Let's talk pure science!

Metallurgy:

Michael Miller of Reality Magazine recently stated that gold is still the gold standard for crowns! Casting alloys still remain the gold standard for the principal material for fixed prosthetic restorations in the mouth due to great biologic compatibility, wear characteristics, strength and flex. We call them yellow or white but those are misnomers. You can't equate color with anything but whether you or the patient likes one over the other based on yellow or silver gray/green.

We rely on manufacturers and product testers to get our info on what we prescribe or order for our bridges. Grain size, phase structure, hardness, strength, shrinkage, corrosion, solderability, acceptance of porcelain or other tooth colored materials for bonding, galvanic action, leaving a metallic taste, inflammatory or allergic potentials, and even vapor release are our concerns. Yet we must draw a bottom line and accept what THEY say about all those things. Experience helps but you don't want to be the first to experience the bad effects of a new or old metal. In considering all this, I parenthetically must say "we dentists must be and should be patient with our lab technicians due to the myriad of technical considerations they face to produce our product that works as we expect it to."

A brief explanation of classes of alloys is indicated here. Classified by composition, there are three categories: High noble, noble, and predominately base-metal. That's composition. High noble is at least 40% gold and 60% gold, palladium and platinum. Noble alloys must have at least 25% by weight noble metal but no requirement for gold. Predominately base alloy is less than 25% gold, palladium and platinum but no other specification on metal composition.

Another classification is based on physical strength (yield strength and elongation): soft, medium, hard, and very hard i.e. in order; Gold Foil, Inlays, Full Crowns, Partials.

The predominately base-metal alloys can be grouped into another golfer's foursome: nickel, chromium, beryllium #I, Nickel-chromium #II, Nickel High Chromium #III, and Cobalt-chromium #IV. An example of each is that we use in dentistry is found in I and IV.

I.	II.	III.	IV.
Rexillium III & Cirrus Premium			Vitallium & Nobillium

Lab Procedures:

Non-precious metal is essential to success, ie. Cirrus Premium Non-Precious Alloy containing Beryllium(Cirrus is identical to the old Rexillium III). Beryllium is critical to successful etching. Beryllium is an ultra-thin oxide coating and makes the alloy fluid in casting, and holds down excessive oxides from Nickel, keeping other bad oxides away. 1.8% Be; Ni 76% CR12% MO4.5% other 5.7%. You must validate periodically that the lab is actually using your chosen metal, following exact handling techniques, every time sand blasting the metal wing interiors, blocking out the polished exterior wing/rest surfaces, and placing the met-etch material on ALL of the to be bonded to enamel surfaces of metal. Met-etch is an acid etching gel that contains 10% Hydrochloric acid and 4% Nitric acids. Some recommend 10 minutes of etch, but up to 20-25 minutes is best. I even ask my lab to double etch to make sure it is adequate. You actually etch long enough until the ultra-light yellow colored gel changes to a green color, dark green. I'm told you cannot over etch that way. Block out material can be a neutral gel like Etch Guard, glycerin, or wax. They must rinse both the etch and block out material and make sure all is removed. I'm told the Met Etch works fine without block out. Met Etch stays where it is put and doesn't run. The bridge is then placed in a distilled H_2O bath or 96% isopropanol for 3 minutes in an ultrasonic cleaner. Then air dry with a hair dryer for 3 minutes. Properly done, the bond to metal can be 7 times that to enamel. For etching porcelain, a 9.5% Hydrofluoric acid thick gel called "Ceram-Etch" can be used. Silane on porcelain causes the surface tension to break and allows lumps of silica particles for bonding material to attach to the porcelain. Zirconia is probably not etchable yet.

Our necessary metal Beryllium is used primarily to lower the melting range of the alloy to the point that gypsum-bonded investments can be used for casting. It causes lots of corrosion but that is what allows us to bond to tooth. So we need it. Everybody knows people can be allergic to nickel (maybe 10-20% of the population) so chrome-cobalt is used instead. Surprise, cobalt is the second most common metal allergen. So we need to rule out allergy to nickel and cobalt before sending our Rx to the lab. Allergies to palladium and gold have been reported. Clinical signs in patients with nickel allergies include a burning sensation in the mouth, a metallic taste, inflamed gums, and anomalies on the tongue. The Ident alloy system helps us. Ask the lab to tell you what is going to be in your bridge and get the sticker from them to put on your patient's chart (record). Put it in a prominent place in case someone calls you and wants to know if their allergy is to your bridge metal! Remember, long span bridges require the highest modulus of elasticity, especially if you're putting porcelain on it. Don't forget the tooth is made of enamel rods that are stacked together and can flex as well as dentinal tubules that are

flexible. So the tooth can move and flex some if not totally wrapped. That is why design of the wings are so important as they grasp those rods and tubules with a flexible metal and sticky bonding. Some mobility of the tooth is good but too much hurts. It has been proposed that non-rigid attachments can help us keep them on and in. I have not done any. Debonding of the metal is our main problem and concern. For long 4+ unit spans we can consider using a non-rigid connector between one abutment and pontic to allow independent movement of abutment. I call them Stress Breaker Maryland Bridges with simple occlusal rests that are not cemented nor bonded to that one abutment. Cantilevering is a viable option that is increasing in success and utility.