

## Brain Storming:

### 1. Swim issues

- a. Snorkels
- b. Shoulder issues from free pull (future injuries)
- c. Questions? (how can swimmers improve/learn freestyle to stop shoulder injuries in the future)
- d. How is blonde hair affected by different chemicals in water?

### 2. Running issues

- a. Any injury below hip level (shin splints, knee problems, sore hips, etc.)

**Main Idea:** Take blonde hair separate into 8 groups and then in 8 containers add 50 Millimeters of fluid, container 1-4 will have pure hair and container 5-8 will have \_\_\_\_ hair. Container 1 hair will not be washed, Container 2 hair will have been washed with dove (type of shampoo) twice a week, Container 3 hair will have Tri Hub (swim shampoo), and Container 4 hair will be rinsed 2 a week too. The same procedure will be done for 5-8 containers.

#### Procedure:

1. Take 60 strands of pure hair (A) and separate it into 8 petri dishes. 15 strands in each dish.
2. Take 60 strands of \_\_\_\_\_ hair (B) and separate into 8 petri dishes. 15 strands in each dish.
3. Add 40 millimeters of chlorinated-salt water in each petri dish
4. Dish 1A will not be touched
5. Dish 1B will not be touched
6. Dish 2A will be washed with 1tsp of Dove Volume and Fullness hair twice a week.
7. Dish 2B will be washed with 1tsp of Dove Volume and Fullness hair twice a week.
8. Dish 3A will be washed with 1tsp of Tri swim chlorine removal shampoo twice a week.
9. Dish 3B will be washed with 1tsp of Tri swim chlorine removal shampoo twice a week.
10. Dish 4A will be rinsed with shower water twice a week.
11. Dish 4B will be rinsed with shower water twice a week.

Repeat the same procedure for the second time.

**Hypothesis:** We believe that blonde hair will be negatively affected by the presence of chlorine or salt water. Having swam most of our lives, we both have witnessed hair damage with other swimmers and discoloration. However we have not noticed any true signs of damage other than complaints, and we think that if this was put into an experiment it would definitely show a negative impact on blonde human hair.

**Rough draft of question:** How can chlorine and salt water affect blonde hair colour? and How can we make a shampoo that would allow hair to withstand the original color without discoloration/negative impact from the chemicals?

Supplies: Autoclavable 10 Packs Sterile Thick Plastic Petri Dishes with Lid, Vabiooth 90mm Dia x 15mm Deep Clear 3 Vents Petri Dish for Lab Science Experiment, Non-Fragile, Scratch-Resistant : Amazon.ca: Industrial & Scientific, 8 samples of human/horse hair, chlorine sample (we will collect this at our facility), salt water sample (collect this at canyon meadows pool), shampoo (this will be decided from survey results), our shampoo sample, microscope (supplied by school),

#### **Ruff draft of our shampoo;**

chelating agents (EDTA, sodium thiosulfate) to bind and remove chlorine/minerals, antioxidants (Vitamin C) to neutralize chemicals, and moisturizers (Aloe Vera, Panthenol, oils) to rehydrate hair stripped by pool water.

Though these are basic ingredients we will add more moisture to ours.

#### **Questions for Rebbeca Smith:**

- Through your many years of swimming have you noticed any impact on your hair (texture, colour, health)?
- What have you used in the past to try and reduce the effects of the chlorine?
- Have you tried the chlorine clarifying shampoo? If so, did you notice positive or negative effects from it?

#### **Answers:**

1.) The biggest impact on my hair I noticed was I had bad split ends, so I did get trim hair cuts often. As far as texture it would be pretty rough. I noticed that when I had a couple weeks off in August during the year that my hair would be so much more vibrant and smooth because my hair wasn't in the chlorine all the time. As far as colour, I didn't notice a huge difference personally as I never dyed my hair. Hair never turned green or anything. I washed my hair almost everyday so I think that helped keep my colour and hair healthy as best I could.

2.) to try and reduce the effects of chlorine I would wash my hair almost everyday, definitely before bed, even if it was just shampoo and no conditioner so I could stay on top of getting the chlorine out of my hair. And if I didn't have time, I found even just rinsing my hair super quick after practice helped so it wouldn't be so stale and crusty. Also brushing my hair after was a huge one. Some people that's difficult with naturally curly hair but for mine I found it was able to dry so much better, keeping my hair healthy with no knots.

I would also use a hair mask sometimes, not all the time because it can be quite slippery with the cap but on weekends when I had 1.5-2days off I would do this.

3.) I actually have never used chlorine clarifying shampoo before. But I did use purple shampoo every now and then alternating with regular shampoo at home with my blonde hair. Not sure if this actually did anything but I always got comments on how my colour stayed such a nice blonde throughout my career so maybe that did play a role.

But the biggest thing I would say that kept my hair pretty healthy throughout my career was just washing it almost everyday as best I could.

### Survey:

<https://docs.google.com/forms/d/e/1FAIpQLSehJNjMdjmB9gBlbLrbTR5hDuZDAFY6sIRA2p2kNAQS-SpcJg/viewform?usp=header>

### Research Questions:

What is the Genetic Make up of Different Types of Hair?

- Brown/black hair and blonde/red hair does not have the same genetic make up because of how brown hair is usually caused by the presence of eumelanin (makes darker skin, eyes, and hair) where as blonde hair is caused by the presence of pheomelanin (lighter hair causes lighter colours also bind to metal ions and potentially influence their distribution and availability within the body).

What Shampoos do most swimmers use on their hair?

In our survey there were a variety of results on what type of shampoo the participants used. Though we concluded that Dove shampoo was the most generic and commonly used for not only athletes but people all around the globe.

What substances can positively impact hair color?

From a dietary intake perspective, substances like lean proteins, foods high in omega-3s, eggs, whole grains, leafy greens, and fruits and vegetables high in vitamin-c. These food categories will not only help restore broken hair but can impact your body as a whole positively.

**Lean proteins:** Lean proteins like chicken, beef, and fish provide a high amount of iron and protein. This is essential for everyday life because of its long chains of amino acids. This is beneficial for your teeth and nails as well because of its benefits for keratin supply.

**Foods high in omega-3:** Examples of foods high in omega three include fatty fishes like salmon, mackerel, and herring. These foods have anti-inflammatory properties reducing oxidative stress. “Oxidative stress occurs when molecules called free radicals damage cells in your body.” says

registered dietitian Michelle Dodd, RD, LD. “This damage can affect any part of your body, including hair follicles.”

**Eggs:** Specifically egg yolks (not the whites) are high in Biotin. This B vitamin advances keratin abundances. One study done by the National Library of medicine shows us that there is a direct connection to biotin levels and hair loss, but other studies have yet to prove that biotin levels are directly connected to hair growth (This may be the case but biotin does affect hair loss).

**Whole grains:** Whole grain has a substance called selenium which helps maintain your thyroid glands healthy. “Thyroid disease can cause your hair to become brittle and fall out,” says Michelle Dodd. But people who have absent thyroid issues can still intake foods with selenium to prompt hair growth.

**Leafy greens:** Leafy greens such as spinach, lettuce, kale, etc. have high amounts of vitamin-A. “This fat-soluble vitamin helps make sebum, the oily substance that moisturizes your scalp and keeps hair healthy,” shares Michelle Dodd. “A vitamin A deficiency can cause a dry, scaly scalp and poor hair growth.”

**Fruits and vegetables high in vitamin-C:** Your body needs vitamin-C and collagen to properly function on a daily basis. These substances straighten your hair so it becomes less prone to become straw like and break. “This water-soluble vitamin acts as an antioxidant to minimize inflammation that affects hair growth and leads to hair loss,” says Michelle Dodd.

Though all of these foods can impact your hair positively it doesn't have a huge impact on hair that is exposed to chemicals.

Can the age of hair impact its ability to withstand color damage?

Why did we choose to use blonde hair during our experiment?

What is Hair?

Even though there are multiple genetic make up for different colors of hair we believed that blonde hair would show the most amount of colour change due to its light color. Blonde hair is also more prone to breakage and damage especially when exposed to harsh chemicals like chlorine for prolonged periods of time.

Hair is a protein filament ( a long chain of proteins). It grows in a sac called the follicle of skin cells in the middle layer of skin. The surface of hair is mostly made up (65-95%) of fibrous protein (types of protein).

The structure of hair is a lot more complicated. The outer layer of the hair itself is called the **Cuticle**, it contains overlapping dead cells that protect the inner layers. The second layer is the **Cortex**. The cortex is the thickest part of the hair. This part contains the most pigment (the part that shows the hair colour). The next aspect of human hair is the **Cortex Cells**. The Cortex Cells are the cells that make up the cortex. The cells are tightly packed together and have Melanin granules inside of them. These cells are responsible for the hair's shape/texture. The final part of the hair is the **Medulla**. This is the innermost layer of the hair. The exact function is unclear.

How does bleaching your hair affect its health?

Bleaching overall is negative for your hair's health. The bleach penetrates into the follicles and strips them of your natural colour. This changes the structural integrity of your hair. It becomes weak and the strands break easily. The bleach also strips the melanin from your hair. There are two main types of chemicals in bleach that do this, ammonia and hydrogen peroxide. Many people think the risk is small, however bleaching your hair more than once is terrible for its health.

Is there any other chemical that can be used as a substitute for chlorine/salt water?

There are many different options to not using chlorinated - salt water as a disinfectant for pools. This includes:

- Ozone Pools - This method uses ozone gas, that is put into the pool water. The gas kills all bacteria, viruses, etc. The ozone gas then turns into oxygen. Ozone pools are a very environmentally friendly choice.
- UV Pool Systems - This system harnesses Ultraviolet Light to disrupt the D.N.A of the pathogens (bacteria, etc) in the pool. This stops them from multiplying. However UV pool systems do not eliminate all pathogens.

There are many other options. But these two are the main ones being used today.

How does your hair type (thick/thin, curly versus straight) affect the impact of chemicals on it?

Blonde hair, along with greying hair are more prone to getting damage from UVB radiation (the sun's rays). Coily hair, especially type 4C, can shrink and break from nearly all chemicals. Hair types 1A, 1B, and 1C are also susceptible to certain types of chemicals.

What shampoo products are already made to prevent hair damage from chemicals?

Already there are so many different shampoo brands available to prevent hair damage from pool chemicals. However between the two of us, we've noticed none of them seem to work. Here is a list of the top names:

1. SoCozy Kids Swim 3-in-1
2. Ultra Swim Chlorine Removal
3. Paul Mitchell Shampoo Three
4. Malibu C Wellness Kit
5. Fairy tales Swim Shampoo

All of these products promise soft, silky, healthy hair after usage.

#### Questions for Interview with Hairstylist:

1. Do you have many clients that swim in a chlorinated - salt water pool? If so, have you noticed any signs of damage from the pool water?
2. Do you find that blonde hair is more prone to chemical damage?
3. What products do you choose to use when dealing with a client with dry or brittle hair?
4. What substances that are in commonly used shampoos can potentially be damaging to hair?
5. Does chlorine clarifying shampoo really work? If so what changes might you add to allow it to moisturize your hair more?
6. Personally, have you noticed any impact on your hair when exposed to chlorine?
7. What type of chemicals has the blonde hair gone through? (hair that you gave us)

### Deadlines (can be changed):

- ~~November tenth—research is done, supplies have been bought/are being bought, survey with swimmers is finished (results and things have been bought), interview with hairstylist is done as well.~~
- ~~November fifteenth—the hair is collected, and we have all materials to start prepping for the experiment.~~
- ~~November twenty-first—start the experiment~~
- ~~December twenty-ninth—experiment is complete (unless it needs two more weeks TBD).~~

**Sources:**

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