Apply directly to the forehead: Holmes, Nana, and hennapecia

There is nothing men will not do, there is nothing they have not done, to recover their health. . . They have submitted to be half-drowned in water, and half-choked with gases, to be buried up to their chins in earth, to be seared with hot irons like galley-slaves, to be crimped with knives, like cod-fish, to have needles thrust into their flesh, and bonfires kindled on their skin, to swallow all sorts of abominations, and to pay for all this, as if to be singed and scalded were costly privilege, as if blisters were a blessing, and leeches were a luxury.

Oliver Wendell Holmes, 1871 (1)

BRANDED BY HENNA

Were Dr. Holmes to observe bodily mischief today, he’d still find needles thrust without cause into flesh and bonfires needlessly kindled on the skin. But, nowadays, the injuries are far less likely to be inflicted on the sick in search of health than on the vain in search of fashion. Botox bruises the foreheads of matrons, collagen scars the lips of barflies. Perhaps the broadest practice, however, is the direct application of henna directly to hair and skin. This global assault has produced rock concerts that resemble the coming of age in Samoa and turned South Beach into the South Pacific. Warriors of the NFL sport body tattoos that put Papua to shame, while trendy folk in SoHo flaunt the umbilical baroque. If the Belle Époque was the Age of Gold, ours has become the Age of Tool and Dye.

Yet the medical literature documents that neither body piercing nor henna is all that safe (2, 3). Injuries provoked by cosmetic intrusion spare no age, no gender, no color, no class. Even the very young fall victim, as in a recent new item headlined “SCARRED CHILDREN.”

Michelle Lolk, of River Edge, took her 6-year-old daughter and 8-year-old son to a tattoo shop this past summer for their first-ever temporary tattoos. Young Ethan got a cross on his arm. His sister, Olivia, got a dolphin on her belly. A day later, Olivia complained of severe pain. “It looked like she was branded with a poker,” Lolk said (4).

Skin branding of this sort (bonfires kindled on their skin, as Dr. Holmes might say) is due to acute contact dermatitis induced by henna’s active agent, lawsone (2-hydroxy-1,4-naphthoquinone) and an added ingredient, PPD (para-phenylenediamine). Henna itself is a shrub ( Lawsonia inermis, or Egyptian privet) cultivated in India, Ceylon, and much of North Africa. The dried leaves are mixed with various solvents and applied directly to the skin or hair. PPD is often added to red henna powder to produce the “black henna” preferred for tattoos (5). But PPD also renders the mixture more allergenic and sometimes virulently toxic: à la the 1996 Lancet report “A Woman who Collapsed after Painting her Soles (6).” Temporary henna tattoos—of the sort applied at rock concerts and kiddie festivals—are intended to persist for only a few weeks but the incidence of acute inflammation, permanent scarring, and keloid formation has become epidemic in the last decade and a half (7–9). Pub Med lists only 3 reports of reactions to henna tattoo in the two decades between 1975 and 1995, but 259 papers (!) since 1995. A number of these cases were caused by henna without PPD (10). Hair dyes come in all sorts of proprietary formulations: a recent study from Korea reported that of 15 henna samples tested, PPD, nickel, and cobalt were present in 3, 11, and 4 samples, respectively (5).

Henna has been recognized as an occupational hazard in hair-dressing salons (11); at various doses the dye induces hemolytic anemia in lab animals and humans alike (12); and oral intake of henna produces an acute inflammation of the colon (13). In cell culture assays, lawsone causes cell death and cell cycle arrest in the S phase (14). As might be expected for a redox-dependent naphthaquinone, individuals who lack oxidant...
defenses on a heritable basis, such as those with G-6 PD deficiency, are particularly at risk for Heinz-body hemolytic anemia (15).

In response to injuries caused by “temporary tattoos,” the FDA last year issued a warning against the import of henna preparations containing PPD, but explained that it was powerless to supervise ingredients in “cosmetic samples and products used exclusively by professionals—for example, for application at a salon, or a booth at a fair or boardwalk (16).” So much for the kiddie trade!

HENNAPECIA OBSERVED

While the young are apt to apply henna directly to the skin, folks of a certain age mainly use henna to color their hair. The practice has been common for centuries in every corner of the world. Recently however, France seems to have swept the honors for turning henna into art, as anyone can attest who has strolled through Paris. When the weather turns balmy, the streets are alive in a blaze of henna, offering coiffures in orange, auburn, red, and crimson.

But there may be a real down-side to this display of vegetal finery. Over the years, on Parisian boulevards, in theatres, concert halls, cafés, and flea markets, I’ve observed a peculiar pattern of baldness in the French henna crowd. Women with henna’d hair, if of a certain age, seem almost uniformly to suffer from drastic, central alopecia quite evident at the back of their scalp, and quite noticeable in areas where their hair is parted. As a rheumatologist, I was struck by the difference between what one might call “hennapecia” and the commonly observed hair loss in patients with systemic lupus erythematosus. Nor is the pattern of hennapecia like that of female androgenic alopecia, with “increased thinning over the frontal/parietal scalp, greater density over the occipital scalp, retention of the frontal hairline, and the presence of miniaturized hairs (17).”

Alas, the phenomenon is not limited to France. Although henna’d hair is less common in the U.S., the same pattern seems to rear its ugly head, so to speak. Last fall, at the Pier Antiques Show in New York, where henna is also much in evidence, I observed 42 women (approximate age: >45) with hair overtly dyed with henna. Twenty-nine had clear signs of hennapecia. As control, I observed 36 “blond” women, presumably due to peroxide, of the same age: only five had similar areas of hair loss. In both groups, the incidence of exposed, undyed roots was pretty much the same.

Ever since Lewis Thomas and I consistently produced hair loss in rabbits given excess doses of vitamin A (18), I have been intrigued by alopecia induced in lab animals and humans by retinoids and/or similar, resonating ring structures. These have been associated with redox-induced changes in the hair growth cycle (19). Lawson and PPD are clearly involved in redox cycling with free radical formation, and there is good reason to believe that oxidative stress is involved both in graying and hair loss. This sequence was worked out by Arck and colleagues and reported in The FASEB Journal last July. Entitled “Towards a ‘free radical theory of graying’,” their paper concluded that “oxidative stress is high in hair follicle melanocytes and leads to their selective premature aging and apoptosis (20).”

Whatever be the cause of hennapecia, it cannot be due to acute inflammation or contact dermatitis: the many scalps I’ve observed, albeit at a distance, seem to have been un-inflamed. It is, of course, entirely possible that woman prone to one or another type of apoptotic alopecia have a unique recourse to henna, but my guess would be that the striking correlation between henna and hair loss puts the onus of alopecia on the dye and/or its additives.

It’s clear that to settle the point, we need experimentation, not simple observation.

ZOLA’S EXPERIMENT: NANA

The distinction between experiment and observation was spelled out for the general reader by Emile Zola (1840–1902), and brought to mind by a lurid postage stamp issued by the French Postal Service in 2003. Few of the eager philatelists who snapped it up at first issue knew that the image was a poor caricature of a Manet portrait of Lucie Delabigne, the red-headed courtesan who became Zola’s fictional “Nana.” Fewer still might have known that they were collecting a piece of scientific, as well as social history. We can thank Claude Bernard, a founder of experimental biology and medicine, not only for FASEB, but for “Nana” as well.

Emile Zola’s 1880 novel, Nana, was a landmark of naturalist fiction, and overtly based on methods spelled out in Claude Bernard’s Introduction à La Médecine...
Expérimentale (1865) In his Le Roman Experimental (also published in 1880), Zola declared that
Claude Bernard . . . explains the differences which exist between the sciences of observation and the sciences of experiment. He concludes, finally, that experiment is but provoked observation. All experimental reasoning is based on doubt, for the experimentalist should have no preconceived idea, in the face of nature, and should always retain his liberty of thought . . . The essence of the higher organism is set in an internal and perfected environment [inherited characteristics] endowed with constant physicochemical properties exactly like the external environment; hence there is an absolute determinism in the existing conditions of natural phenomena (21).

Zola assigned Nana a constant internal milieu, the “inherited characteristics” of a feral, manipulativecourtesan. He then exposed his heroine to a variety of ligands, (journalists, bankers, actors, gentry, tycoons), varied the strength of the buffer (theaters, garrets, hotels, mansions) and changed the ambient oxygen tension (age, war, disease, death). He then recorded the results of these interactions “true to life” in the laboratory notebook of his naturalist novel.

Zola introduces Nana at time zero of his experiment. In her first appearance on stage, she is clad only in a diaphanous, see-through gown:
Applause burst forth on all sides. In the twinkling of an eye she had turned on her heel and was going up the stage, presenting the nape of her neck to the spectators’ gaze, a neck where the golden red hair showed like some animal’s fell. Then the plaudits became frantic (22).

The experiment proceeds and her nature (feral, manipulative) remains constant; only the ligands and buffers change; the lovers and venues vary. At the book’s end, after she has been exposed to a repertoire of oxidative stress (age, disease, death), Nana dies of syphilis. A bellicose crowd marches under her windows at the Grand Hotel screaming “On to Berlin” as the Franco-Prussian war begins. Nana fades away, along with the Second Empire of Napoleon III: “On the bed lay stretched a gray mass, but only the ruddy chignon was distinguishable and a pale blotch which might be the face (22).”

Zola described the faith of a 19th century realist, in a passage that remains as pertinent to experimental biology as to the art of the novelist:
The novelist is equally an observer and an experimentalist. The observer in him gives the facts as he has observed them . . . then the experimentalist appears and introduces an experiment, that is to say, sets his characters going in a certain story so as to show . . . the machinery of his intellectual and sensory manifestations, under the influences of heredity and environment, such as physiology shall give them to us (21).”

Perhaps that’s the machinery novels would be exposing, had novelists remained in touch with experimental science. And perhaps the FDA might send people to watch the influence of heredity and the environment on henna applied directly to the forehead.

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