



S.F.V.B.S.

SAN FERNANDO VALLEY BROMELIAD SOCIETY

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JANUARY 2016 NEWSLETTER

OFFICERS

Pres: **Mike Wisnev** V.P.: **John Martinez** Secretary: **Leni Koska** Treasurer: **Mary Chan**

Membership: **Joyce Schumann** Advisors/Directors: **Steve Ball, Bryan Chan, Richard Kaz -fp, Mary Carroll**

Sunshine Chair: **Georgia Roiz** -Refreshments: **Kathleen Misko** -Web: **Mike Wisnev** -FaceBook: **Roger Cohen** -Editors: **Mike & Mary K**

next meeting: **Saturday Jan. 2, 2016 @ 10:00 am**
Sepulveda Garden Center 16633 Magnolia Blvd. Encino, California 91316

AGENDA

9:30 – SET UP & SOCIALIZE 10:00 -
Door Prize – arrive before 10:00 10:05 -Welcome
Visitors and New Members. Make announcements

10:15 - Introduce Speaker: Gregg DeChirico Program
Topic: “Discovering the Wonders of Peru”

Gregg has grown plants of all types for over 30 years. He has a nursery, Gregg’s Greenhouse, located in the Santa Barbara area (Carpinteria) specializing in seed-grown rare and exotic plants. Gregg has traveled throughout Latin America to photograph the flora and fauna.



Gregg has served as president of several Cactus & Succulent Societies and is on the board of the Cactus & Succulent Society of America (CSSA).

We will have a travelogue starting in arid coastal Northern Peru, heading south and traversing the Andes three times before ending in Peru’s southern highlands. Our zig-zagging journey takes us through cactus gardens in the lush hills

valleys of Amazonia and Cajamarca, then west to the seemingly barren pacific coast where life teems on offshore islands, and then high into the Andes to the slopes of the Cordillera Blanca where forests of orchids and bromeliads grow within view of glaciers, then across the Altiplano where stands of huge Puya raimondii tower over grassy plains, and finally to the cultural wonder of Machu Picchu and historic city of Cusco. Along the way there are many splendid and wondrous sights of flora and fauna, as well as culture- both past and present- all captured in photos illustrated in this presentation. **You don’t want to miss this program!**

11:15 - Refreshment Break: Will the following members please provide refreshments this month: **Colleen Baida, Steve Ball, Wesley Bartera, Dave Bassani, Ron Behar and anyone else who has a snack they would like to share.** If you can’t contribute this month don’t stay away.... just bring a snack next time you come. **Questions about refreshments?** Contact Kathleen at 818-402-6031 or leenest@aol.com

Feed The Kitty

If you don’t contribute to the refreshment table, please make a small donation to ([feed the kitty jar](#)) on the table; this helps fund the coffee breaks.

11:30 - For Show and Tell please bring a plant.

11:45 – Mini Auction: members contribute

12:00 – Raffle: We need each member to donate

12:15 - Pick Up around your area

12:30 – Meeting is over—Drive Safely <

President's Message

We had a great holiday party. Thanks to Kathleen who accepted the challenge, as well as Bryan, Joyce, Gisele and Mary K who all helped out with setup, as well as everyone else who brought in some great dishes.

Mike Wisnev

Hope to see you all at the next meeting by 10:00 am...

Mary K is taking a look back at last month..... As usual we had lots of great food for the Holiday lunch. ***Kathleen Misko*** went all out with preparing for the party; she even brought in her china tea serve set. It was so nice that several members were afraid to use it in fear of breaking a piece. ***Haha*** Thanks to the many members who pitched in to help with serving and cleaning up but ***Ana Wisnev*** deserves a gold star for managing the kitchen; she was in there for hours organizing and keeping everything clean. We had plenty great looking pot luck dishes; so many I couldn't try them all. A special thank you to ***Kim*** and ***Artie***, who couldn't attend, for donating water and sodas. There were no raffle plants but I brought one in for the earlier arrival drawing. ***Joyce***, our membership chair, offered a drawing for folks who paid early for 2016 membership. ***Bryan Chan*** donated a plant for that drawing and ***Nancy Pyne-Hapke*** was the winner. ***Bryan*** handled the gift exchange and the holiday gift plants. Please welcome new members, ***Colleen Baida***, ***Ron Behar*** and ***Raquel Smith*** from the Dec. meeting; they probably heard about our great cooks!! We are grateful for 2016 Executive Officers voted in and equally grateful for the members who accepted volunteer positions.

New 2016 Elected Officers are:

President: Mike Wisnev
V-President: John Martinez
Secretary: Leni Kosko
Treasurer: Mary Chan
Membership: Joyce Schumann
Advisor/Directors: Bryan, Richard,
Mary & Steve

Volunteers:

Editors: M. Wisnev & Mary K.
w/ Nancy P-Hapke to continue snail mail
Raffle: Steve Rudolph
Refreshments: Kathleen Misko
Sunshine Chair: Georgia Roiz
Webmaster : Mike Wisnev
Facebook : Roger Cohen

Announcements:

- **Happy January Birthday** to *Ingrid Young 5th*, *James Johnson 8th*, *Phyllis Frieze 11th* and *Leni Koska 26th*
- **Facebook** – For many years Barry Landau managed our facebook page; unfortunately he has resigned. We wish Barry well; he will be missed. Barry was always helpful with other speakers and very knowledgeable about the show-n-tell plants. Now that he is gone we needed someone to step up and to fill a part of that void by posting taking photos at the meetings and show notices. Thankfully Roger Cohen has agreed help manage the club's facebook page. sanfernandovalleybs@groups.facebook.com
- **Holiday Party photo** – If you would like to pay for a color copy please contact Mary Chan at mchan2001@aol.com or (818) 366-1858 / please see attachment.
- **Speakers** - Let us know if you have any ideas for Speakers about Bromeliads or any similar topics? We are always looking for an interesting speaker. If you hear of someone, please notify John Martinez johnwm6425@gmail.com or Mary K. at 818-705-4728 or e-mail rango676@aol.com <>

Please pay your 2016 Membership Dues

NEED TO RENEW ?.....

**Pay at the meeting to: Membership Chair – Joyce Schumann or Treasurer - Mary Chan
or Mail to: SFVBS membership, P.O. Box 16561 - Encino, CA 91416-6561**

Yearly Membership Dues \$10.00 for a single or couple

Please Put These Dates on Your Calendar

Here is our 2016 Calendar. As our schedule is always subject to change due to, please review our website and email notices before making your plans for these dates.

Saturday Feb 6, 2016	<i>Nels Christianson</i>
Saturday Mar 5, 2016	<i>Guillermo Rivera</i>
Saturday April 2, 2016	SFVBS Regular meeting - STBA
??? Sat May 7, 2016 ???	SFVBS Regular meeting - STBA
Sat. & Sun. May 7-8, 2016	LaBallona Bromeliad Show & Sale
??? Sat June 4, 2016 ???	??? Regular meeting ???
Sat & Sun June 11-12, 2016	SFVBS Show & Sale w/ the Cactus Club
Saturday July 2, 2016	SFVBS Regular meeting - STBA
Saturday August 6, 2016	<i>Andy Siekkinen</i>
Sat. & Sun. Aug 6-7, 2016	So. Bay Bromeliad Show & Sale
Saturday Sept 3, 2016	SFVBS Regular meeting - STBA
Saturday Oct 1, 2016	SFVBS Regular meeting - STBA
Saturday Nov 5, 2016	SFVBS Regular meeting - STBA
Saturday Dec 3, 2016	SFVBS Regular meeting - STBA
Saturday Jan 7, 2017	SFVBS Regular meeting - STBA

STBA = Speaker To Be Announced

***We wish you and your family a
Happy, Healthy and Safe 2016***

<<<<<< Chinese Year of the Monkey begins Feb 8 >>>>>>

Tidbits of info - The monkey ranks ninth of the 12 animals in the Chinese zodiac.

Each year is related to an animal sign according to a 12-year-cycle.

Years of the Monkey include 1920, 1932, 1944, 1956, 1968, 1980, 1992, 2004, 2016, and 2028.

If you were born in these years.....

Lucky numbers: 4 and 9

Lucky days: the 14th and 28th of any Chinese lunar calendar month

Lucky colors: white, blue, gold

Lucky flowers: chrysanthemum, crape-myrtle

Lucky direction: north, northwest, west

Lucky months: the 8th and 12th Chinese lunar months.

A tener tenera tenerum frenum , vel mica of Botanical Notitia Nomenclature vel Biochemistry illi alio interested in Bromeliaceae. Really?!

Some might say Taxonomic Tidbits is closer to Taxonomic Tomes than the actual title. Probably more would agree if they knew what a tome is. More on this later.

This author suggested a new shorter column might be good. As with all major decisions, it was not taken lightly. A Committee was formed to determine if the new column should it replace Taxonomic Tidbits or be an additional column. The Committee was immediately overwhelmed, and formed three subcommittees. The financial committee then hired consultants, almost bankrupting the Club.

A topics committee considered whether far ranging themes could be explored, like self –help, cooking and the Carolina Panthers? It started to consider whether jargon could be used, but a fourth committee was appointed to determine if the topics committee could consider this topic, finally deciding this required a jargon committee.

The author committee faced real problems. Could one columnist competently cover these topics, or should guest columnists be enlisted? Would a new columnist(s) be a problem for the Tidbits author? He assured the Club this would not be a problem, **insisting only that each thought be in a different font and color, as shown in this sentence.** A font committee was composed in haste, and an HR consultant hired to determine how best to deal with the Tidbits columnist.

Other members were outraged the Tidbits columnist repeatedly refers to himself in the first person. This is apparently is a grievous error in journalistic standards. Writers should stay out of the story, even if about themselves, and if necessary use “this writer” rather than the capital form of the ninth letter of the English language, which apparently can’t even be printed.

A title committee was formed when the Tidbits author suggested the new column be called Taxonomic Tidbits, and the existing one actually be changed to Taxonomic Tomes. Some worried this change would be too confusing, perhaps causing members to leave the Club, while others feared this might be illegal . When the committee actually learned what the word meant, the HR consultant was asked if the writer’s choice hinted at deep seated issues.

HR advised apparently alliterations amuse him, and he could not think of another word starting with “T”. Later, it was learned a colleague referred to one of his memoranda as a tome. This was and still is a source of great concern. He was embarrassed since he did not know the definition of tome. Upon looking it up, he was horrified to find it was “a book, especially a large, heavy, scholarly one.” Later, in an unsettling senior moment, he didn’t accurately remember the word; initial drafts used Taxonomic Tombs, not Tomes. His wife can confirm this last matter, though she didn’t bother to tell him of the error, causing additional stress. Finally, the near use of Tombs induced panic over the widespread ridicule he might have suffered.

The foregoing proved too much, necessitating a paid leave of absence, and making it impossible to include the whole column this month. He promises to conclude next month, also explaining how the title was selected.

By now I hope you have figured out this page is something humorous submitted by Mike

Taxonomic Tidbits – *Distinguishing Aechmea and Portea, Part 2; Gravisia and the Portea-Gravisia complex*

By Mike Wisnev, SFVBS President (mwisnev@sbcglobal.net)

San Fernando Valley Bromeliad Society Newsletter – January 2016

Gravisia is an old genus that was merged into *Aechmea* about 45 years ago. So it is hardly surprising if you haven't heard of it.

Why bother with an article on them? By coincidence?, I heard about them four times in a couple months when doing various articles to appear later. Since they ended up in three different Tidbits to come, I combined them in this article instead.



The type plant is *Gravisia exsudans*, which is now *Aechmea aquilega*, pictured above. Photo from Bromeliario Imperialis.

1891 – a new genus. Dr Carl Mez published a massive monograph on bromeliads in the 1890's. Surprisingly, his taxonomic system incorporated the use of pollen in addition to other factors. Mez created the *Gravisia* genus (in honor of a Belgian botany professor) in 1891, which was distinguished on the basis of having pollen with more than five pores, sessile flowers and free sepals (that is not joined together). Interestingly, *Portea* show up next to *Gravisia* in his key since they also have pollen with more than five pores. However, they have pedicellate flowers and high connate sepals (sepals joined for most of their length).

This is aptly named *A tomentosa* for its furry inflorescence and sepals. Photo by Prof Eric Gouda.



A tomentosa was first illustrated over 350 years ago, as shown to the right. *Theatrum Rerum Naturalium Brasiliae* vol.1-4 1660-1664, vol.4 *Icones Vegetabilium* (drawings attr. to A. Eckhout, compiled by C. Mentzel) and *Libri Principes (TBlp)*, attr. to G. Marcgraf, 1640 ? <http://www.bromtravels.nl/ht/lists-pipusp.html>

1970 – *Gravisia* become *Aechmea*. Dr Lyman Smith moved the then eleven species of this genus into *Aechmea*, subgenus *Aechmea*. He stated that studies showed some *Aechmea* also have similar pollen, and the correlation with inflorescence no longer exists. See Notes on Bromeliaceae, XXX.



A amoricum, a recently described species. A New and Attractive *Aechmea* Species from the State of Bahia, Brazil, Bruno Rezende Silva & Harry E. Luther. Journ Brom Soc. 52(5): 221-5. 2002 Photo by Silva. The article notes its differences with other similar species in the *Gravisia* complex – *Aechmeas blanchetiana, fraudulosa and eurycorumbus*. For those in the hobby a long time, the name “is based on the long friendship of the co-collectors, John Anderson and the late Wally Berg.”

1991 – a new complex. However, the *Gravisia* name has made a comeback. In 1991, exactly one century after Mez created the genus, Read and Luther described an *Aechmea/Gravisia* complex¹ consisting of four older *Gravisia* species and four other *Aechmeas*. These plants “were all vegetatively similar, with very similar scape, scape bracts, primary bracts, floral bracts and large yellow petals.”

The abstract states that these are “large *Aechmea* species with yellow-petaled, polystichously flowered, much-branched inflorescences.”

2007 – the complex grows. In their 2007 book called Fragments of the Atlantic Forest of Northeast Brazil, Elton Leme and J. A. Siqueira more than doubled the size of the *Gravisia*

¹The term “complex” does not appear to have a formal botanical definition. It seems to be an informal term to address a group of plants related in some fashion. .

complex. The complex was now up to 21 species. In general, the species in this group are facultative epiphytic, and are located in in northeast Brazil north of the Jequitinhonha river.

Some other plants in the complex include *A mulfordii* (in *Gravisia* per Mez), and *A blanchetiana* (added to the complex by Leme).



Last month's article noted that one *Portea* had been moved to *Aechmea*. This is *A leptantha*, pictured left. It had been described as a *Portea* in 1929 by Harms and considered as such until 2007.

Except for the yellow-orange flowers it seems much like the *Portea* pictured last month.

Leme and Siqueira moved what had been *P leptantha* to *Aechmea*. Based on a 2004 molecular study² and other morphological traits. they felt it is a member of the so-called *Gravisia* complex of *Aechmea*.³ They stated that the

“closer morphological affinity of *A. leptantha* to the *Gravisia* complex is due to a combination of comparatively short-pedicellate flowers, sepals shortly connate at base and asymmetrical, with a narrow lateral wing 1.5 to 2 times wider than the opposite half, and apically short-

² Dylan Wade did a masters thesis A Survey of Fruit, Ovary and Seed Morphology of the Bromelioideae (Bromeliaceae) and a Molecular Analysis on the Genus *Portea* Using Three Chloroplast Loci. It seems the only copy may be at the U. of Wyoming.

³ Interestingly, the 2010 study discussed later found that *A leptantha* was a *Portea*, not a *Gravisia*, while the 2015 study noted in the next footnote showed the opposite.

mucronulate, plus orange-yellow petals. In typical *Portea* species [i.e., *P. alatisepala* Philcox, *P. fosteriana* L. B. Sm., *P. grandiflora* Philcox, *P. kermesina*, *P. nana* Leme & H. Luther, *P. petropolitana* (Wawra) Mez, and *P. silveirae* Mez], the flowers are long and slender-pedicellate, the sepals half connate or nearly so, with a very large lateral wing 3 to 3.5 times wider than the opposite half, besides a long mucronate apex, and violet-blue petals. Another distinctive trait associated with typical *Portea* species is longer flowers, i.e. (45-) 50-80 mm long, when compared to the 25-45 (-53) mm long flowers of the *Gravisia* complex taxa.”

2015 – a *Portea/Gravisia* complex. A 2015 DNA study strongly support a *Portea/Gravisia* clade.⁴ (A “clade” basically consists of all the species that are grouped together based on the results of a DNA study.)

This study was pretty comprehensive – it sampled 20 out of the now 25 *Gravisia*, and 6 of the 10 *Portea*. All 26 of these were on one clade, along with three *Canistrum*⁵ and 3 other *Aechmea* noted in the next paragraph. It also found that all members of the *Portea/Gravisia* clade had pollen with more than five pores.⁶

There were actually four different groups within this complex. Three of them were groups of *Gravisia* and *Canistrum*, while the fourth was *Portea* and 3 other *Aechmea* (*A. bahiana*, *marauensis* and *rubrolilacina*).

⁴ Heller, Leme, Schulte, Iseppon, and Zizka. Elucidating Phylogenetic Relationships in the *Aechmea* Alliance: AFLP Analysis of *Portea* and the *Gravisia* Complex (Bromeliaceae, Bromelioideae).. Systematic Botany (2015), 40(3): pp. 716–725

⁵ The 3 *Canistrum* were *C. alagoanum*, *aurantiacum* and *pickelii*.

⁶ It wasn't clear that the authors addressed Smith's concerns that many *Aechmea* have polyporate pollen. However, the *Gravisia* complex, as currently constituted, is much larger than *Gravisia* in 1970 and I suspect the study just included many of the *Aechmea* that Smith said were polyporate.



A cathcartii, described in 1981 and named after its collectors, Dennis and Daris Cathcart, who found it in Venezuela. See J Brom Soc 31(2):60-1 (1981) Photo in J Brom Soc 47(6):264 (1997), which reintroduced the species.

The 2015 study noted that numerous earlier studies supported a relationship between *Gravisia* and *Portea*, though they were not as comprehensive. In 1998, Bohme suggested that *Gravisia* be merged into *Portea* based on their common pollen characteristics and similar septal nectaries. A 2004 study on *Aechmea* analyzed about 60 different plant characteristics statistically and found a clade consisting of 3 *Portea* and 5 *Aechmea* that are in the *Gravisia* complex.⁷ In 2007, a study sampling a wide variety of bromeliads found a genetic relationship between the 4 *Gravisia* and one *Portea* sampled; these same five species had a different anatomical leaf structure than other species in the study.⁸

⁷ See Faria, Wendt and Brown, 2004. Cladistic relationships of *Aechmea* (Bromeliaceae, Bromelioideae) and allied genera. *Annals of the Missouri Botanical Garden* 91: 303-319.

⁸Horres, R., Schulte, K., Weising, K., Zizka, G., 2007. Systematics of Bromelioideae (Bromeliaceae) – evidence from molecular and anatomical studies. *Aliso* 23, 27–43.



A blanchetiana is shown here at HBG. It is fairly well-known in cultivation and differs from *A amicorum* shown earlier, by virtue of its longer floral bracts with yellow margins. There is a cultivar known as Orangeade for its orange leaves.

Finally, a large *Aechmea* DNA study⁹ in 2010 sampled two *Gravisia* (*A aguilegia* and *A leptantha*, which they still called *P leptantha*, despite Leme's referral to *Aechmea*), though it did not mention *Gravisia* as such. The results found a clade consisting of *Portea*, these two *Gravisia*, *A marauensis* and *Canistrum aurantiacum*. The 2010 study noted that these species were related, were all in eastern Brazil and had multiporate pollen; it stated *Portea* could be redefined to include these species.

⁹ See Sass, C. and C. D. Specht. 2010. Phylogenetic estimation of the core Bromelioids with an emphasis on the genus *Aechmea* (Bromeliaceae). *Molecular Phylogenetics and Evolution* 55: 559–571.

This 2015 study did not suggest any actual name changes. It stated that “the final taxonomic treatment and ranking of the *Gravisia* complex (separate genus or subgenus of a broader genus *Portea*) requires more studies in the core bromelioids and a revision of the genus concept for the whole subfamily.” Id at 722. So, at least for now, all the *Gravisia* are still *Aechmea*.



The results of some studies have found that *Canistrum alagoanum* may be a *Gravisia*, along with a couple other *Canistrum* species. Photo by Elton Leme, J. Brom. Soc. 52(3) 119 (2002). It grows in the same general location and has similar pollen structure as *Gravisia*, though its inflorescence structure differs.

As an aside, it is interesting to note that almost all of the studies on *Gravisia* have been done by German botanists. I suspect this isn't a coincidence.¹⁰ Despite the advances in worldwide communication, some combination of language barriers, local interests and other factors may lead to areas of research in one country as opposed to others.

In this particular case, it is also worth recalling that Mez, a German botanist, was the leading expert in Bromeliads from about 1890 until Smith's publications in the 1970s. His work relied quite a bit on pollen, and he created the *Gravisia* genus. One might surmise that German trained botanists were not exactly thrilled to see Smith de-emphasize pollen and eliminate *Gravisia*. Even if indifferent, researchers need to research and publish, and Smith's revisions to Mez's work no doubt led to a number of topics to investigate.

As is the case in so many cases, not all the studies agree. For example, one recent 2015 study found that *Portea* itself might need to be broken up.¹¹ Nonetheless, it would hardly be surprising at this point if *Gravisia* are either resurrected in the not too distant future, or merged into the *Portea* genus.

¹⁰ This article had me wondering about coincidences. While there are no doubt many of them, I suspect many apparent coincidences might not really be coincidences. For example, this article stemmed from 4 seemingly coincidental references to *Gravisia*. Derek Butcher suggested a bromeliad at the HBG might be a *Gravisia*, and I looked a bit at this topic. Not much later, I did some articles on *Aechmea* and *Portea*, and kept seeing references to *Gravisia*. It is hardly surprising to see these references given the relationship among them. More importantly, on reflection I realized that I had seen many similar references in the last few years, but I didn't even remember this – perhaps I completely ignored them since I had no idea what a *Gravisia* was or perhaps I looked a bit at them and found they were now *Aechmea* and thus dismissed the term. What appeared to be coincidental was basically due to the fact that now I know what *Gravisia* are (or were), and focused on them more carefully when seeing the references.

¹¹ Evans, T.M., R. Jabaily, A.P. de Faria, L.O.F. de Sousa, T. Wendt, and G.K. Brown. 2015. Phylogenetic Relationships in Bromeliaceae Subfamily Bromelioideae based on Chloroplast DNA Sequence Data. *Systematic Botany*, 40(1):116-128.



A multifordii (to the left) may not have a spectacular inflorescence but its leaves are quite attractive. It was originally described as *Gravisia fosteriana*, but when Smith moved the genus into *Aechmea*, a different name was needed since there already was an *A fosteriana*. Both were named after Mulford Foster.



An unlabeled bromeliad in the HBG Jungle Garden. Derek suggested it is a *Gravisia*, and I suspect it is *A aquilegia*, HBG 33200, acquired in 1974 from Marina Orchids like many other bromeliads in the Jungle Garden.

Taxonomic Tidbits –DNA Studies

By Mike Wisnev, SFVBS President (mwisnev@sbcglobal.net)

San Fernando Valley Bromeliad Society Newsletter – January 2016

This month's article, and others in the future, will report on various DNA studies. When I sent out the October 2014 Newsletter, I included an article I did on this topic in the Cactus and Succulent Journal, but some have told me it was too complicated. This article tries to help out in understanding some basic concepts in these studies, which are technically called phylogenetic studies.

Most of the DNA studies are looking to see if certain genera are valid or related. To do so, they use portions of the DNA of some species from each genera, as well as other hopefully related ones. The key here is that they don't look at all the species of the genera, and don't come close to looking at the all the DNA. Why not – too much time and money would be needed. After a lot of work doing this and finding out the DNA sequences, they use computer programs to run various statistical analyses.

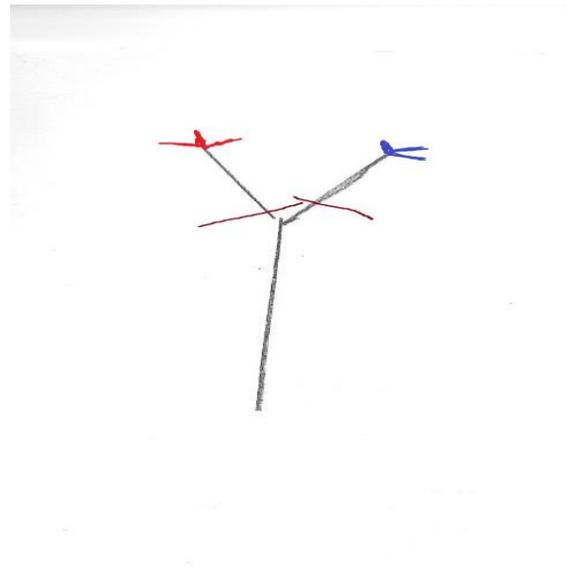
These programs then produce various cladograms that show the relationships of the species. **It is probably easiest to think about cladogram as trees - ones that only have leaves at the end of branches.**

Here is one way to show a cladogram.

Treat the red and blue lines at the end as leaves, each representing a single species tested in the study. Ignore the brown lines for now.

As explained in more detail below, each branch of a tree, together with all the branches coming off it, is considered a clade. If all the species of a genus fall on one clade, and there are no other members of other genera on that clade, then the genus is considered valid – the technical word used is monophyletic. If a genus is not monophyletic, then some changes need to be made to correct it. The nature of the changes depends on the results, including plant characteristics.

Study #1. Let's assume a botanist is studying two fake genera that are thought to be closely related – they have many common features and some different ones. Genus Red has red (and sessile) flowers and Genus Blue has blue (and pedicellate) flowers. She wants to see if they are monophyletic. Both genera have 10 species, and she samples 3 species of each for the study.



The study produces the cladogram shown above. The results show all three red species on the left branch, and all three blue species on the right. These results indicate both Genus Red and Genus Blue are monophyletic. If you cut the branches, as indicated by the brown line, each branch would show all the members of one genus without any species of another genus. As a result, the study would conclude Genus Blue and Genus Red are good genera, based on its results.

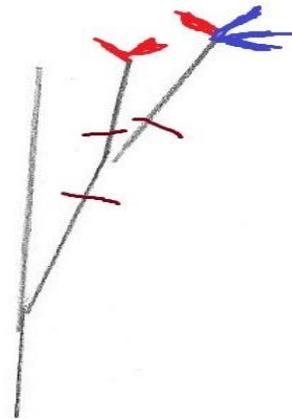
Study #2. Using the same facts, now let's assume the results produce the cladogram to the right. There are three different clades shown, depending on where you cut the branches (the brown lines show where you can cut): (1) one clade of two red species, (2) one clade of 3 blue species and one red species, and (3) one clade of all six species.

Here one of the red species groups with blue species. Remember that monophyletic means all members show up on one branch (including side branches) and no other species show up on that branch. No matter where you cut the branches, neither Genus Red nor Genus Blue meets this test. Two technical terms apply. Genus Blue is paraphyletic since a member of Genus Red shows up with it. Genus Red is polyphyletic, since it shows up on different branches.

What does the study do now? Remember this is a sample of 3 species out of 10. Given that, the botanist probably says more studies are needed, with more species and probably different DNA samples, and doesn't change anything yet.

However, there are other approaches. **While the most critical component of the study is the cladogram, which can't be ignored, botanists also consider plant characteristics to decide how to group the plants.** They look at which species fall on which branches and see if they have common characteristics that generally differ from those on another branch.

For example, assume all the blue species and the one red species on the blue branch had connate sepals (that is, sepals that were joined together), while the other two red species had free sepals. In this case, the study might propose that the one red species be moved from Genus Red to Genus Blue. This is when you see a statement like *Red smithii* is now considered to be *Blue smithii* based on recent DNA studies. Under this approach, the botanist cuts the two side branches off the main branch.



There is another approach. The botanist might conclude that merging Genus Red and Genus Blue into one genus made the most sense. Under this approach, the botanist simply cuts off the main branch.

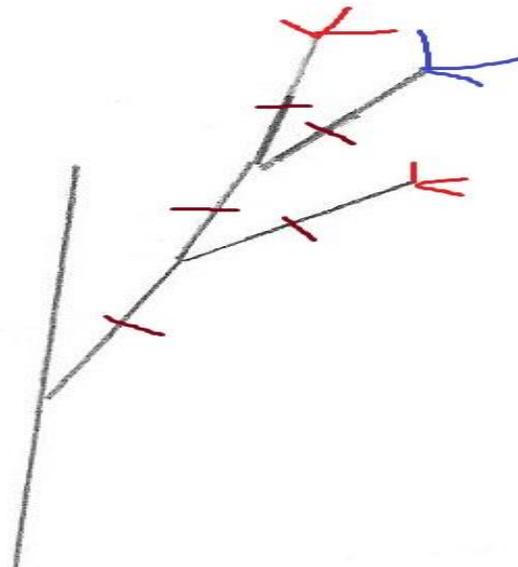
While different conclusions can be drawn from this one study, it is important to note that all the conclusions are consistent with the 3 clades noted at the outset of the example. Almost all botanists agree that the key to determining a taxa, such as a genus, is determining whether it is monophyletic. While other plant features are important, they can't be used to override the DNA results.

Thus, other than concluding that more studies are needed, you can't decide to ignore the clades and report that the Genus Red is still a good genus.

The above example also shows why some subjectivity remains. While the DNA results produce objective results and determine what is a clade, it is up to botanists to decide which clades should be treated as species or genera or subgenera.

Let's look at one last cladogram to show how a **decision regarding one genus can impact another genus.** .

Here the study samples six species of Genus Red (which has 10 species), and all three members of Genus Blue. The study gets the cladogram shown to the right. Remember that each branch, with its side branches, is a clade, and a clade shows a monophyletic group of species.



This cladogram shows that Genus Blue is monophyletic group since all its members fall on one branch, and no other species are on that branch. But Genus Red is a problem. Its members fall on two different branches, and no matter where you cut the branches, don't group together without including the blue species. (No, you can't cut off the blue branch and then ignore it when considering the remaining branches.)

This example shows that Genus Red can't be considered a valid genus unless Genus Blue is included – the only way to keep all red species together is to cut the entire side branch off. This might not make any sense, however, if Genus Blue doesn't seem to have common characteristics with Genus Blue.

Another approach is to just split Genus Red into two genera. For example, assume each red branch corresponded to a subgenus of Genus Red. Here we could conclude that each subgenus is monophyletic, but they don't belong together and need to be considered different genera. Various studies have in fact found this to be the case with subgenera of a given genus.

Various approaches are possible, depending on where you cut the branches. But it shows how the decision to keep one genus may impact another. You can only keep Genus Blue as it is by dividing Genus Red into two genera. You can only keep Genus Red together by including Genus Blue. Again different botanists might take different approaches, or might again feel more studies were needed before proposing anything.

Finally, there is no rule as to what is a genus or a subgenus, as long as they are clades. If you decided the bottom red branch is a genus, there is no requirement that the branch above it be cut in the same place so that the blue and other red species are lumped into a single genus.