

# THE SCIENCE OF TATTOOS

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difficult to break apart as they absorb only specific and limited frequencies of light.

(7) The removal process is expensive, takes a long time, and comes with its own side effects. Laser removal can take more than 12 laser sessions depending on the tattoo and how a person's body responds to the treatments. Each session requires a recovery phase of 4-6 weeks, for the skin to respond and heal, before the next session can begin. Thus, the total time required to remove some tattoos can take over a year. Even then there still might be a ghost image left. For people with darker skin, they also risk hypopigmentation (loss of natural skin pigment) in the area that's treated with lasers. This is because the lasers can accidentally

target some of the dark natural pigments in the skin (e.g. melanin) and destroy them. Tattoos further away from the heart are also harder to remove because circulation is poorer.

(8) There is some controversy over the tattoo inks used as their safety is not tightly regulated. Many of the colored inks use toxic heavy metals to increase their stability. For example, mercury is found in red inks and lead is found in yellow, green and white inks. These heavy metals can cause issues if a person needs an MRI (magnetic resonance imaging) to locate tumors or other diseases in the body. Since MRIs use very strong magnets, sometimes heavy metals in tattoos can respond by heating up and causing burns in the tattooed area.

## Article Questions

- 1) Why is the epidermis a bad location to place the tattoo ink?  
*The cells of the epidermis shed very easily at a rate of 30 000 to 40 000 cells an hour. Any ink found in this layer would be removed within a month at this rate of shedding. (3)*
- 2) Why don't macrophages get rid of all of the tattoo ink?  
*Most of the ink particles are too large for the macrophages to engulf and get rid of, so much of the ink cannot be easily engulfed and carried away by macrophages. (4)*
- 3) Why does a tattoo begin to lose its sharp lines as time goes by?  
*Macrophages constantly attack the ink throughout a person's lifetime causing the ink to disperse and be removed over time which causes fading. (4 & 5)*
- 4) How do lasers help remove tattoos?  
*They use intense pulses of light to fracture ink particles into smaller bits which are easier for the macrophages to engulf and dispose of. (6)*
- 5) In paragraph 7, the last sentence states, "Tattoos further away from the heart are also harder to remove because circulation is poorer." Why do you think this makes tattoos harder to remove using laser removal techniques?  
*Areas with poorer circulation will have a more difficult time circulating the macrophages which are vital to removing the ink particles which have been broken apart by the laser. (7)*
- 6) How might the heavy metals used in inks become a health concern when trying to remove tattoos using laser?  
*When the lasers break apart the pigments, they become easier to circulate within the body through the transport action of the macrophages. This also means that the toxic heavy metals that were trapped in the dermal area of the skin are now readily circulated throughout the body. There may be a concern about the long-term health effects of this type of heavy metal exposure after the laser removal treatment. (8)*