.

A Tri-colored rats are those elusive colors that many people have had over the years but alas they were not genetically from a tri-colored/calico gene so were not able to pass on their uniqueness to their offspring. These rats have an actual colored spot(s)/patch(es) different from the base color and are not just a molting rat (the spots will show up in the nest).

These types of rats are called somatic mosaics, meaning the anomaly happened to that rat during development in its body cells but not to the germ cells (sperm/eggs). We have an excellent article explaining this **www.afrma.org/mk-somatic.htm.** They can come in many variations, Blue or Beige spot on Black, Fawn spot on Agouti, Black spots on Beige, etc.

Others we have seen similar are ones that look like a "tortoiseshell" with the two colors in smaller sizes and about equal in proportion (like a tortoiseshell cat) rather than a few larger spot(s)/patch(es) of a different color on the base color. There were breeders in the Midwest working on what they called "Tortoiseshell" during 2001–2008 that was reproducible. These looked more like a rat that was molting in patches: Robin MacDonald's page "Tortishell Effect" (bottom of page; hers came from the "shadow/melanistic" rats) **https://web.archive.org/web/20150110074240/http://www.deer-creek.us/shadows.html**, and on A. Gangi's site: "Shadow and Torties vs Pale Belly and Rusting Faults" **http://rodentfancy.com/pets/?s=torties**, "Shadow, Midnight and Torties" **http://rodentfancy.com/pets/2008/01/shadow-midnight-and-tortishell/**, "Shadow, Midnight and Tortoise shell: Three New Varieties in the Domestic Rat" **http://rodentfancy.com/pets/wp-content/uploads/2008/01/torties.pdf**.

Whenever anyone gets one of these, they should always try to breed them to see if possibly they have that new mutation that is genetically reproducible. Ideally, rebreed the parents to see if it will happen again, then breed the "tri-colored" offspring with the parent (son to mother, daughter to dad) and to its siblings. Once you get kids from the tri-colored rat, breed them back to it and to each other. If more tri-colors do not show up at this point, you are likely dealing with a somatic mosaic.

The photo of your rat doesn't look like Merle (**www.afrma.org/rataocp.htm#merlerat**). What color are the parents? It does look like possibly a somatic mosaic/tri-color. Please send us photos when it gets older.

Send in your questions, comments, articles, etc., related to colors, markings, or coats to the Editor or e-mail **editor@afrma.org.**