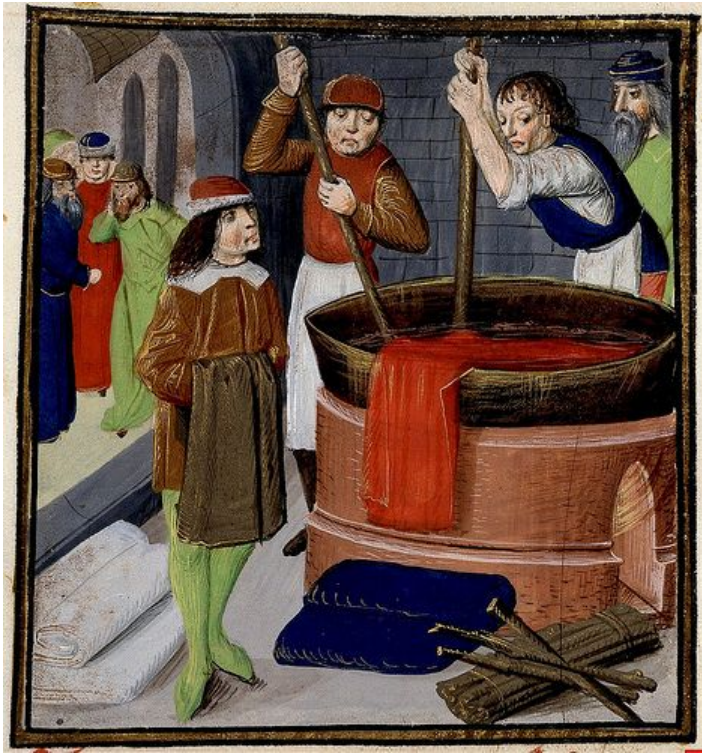


RAV NACHUM RABINOVITCH AND THE ART OF ANCIENT DYEING

By **Baruch Stermán** - November 12, 2020



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"The Worst Jobs in History," a lesser-known but very entertaining BBC series, ran sporadically from 2004 to 2006. Just as it sounds, it was an engaging presentation of some of the truly repulsive career choices made throughout the ages. One of the most highly rated episodes—which suggests that this job falls somewhere near the top of the unfortunate list—describes the ancient profession of sea snail-dyeing. The show features an interview with a certain John Edmonds who, dressed in medieval garb, demonstrates the steps involved in the dyeing process. We watch as he smashes the snails with a hammer, ferments their putrefied dye glands in a murky chemical concoction, tastes a sample of the rancid mixture to test its readiness, and finally, under incredibly malodorous conditions, dips a tuft of wool into the dye. The beautiful color, which slowly appears before our eyes, belies its disagreeable origins. Rav Nachum Rabinovitch zt"l, *Rosh Yeshiva* of *Yeshivat Ma'aleh Adumim*, was undoubtedly unaware of the part he played in the making of that memorable episode. But first, let me back up a bit.

Lustrous dyes obtained from snails living in the Mediterranean Sea and the fabrics dyed with them were once the cornerstone of the economy in the ancient Near East. Merchants greedily viewed them through the lens of financial opportunity, and buyers saw them as symbols of status and opulence. But to the Jews, however, they were to be sanctified, particularly the sky-blue wool known in the Bible as *tekhelet*. It adorned the Temple walls and curtains, comprised the clothes of the High Priest, and, of course, a thread of *tekhelet* was worn by Jews as a reminder of their holiness and spiritual responsibility. At some point around the seventh century CE, however, due in part to war, persecution, and the vagaries of history, knowledge of the process of the manufacture of *tekhelet*, and the secrets of obtaining – or even identifying – its marine source, slipped into obscurity. The verse in Numbers, "Let them attach a cord of *tekhelet* to the fringe (*tzitzit*) at each corner" (15:38), continued to be recited daily by Jews in the *Shema* prayer. But it was transformed from a practical directive—which the Talmud describes as equal in import to all the other commandments (*Menahot* 43b)—to a reference to an arcane *mitzvah* to be reinstated in the distant future, perhaps only in messianic times.

Modern investigation into *tekhelet* and the *hillazon* (the Talmudic term for the marine creature), both secular and Jewish, has been ongoing for over 200 years. Most notable among the Jewish scholars were the attempts in the late 1800s of the iconoclastic Hasidic Rebbe, R. Gershon Henokh Leiner of Radzyn, to reestablish the *mitzvah* of *tekhelet*, as well as the comprehensive research of Rav Yitzhak Isaac ha-Levi Herzog. Rav Herzog, a brilliant Talmudic scholar and polymath—who would later become the first Chief Rabbi of the State of Israel—wrote his doctorate on the subject of “Hebrew Porphyrology,” a term he coined to describe the study of the ancient purple and blue dyes. This masterful work, completed in 1914 and still an important source today, delves deeply into all aspects of the topic from *Halakhah* to archaeology, chemistry, marine biology, philology, and more. Efforts notwithstanding, however, the mystery of *tekhelet* and the *hillazon* remained intractable.

About 35 years ago, Israeli researchers discovered that at a very specific stage in the snail-dyeing process, exposure to sunlight, would yield the desired sky-blue color which had so eluded previous investigation. This scientific breakthrough made possible the identification of the authentic *hillazon* as the *murex trunculus* sea snail and revealed the method of using it to yield the azure hue as maintained by Jewish tradition. Rav Eliyahu Tavger of Jerusalem applied that newfound information, and in 1987 he succeeded—through much trial and error—in dyeing the first *tekhelet* strings in over 1,300 years. “*Ptil Tekhelet*” was founded shortly thereafter by Rav Tavger, Joel Guberman, Ari Greenspan, and myself, with the goal of making *murex*-dyed *tekhelet* strings available to all. My background in science and engineering proved valuable in bringing the processes for manufacturing *tekhelet* strings up to a modern industrial level that would allow for mass production. Gradually, Rabbis and lay people became aware of our organization and the reasoning which leads to the identification of the *hillazon* as the *murex*. As a result, many began to wear *tekhelet* strings on their *tzitzit* and *tallit*. Prominent *poskim* (such as Rabbi Zalman Nechemia Goldberg, zt”l, Rabbi Yisroel Belsky, zt”l, and Rabbi Hershel Schachter, *yibadel le-hayyim arukhim*) were among the earliest—and most enthusiastic—adopters.

From early on, Rav Nahum Rabinovitch was aware of our work but was quite skeptical and hesitant to accept the new *tekhelet* as authentic. Joel Guberman, who lived close to Rav Rabinovitch’s yeshiva, would engage him regularly in discussion about the topic, but he was met with an interesting challenge from the Rav. All the current researchers, he argued, used modern techniques and modern chemistry. How could one be sure that in ancient times, it was possible to dye with the *murex* in general and to get the snails to dye sky-blue in particular? Could we dye *tekhelet* using only means that were available to the dyers of old? To be sure, from a halakhic perspective, Rav Rabinovitch had no problem using modern chemicals and processes. Many ritual objects (including *kelaf* and *tefillin*) are manufactured today using updated techniques and ingredients that are very different from those employed by previous generations. However, Rav Rabinovitch maintained, it required demonstration that it was possible to obtain sky-blue *tekhelet* from the *murex* using methods that were available in ancient times. If that could be shown, modern techniques could be used thereafter without any problem.

Enter John Edmonds. Through a series of unlikely events, our organization became aware of Edmonds’s work with dyes. He was a retired engineer whose hobby was studying medieval crafts. He also volunteered at the Chiltern Open Air Museum, a lovely, family-friendly place on the outskirts of London with the tagline, “*Where buildings come alive through history.*” John (dressed in appropriate costume) would demonstrate crafts as they were carried out in earlier times, and his forte was dyeing wool with *Isatis tinctoria*, commonly known as woad. Woad is a plant that produces blue indigo dye and was known to the Talmud as *isatis* – one of the fraudulent sources of *tekhelet* (along with *Kala ilan*, another plant-based indigo) passed off as authentic by unscrupulous dealers. The dye molecules obtained from the *Murex* are closely related structurally to indigo, and their chemistry is likewise similar. They both belong to a class called “vat dyes.” In order for them to bond with fabrics, vat dyes need to be dissolved in water through a process called “reduction.” Only then can the wool or cotton be dipped into the resulting solution. Once the dyes are thoroughly absorbed, they undergo the reverse process called “oxidation” to return the molecules to their original state. This exacting procedure results in extremely colorfast and durable colored textiles. All this is well known to modern chemistry, but in ancient times the methods used to dye plants were completely dissimilar to those used for sea snails. While indigo dyeing has been practiced continually since antiquity, *murex* dyeing ended abruptly and the associated know-how was lost. Due to the fact that Edmonds had vast experience with dyeing plant-based indigo, Joel reached out to him and asked if he could determine how sea snails might have been used to dye in ancient times. Challenge accepted, John began to research the matter.

Using the vague and often ambiguous 2,000-year-old descriptions of snail-dyeing provided by Roman naturalist Pliny the Elder, Edmonds eventually came to realize that the “natural” process for dyeing that was employed back then was based on fermentation. The key was to create conditions for bacteria of the *Clostridia* class, which are found on the snail meat, to thrive. Wood ash or stale urine would have been used in ancient times to create the basic environment with a pH between 8.5 and 9 that was necessary for fermentation to take place. Pliny mentions adding salt, which John did as well, realizing that this served to keep competing bacteria at bay. Edmonds placed this heady brew into a warm bath and heated it to a moderate temperature for a week or two to optimize the fermentation process. In fact, this recipe dovetails well with the somewhat laconic description of the dyeing process used by Jewish

tekhelet dyers in Israel as reported by Rav Shmuel bar Yehuda to Abaye upon his arrival in Bavel: "How do you dye *tekhelet*? . . . We take the secretion from the *hillazon* and various herbs, put it in a pot, and heat it all up." (*Menahot* 42b). John's experiments proved successful, and it was the discovery of this unsavory process which ultimately led to his starring role on the BBC program.

The results of Edmonds's experiments were immediately shared with Rav Rabinovitch, who remained skeptical. With all due respect to John Edmonds, he pointed out, the information obtained and data provided were hardly up to the scientific standards of peer-reviewed observation and reporting. Furthermore, good scientific experimentation must be replicable. Even if that meant pushing off a decision regarding *tekhelet*, he gently quipped, "We waited over a thousand years; we can wait a bit longer." And so, undeterred, we continued our efforts and experimentations, eventually enlisting the help of Dr. Roy Hoffman (a former student of Rav Rabinovitch) of the Department of Chemistry at the Hebrew University of Jerusalem. With our assistance, he carried out the process under laboratory conditions with precise measurements (leading to an article that can be found [here](#)). Once Rav Rabinovitch saw these results, he accepted the fact that the means and methods of *murex*-based *tekhelet* dyeing were indeed available to the ancients. It was only a short while later that Rav Rabinovitch himself began to wear *tekhelet* strings on his *tzitzit*. His innate humility, however, which was evident even as he pushed us harder, prevented him from advertising his position. With characteristic respect for personal autonomy with regard to halakhic decisions,^[1] he encouraged his students to come to their own conclusions based on their own careful investigation.

This episode highlights a number of the attributes of Rav Rabinovitch's personality that made him the great leader, *posek*, thinker, and teacher of so many. His skepticism was hardly the result of a disparaging attitude toward secular scientific thought—quite the opposite. He was thoroughly aware of modern scientific methodology, including the pitfalls of amateur experimentation. In order to allow "scientific proof" into his halakhic *pesak*, he demanded that it be of the highest quality. If it did meet his standards, however, he would accept the ramifications and absolutely incorporate it into his thinking and practice. He was a man of truth, uncompromising in his search for it yet ready to bow before it once convinced. Over the years, we have met many Rabbis who have accepted *murex tekhelet* as authentic; but, for one reason or another, they feel that they cannot acknowledge that fact and certainly will not wear it. Rav Rabinovitch, once convinced, let no extraneous considerations deter him from doing what he believed was correct.

This same adamant quest for truth and demand for the highest standard when it came to science is evident in his *piskei Halakhah* in other areas as well. Jewish Law as it pertains to electricity (its use on Shabbat in particular) is complicated, and any attempt to find precedent in Talmudic discourse will necessarily rely on comparison of context or analogy of principles. Without a deep, fundamental understanding of the nature of electricity, circuits, and the physical processes that generate heat, light and force, comparison to cases that arose in a world before electricity can be flawed, inaccurate, or imprecise. As someone with a doctorate in Quantum Optics, I have often been frustrated when reading *teshuvot* dealing with modern LED lighting or wireless technology, for example. The approach taken by Rav Rabinovitch in collaboration with students of his who have become experts in the field (particularly Prof. Dror Fixler of Bar Ilan University), however, relies on a thorough knowledge of the relevant physics. Whether or not one agrees with their practical decisions, there is no question that they are based not only on a comprehensive grasp of all halakhic issues related to the topic but also on a profound understanding of the underlying scientific principles of the reality in question.

From a halakhic perspective, dyeing according to the ancient recipe discovered by Edmonds would have made things much simpler—though extremely less efficient and certainly unrealistic for mass production. The reintroduction of *tekhelet* into practice using modern techniques has complicated matters, raising issues similar to those relating to electricity on Shabbat. The requirement that an action be performed "with intent" factors into what is prohibited on Shabbat (termed *melekhet mahshevet*, or "thoughtful activity"). In the same way, there is a requirement when dyeing *tekhelet* and manufacturing *tzitzit* that it be done with the express purpose of the *mitzvah* in mind (*lishmah*). Furthermore, the definition of what is considered a person's direct force (*koah gavra*) is likewise an issue that comes into play both with respect to Shabbat and *tekhelet*, since both the violation of Shabbat and the production of kosher *tekhelet* require a direct human act. Can one open a window that leads to extinguishing a candle on Shabbat, and can one open a valve that leads to a flow of *tekhelet* dye through the wool? Indeed, principles derived from *hilkhot Shabbat*, an area deeply studied and well traversed, can shed light on problems relating to the uncharted halakhic territory of *tekhelet*-dyeing. Questions regarding the use of an electric pump or introducing ultrasonic probes into the bath in order to increase penetration and adherence of the dye, for example, are being asked for the first time in halakhic history. *Poskim* like Rav Rabinovitch have sought from us the relevant scientific background and engineering details so that the fundamental physical reality can be completely understood before determining the permissibility of such innovative techniques.

There is one final point I take away from our encounters with Rav Rabinovitch. In our attempts to revive the lost *mitzvah* of *tekhelet*, in some cases, the perceived challenge to tradition has led detractors to respond with cynicism and even derision. Rav Rabinovitch's

rejection of our original endeavors did not come from a negative place and was not taken as such. Rav Rabinovitch simply wanted us to meet higher standards, and eventually we did. Through the behind-the-scenes part he played in the discovery of the ancient methods and means of the job deemed "history's worst," we continue to be inspired by Rav Rabinovitch to strive to achieve our absolute best.

Yehi Zikhro Barukh.

^[1] See [David Silverstein's article](#) on this site.



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