

## Topics in Perek Hatecheiles

### Daf Yomi, Menachos Perek 4

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#### *Techeiles Revisited* Rabbi Berel Wein

One of the enduring mysteries of Jewish life following the exile of the Jews from the Land of Israel was the disappearance of the observance of including a string of *techeiles* in the *tzitzis* garment that Jews wore. *Techeiles* was known to be of a royal blue color while the other strings of the *tzitzis* were white in color. Not only did Jews stop wearing *techeiles* – they apparently even forgot how it was once manufactured. The Talmud identified *techeiles* as being produced from the “blood” of a sea creature called *chilazon*. And though the Talmud did specify certain traits and identifying characteristics belonging to the *chilazon*, that description was never specific enough for later generations of Jews to unequivocally determine which sea creature was in fact the *chilazon*. It was known that the *chilazon* was harvested in abundance along the northern coast of the Land of Israel from south of present-day Haifa to just north of present-day Tyre in Lebanon (Shabbos 26a). Though the *techeiles* itself disappeared from Jewish life as part of the damage of exile, the subject of *techeiles* was discussed in the great halachic works of the ages. Just as the Jews did not forget Zion and Jerusalem, their subconscious memory of past glory and spiritual greatness kept *techeiles* alive in their memory if not in actual practice.

There are a number of basic questions that require study in order for any determination of the possibility of actually observing *techeiles* in our time to occur. The three main questions are: 1) When and why did *techeiles* disappear from the Jewish world? 2) Which sea creature is actually the *chilazon* and how can blue dye be manufactured from it?; and 3) Even if the *chilazon* can be positively identified and *techeiles* processed from it, is it within our halachic power to revive a “lost” commandment, the tradition (*mesorah*) of which has also been lost? These questions, which have always existed and been discussed in halachic and rabbinic literature, began to move from the realm of purely intellectual and speculative to the arena of actual Jewish practice about

one hundred twenty five years ago. Since then, the search for the *chilazon* and the debate about renewing the observance of *techeiles* has been intensified until it now has achieved the status of discussion regarding practical behavior and observance.

There have been various dates and reasons attributed to the demise of *techeiles* in the Jewish world. In the ancient world (and later in the world of Rome), the colors of purple and blue were reserved for royalty and the upper classes. The Romans were especially jealous of their governmental monopoly on producing dyes for the royal purple and blue. The Talmud records the arrest of two rabbis from Israel who were smuggling *techeiles* into the Jewish community of Babylonia (Sanhedrin 12a). The Talmud also records that *techeiles* was brought to Babylonia in the time of Rav Achai c500 CE (Menachos 43a). There is no specific reference in the Talmud that Jews were not able to obtain and wear *techeiles*. Since the final redaction of the Babylonian Talmud occurred c570 CE, Rabbi Isaac Halevi Herzog, the late Chief Rabbi of Israel, in his seminal work on *techeiles* assumes that the *techeiles* manufacturing factories in the Land of Israel were destroyed during the time of the Moslem conquest of the country in c638. In any event, the range of dates advanced for the disappearance of *techeiles* in the Jewish world extends from the late fifth century (Rabbi Yehoshua Kutner in Yeshuat Malko, Orach Chaim, 2:1-3) to the fifteenth century with the fall of Constantinople to the Moslems in 1453 (mentioned by Rav Herzog as a possibility, though he personally rejects it.) Mar Shalom Gaon (died 859), Rav Nachshon Gaon (died in 889) Rav Shmuel ben Chafni Gaon (died 1034), Rav Yitzchak Alfasi (died 1103), Rambam (died 1204), and many other great Geonim of Babylonia and Rishonim of Spain and France bemoan the disappearance of *techeiles* from the Jewish scene. From all of this it seems clear that *techeiles* was no longer available by the time of the zenith of the Moslem conquests in the Mediterranean basin and the Balkans in the seventh century. Rabbi David ben Zimra (Radvaz) of Cairo stated at the end of the fifteenth century that *chilazon* may certainly yet exist in the waters of the Mediterranean but that “we are unable to harvest it.” This situation remained in effect until the end of the nineteenth century.

As for the remaining two questions regarding *techeiles* – the identity of the sea creature called *chilazon* and whether a “lost” commandment and tradition can be revived after centuries of absence – there entered on the scene in 1889 Rabbi Gershon Henoch Leiner, the Radzyner Rebbe. Rabbi Leiner claimed that the *chilazon* was a squid and he actually produced thousands of sets of *tzitzis* that included a blue string made from a dye

obtained from that squid, which he believed was *techeiles*. He defended his contentions in a massive three-volume work of Torah scholarship entitled *Sfunei Tmunei Chol, Psil Techeiles*, and *Ein Hatecheiles*. However, Rabbi Herzog in his 1913 dissertation already proved that Rabbi Leiner's squid was not the *chilazon*. Rather, he advanced the theory that the *chilazon* was a snail, *Murex trunculus*, that had been discovered in Mediterranean waters by a French zoologist, Henri Lacaze Duthiers, in 1857. However, Rabbi Herzog was disappointed by the fact that the dye obtained from this snail was purple in color and not the blue indigo necessary for *techeiles*. The problem that Rabbi Herzog raised was solved by a chance discovery of Otto Elsner of the Shenker Institute in Tel Aviv in the early 1980's. He discovered that the liquid extracted from the gland of the snail, when exposed to the air turns purple in color. However, during the dyeing process, when it is exposed to direct sunlight it turns into a brilliant indigo blue. The many thousands of Jews who wear *techeiles* today in their *tzitzis* obtain their *techeiles* strings from the dye of this *Murex trunculus* snail (except of course for the Radzyner Chasidim who follow their Rebbe's opinion that a squid was the *chilazon*.) There seems to be little doubt today that the snail, *Murex trunculus*, is indeed the long-lost elusive *chilazon*.

The question of reviving *techeiles* use has been hotly debated in rabbinic circles for over a century. Rabbi Yosef Dov Soloveitchik, the rabbi in Slutzk and Brisk in the middle and late 1800's, discussed Rabbi Leiner's *techeiles* and rejected it. Unfortunately, the Beis Halevi's actual responsa was lost and two versions of his reckoning have come down to us. The Radzyner Rebbe, quoting the Brisker Rav in order to answer his objection, presents Rav Soloveitchik's contention that since this squid was well known to the rabbis of all the ages, yet they did not regard it as being the *chilazon*, this in effect constitutes a negative tradition regarding equating the squid with the *chilazon*. However, if the *chilazon* was instead found to be a newly discovered sea creature that was unknown to the rabbis throughout the centuries, the lack of rabbinic tradition would not necessarily disqualify the *techeiles* produced from this recently discovered sea creature; assuming, of course, that the prospective *chilazon* and *techeiles* met the criteria set forth in the Talmud. Within the Brisk family, though, a different line of reasoning is attributed to the Beis Halevi. They claim that the Brisker Rav required a positive tradition regarding the identification of the *chilazon*, and once that line of *mesora* was broken, the halachic determination of the *chilazon* and wearing *techeiles* derived from it would have to wait for Messianic times (see Rav Yosef Dov Soloveitchik, the Beis Halevi's great grandson, in *Shiurim L'zecher Abba Mari Z"l* vol. 1, p. 228). Clearly, this discrepancy regarding the Beis Halevi's position has ramifications regarding *techeiles* obtained from the *Murex trunculus* since the recent discovery of the existence of this snail and the even more recent discovery of how to obtain blue indigo dye from its gland, would be sufficient in terms of the first position attributed to the Brisker Rav,

and on that basis some feel that it is obligatory to wear *techeiles* in our very time.

There is a statement in the Midrash (Midrash Tanhuma (Shelach 28); Bamidbar Rabba (17:5).) that *techeiles* was "nignaz" – "put-away/hidden." There are those that maintain that this statement also precludes the use of *techeiles* in our time. But it seems clear that this was not the intention of Midrash, especially since *techeiles* was still in use after the time of the writing of this Midrash. Rabbonim such as Rabbi Yechiel Michal Tikutchinsky have interpreted the Midrash as meaning that *techeiles* became less and less common but not that it disappeared completely, nor was this Midrashic statement intended to prevent the use of *techeiles* amongst Jews of later generations. There is no unanimity in current rabbinic opinion regarding this question of the reintroduction of *techeiles* into Jewish life and practice, though as an empiric observation the use of *techeiles* continues to spread widely throughout the Jewish people. One thing is certain, *techeiles* has become a living issue and has left the exclusivity of the study hall and entered into the everyday life of tens of thousands of Jews the world over.

### **Principles Regarding Tying Tzitzis with Techeiles Collected Sources**

Although the method for tying white *tzitzis* is fairly standardized, the situation regarding *tzitzis* with *techeiles* is the subject of widespread *machlokes*. There are many aspects dealt with by the *gemara* and *Rishonim*:

#### **Number of strings on each corner**

תנו רבנן כמה חוטין הוא נותן? בית שמאי אומרים ד', ובית הלל אומרים ג'...  
מנחות מא :

*The Rabbis taught, How many strings does one place [on each corner]? Beis Shammai say four and Beis Hillel say three...*  
Menachos 41b

#### **Ratio of white to techeiles strings**

מכמה גדילים אתה עושה? אין פחות משלושה - דברי בית הלל. בית שמאי אומרים: שלושה של צמר ורביעית של תכלת. והלכה כבית שמאי. ספרי שלח (קטו)

*How many strings must one place? Not less than three - this is the opinion of Beis Hillel. Beis Shammai say: Three [strings] of [white] wool and a fourth of techeiles. And the halacha is according to Beis Shammai.*  
Sifre Shelach (115)

כמה גדילים נעשים? אין פחות משלושה חוטים כדברי בית הלל. בית שמאי אומרים: מארבעה חוטים של תכלת וארבעה חוטים של לבן... והלכה כדברי בית שמאי. ספרי כי תצא (רלד)

*How many strings are placed? Not less than three strings according to Beis Hillel. Beis Shammai say: Four strings of techeiles and four strings of white. And the halacha is according to Beis Shammai.*

\*Note: The Vilna Gaon claims that the correct version of this Sifre is "בג' חוטין של לבן ורביעית של תכלת" - "With three strings of white and a fourth of techeiles." This change would harmonize the two quotes from the Sifre.

There are three different opinions of the *Rishonim* regarding the ratio of white to blue strings:

- **Rambam** (הלי ציצית א':ו') - Half of one string (when folded becomes one of the eight strings) is *techeiles*. The Rambam understands the *posuk* in *Bemidbar* in the following manner: ונתנו על ציצת הכנף (=לבן) פתיל - תכלת - put upon the fringe of each corner (= white) one thread of blue. Only the windings (פתיל) around the white core (כנף) must be *techeiles*.
- **Raavad** (השגות הלי ציצית א':ו') and **the Aruch** (ערך) - Based on the *Sifre* in *Shelach* hold that one full string (when folded it becomes two of the eight) must be *techeiles*.
- **Rashi** (התכלת) and **Tosfos** (שם וכן מא':) - Two full strings (four of the eight) are *techeiles*.

## Issues regarding the windings (*krichos*)

### Chulyos

וכמה שיעור חוליא? תניא, רבי אומר כדי שיכרוך וישנה. תאנא, הפוחת לא יפחות משבע, והמוסיף לא יוסיף על שלוש עשרה. הפוחת לא יפחות משבע - כנגד שבעה רקיעים, והמוסיף לא יוסיף על שלוש עשרה - כנגד שבעה רקיעין ושהא אורין שביניהם.

And what is the measurement of a *chulya* (link)? We learned in a *Braisa*, Rebbe says so that you can wind once, then again, and a third time. We learned in a *Braisa*, One who minimizes should not have less than seven, and one who maximizes should not exceed thirteen. One who minimizes should not have less than seven - this is analogous to the seven heavens, and one who maximizes should not exceed thirteen - this is analogous to the seven heavens and six spaces between them.

Menachos 39a

According to the Gemara when tying *tzitzis*, there is a concept of *chulyos* (literally links or vertebra). There is an argument as to what the numbers seven and thirteen refer. Most *Rishonim* explain that these numbers refer to the amount of *chulyos* (each of which is made up of three twists as Rebbe states). Some *Rishonim* explain that each *chulya* can have between seven and thirteen twists, and they explain Rebbe's three twists as referring either to the number of *techeiles* twists in each *chulya* (and the number seven includes both the white and the *techeiles*), or that Rebbe is talking about the absolute minimum required to fulfill the *mitzva* (*bedieved deoraysa*), but the best method (*lechatchila derabanan*) should have between seven and thirteen twists.

### Color of twists

תנא, כשהוא מתחיל בלבן - 'הכנף', מין כנף; וכשהוא מסיים, מסיים בלבן - מעלין בקדוש ולא מורידין. מנחות לט.

We learned in the Mishna, When one begins, he begins with white - "[the fringe of each] corner," the same kind as the corner [i.e. The same color as the garment]; And when one concludes, he concludes with white - one always increases holiness and never decreases.

Menachos 39a

There is an argument as to the explanation of this passage:

- **Rav Amram Gaon** (גאוןיקה ח"ב עמ' 331-330) holds that the first *chulya* is white, the next is *techeiles*, and so on alternating white and *techeiles* for seven or thirteen *chulyos*. These *chulyos* of alternating colors are termed *l'sayrugin*.
- The **Rambam** (הלי ציצית א':ב-ג') holds that the first twist of the first *chulya* and the last twist of the last *chulya* are white, and all the other twists are *techeiles*.
- The **Raavad** (השגות הלי ציצית א':ז) holds that the twists of each *chulya* alternate between white and *techeiles*.

### The Knots

#### Kesher Elyon

ואמר רבה שמע מינה קשר עליון דאורייתא. מנחות לט.

Rabbah says, this implies that the upper most knot is required from the Torah. Menachos 39a

Rashi (מנחות לט. ותוספות שם) brings down two possibilities regarding the placement of the uppermost knot.

- Closest to the garment, in order to connect the strings to the garment
- At the end of all the twists, which adds stability to the windings

#### Double or single knots

There is an argument as to the nature of the knots of the *tzitzis*. The Geonim (גאוןיקה ח"ב עמ' 331) hold that a knot can be one string tucked under itself. Rabbenu Tam (מנחות לט.) compares the knots of *tzitzis* to knots in other laws like *Shabbos* and therefore requires a double knot. According to Rabbenu Chananel, the knot is made by looping one string around the rest, whereas the Mordechai holds that all the strings are used (by looping four around the other four).

#### Knots on each chulya

אמר רבה שמע מינה צריך לקשור על כל חוליא וחוליא

מנחות לח:

Ravah says, this implies that one must tie a knot after each and every *chulya*. Menachos 38b

#### Five Knots

ציצית, שש מאות. שמונה חוטין וחמישה קשרים, הרי שש מאות ושלש עשרה. תנחומא, קרח י"ב

[The word] *tzitzis* is numerically equivalent to 600, 8 strings and 5 knots adds up to 613.

Tanchuma, Korach 12

## The length of the windings and the strings

אמר רב הונא אמר רב ששת אמר רב ירמיה בר אבא אמר רב... מנחות לט.

*Rav Huna said in the name of Rav Sheshes in the name of Rav Yirmiyah bar Abba in the name of Rav: The most ornate techeiles ought be a third windings, and two thirds hanging threads.* Menachos 39a

## Various opinions regarding the krichos for tzitzis with techeiles

**Disclaimer!** Very few *Poskim* define their *shittah* in complete detail. Often they discuss one issue (for example, alternating the colors of the *chulyos*), but leave another (e.g. the type of knot) unexplained. In the following list of *shittos*, some details are the result of speculation in order to determine a complete practical method of tying.

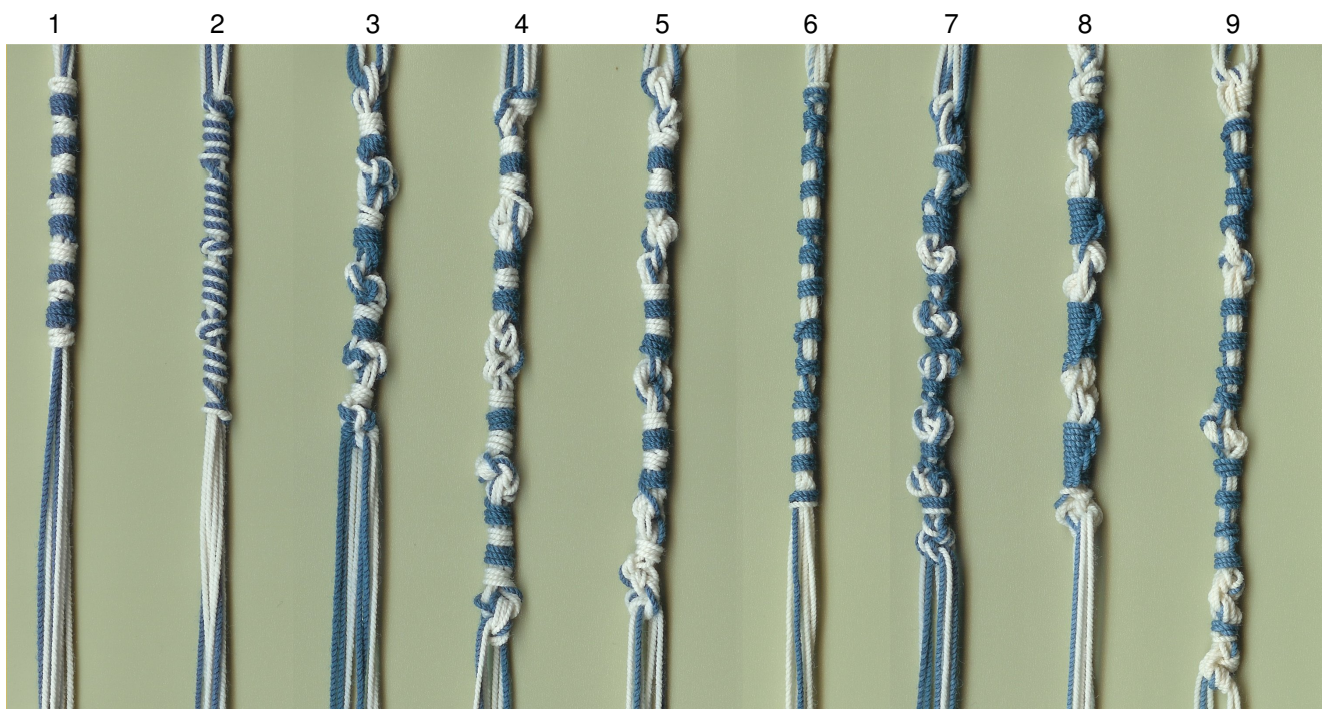
The principles discussed above are applied differently by the *Poskim*. The numbers correspond to the accompanying picture. The following is an (incomplete) list:

1. **Rav Amram Gaon** - seven or thirteen *chulyos* alternating white then *techeiles*. A knot at the beginning and at the end (according to the **Baal Haitur**, a knot after each *chulya*). (These knots are not double, but rather the winding string tucked under itself. According to the *Shaalos U'tshuvos Binyamin Zeev*, the knots are double knots.)
2. The **Raavad** according to **Rav Natronai Gaon** - five knots. Between each knot, seven to thirteen twists, with the twists alternating white then *techeiles*. Between the second and third knot, the amount of twists is not definite, but most probably still alternate between *techeiles* and white.
3. **Tosfos** - first a double knot, then one *chulya* of white and one of *techeiles*, then a second double knot, again white then *techeiles* and a knot, then again white and *techeiles* then a knot, and finishing with one white *chulya* and a double knot. This has seven *chulyos* and five knots.
4. The **Chinuch** - thirteen *chulyos*, alternating white and



*techeiles* distributed between five double knots. Between the first and second knot - three *chulyos* (white, *techeiles*, white). After the second knot another three *chulyos*, (*techeiles*, white, *techeiles*). After the third another three (white, *techeiles*, white), and after the fourth - four *chulyos* (*techeiles*, white, *techeiles*, white).

5. The **Vilna Gaon** - thirteen *chulyos*, alternating white and *techeiles* distributed between five double knots. Between the first and second knot - four *chulyos* (white, *techeiles*, white, *techeiles*) and the same between the second-third, and third-fourth knots. Between the fourth and last knot - one *chulya* of white.
6. The **Rambam** - all twists are *techeiles* except the first and last. Seven or thirteen *chulyos* are tied with a knot between each that keeps them together and separate from each other. The **Yemenites** have a tradition (even with white *tzitzis*) of tying each *chulya* into a special knot.
7. The **Rambam** with double knots after each *chulyah* - In the example shown here, the knots are double knots. Note also that the strings here are according to the opinion of *Tosafos*.
8. The **Rambam** according to the **Radzyner** - has all the twists *techeiles* except the first and last. There are five knots: between the first and the second knot there are seven twists, between the second and third - eight twists, between the third and fourth - eleven twists and between the fourth and last - thirteen twists (similar to the way we tie *tzitzis* without *techeiles*). Each group of three is separated by winding the *techeiles* around and inside them to hold them together.
9. Another understanding of the **Rambam** - The thirteen *chulyos* are tied with the Yemenite knot, and are distributed between five double knots. Four *chulyos* between each of the first four knots and one *chulya* between the fourth and last double knot.





**Kala Ilan**  
Rabbi Dr. Ari Zivotofsky

The Gemara in *Menachos* (41b) states:

ת"ר: טלית שכולה תכלת - כל מיני צבעונין פוטרין בה,  
חוץ מקלא אילן

The Rabbis taught in a Baraisa: With respect to a garment that is made entirely of *techeiles*, threads of all colors satisfy the *tzitzis* obligation in it, with the exception of *kala ilan*.

Rashi explains the reason why the *kala ilan* dye is unacceptable:

דדמי לתכלת וזימנין דמזבן לה לאינש אחרינא וסבר דכל  
חוטיה תכלת וכי מצריך לטלית אחריתי שקיל תרי חוטים  
מהכא ונותן שם... ושדי קלא אילן עם לבן בציצית והוי  
כלאים בלא מצוה.

Since it is similar to *techeiles* and it may happen that the *tallis* is passed to another person who assumes all the strings are made of *techeiles*. And when he needs them for another *tallis*, he will take two strings from this [*tallis*] and put them on the other one... and he will have *kala ilan* with white on the *tzitzis* thus making *kelaim* without any *mitzvah*.

*Kala ilan* is a fraudulent dye which is visually indistinguishable from the more expensive *techeiles*. It is therefore imperative to ensure that one not substitute *kala ilan* for *techeiles* either maliciously or by accident. As the Gemara explains previously (*Menachos* 40a), the *mitzvah* of placing *techeiles* on one's *tallis* overrides the *issur* of *shaatnez*, and as such, one is obligated to put *techeiles* (which by definition is of wool, c.f. *Yevamos* 4b) on a *tallis* made of linen. This, of course, is true only when using authentic *techeiles*, but if the wool strings are dyed with the counterfeit *kala ilan*, the prohibition of *shaatnez* would remain intact, hence the *gezeirah* against any use of *kala ilan* was instituted in order to avoid any possible confusion. (c.f. הלכות קטנות לרא"ש (מנחות) הלכות ציצית (סימן).

Although the white (i.e. non-*techeiles*) strings of the *tzitzis* can theoretically be made of any color, the *gezeira* against using *kala ilan* (instead of white) is so severe that Rav Moshe Feinstein felt that even if one had true *techeiles* strings that were afterwards dipped in *kala ilan* (to increase their luster), they would still be prohibited. (*Iggros Moshe, Yoreh Deah*, vol. 2; 133)

Since *kala ilan* was identical to the much more expensive *techeiles*, unscrupulous people might attempt to pawn off strings dyed with it in place of genuine *techeiles*. The Sifri (*Bamidbar*, 115) warns against this:

אני ה' אלהיכם אשר הוצאתי אתכם מארץ מצרים, וכי  
מה ענין יציאת מצרים לכאן אלא שלא יאמר הרי אני נותן  
צבעונים וקלא אילן והם דומים לתכלת ומי מודיע עלי  
בגלוי אני ה' אלהיכם דעו מה עשיתי להם למצריים שהיו  
מעשיהם בסתר ופרסמתים בגלוי

"I am Hashem your God who took you out of the land of Egypt", What does leaving Egypt have to do with this [parasha of *tzitzis*]? Rather one should

not say, "Behold I put other dyes and *kala ilan* which are identical to *techeiles* and who can make this information public?" "I am Hashem your God". Know what I did to the Egyptians whose misdeeds were done in private and I advertised them in public.

This idea is brought down in a number of additional places including *Bava Metziah* (61b), Rashi on the posuk in *Shema* (*Bamidbar* 15:41), and *Sheiltos D'rav Achai Gaon Vaera* 43. These sources show that the similarity between *kala ilan* and *techeiles* was absolute, in that only *Hashem* can distinguish between them. Nevertheless, this assertion is challenged by the Gemara in *Menachos* (42b):

ת"ר: תכלת אין לה בדיקה, ואין נקחית אלא מן  
המומחה... ותכלת אין לה בדיקה? והא רב יצחק בריה  
דרב יהודה בדיק ליה, (סי' בגשם) מייתי מגביא גילא ומיא  
דשבילתא ומימי רגלים בן ארבעים יום, ותרי לה  
בגוייהו מאורתא ועד לצפרא, איפרד חזותיה - פסולה, לא  
איפרד חזותיה - כשרה

The Rabbis taught in a Baraisa: *Techeiles* has no means of examination, and therefore, it may be bought only from an expert... Does *techeiles* actually have no means of examination? But Rav Yitzchak the son of Rav Yehudah would test [*techeiles*] for authenticity. (BeGeSheM is a mnemonic for the items that he used in his test.) He would bring alum, sap of fenugreek, and urine that is forty days old, and he would soak [the *techeiles*] in them from evening until morning. If its color faded, [the thread] was deemed unfit, for fading indicates that it is *kala ilan*, and if its color did not fade, it was deemed fit, for this indicates that it is genuine

The Rambam (*Hilchos Tzitzis*, 2:5) agrees that although the two are visually identical, chemical tests can distinguish between *kala ilan* and *techeiles*. It is generally agreed that the tests recounted here are difficult to understand and are therefore inconclusive (שו"ת שאילת). (יעבץ חלק א סימן נו

**Kala ilan and Isatis**



*Isatis tinctoria*

The Aruch defines *kala ilan* as indigo (פירוש (אינדק"י) and the *Mosif* adds "Binyamin said: That is its Greek name, it is a type of dye that is similar to *techeiles*." The *Nemukay Yosef*

לד, ע"א בדפי (חרי"ף) also

identifies *kala ilan* with indigo and the color blue. The *Teshuvos Hageonim* (333 ע"מ 333) notes that in Arabic it is called *nil* (which is indigo).

Another dye mentioned by Chazal as similar to *techeiles*, and identified with the Arabic *nil* is *isatis* (איסטיס) (Kaftor Vaferach, ch. 48, Radvaz in Teshuvah 685, Rav Bartenura on the Mishnah in Kelaim 2; 5, Pachad Yitzchak, vol. 4, p. 78 – see Rav Shlomo Teitelbaum in *Lulaot Hatecheiles*, pp. 235-240)

Although both *isatis* and *kala ilan* both denote indigo and are both similar to *techeiles*, the terms are not used interchangeably. (The Rambam (*Hilchos Tsitsis*, 2; 1) does seem to use *isatis* in place of *kala ilan*. Most probably the two were



*Indigofera tinctoria*

associated with different plants which both produced the same dye (indigo). *Isatis* referred to the woad plant, (*Isatis tinctoria*) which is indigenous to the temperate regions of northern Europe, while *kala ilan* corresponded to *Indigofera tinctoria* which was cultivated in warmer climates (specifically China and India) and yields much higher concentrations of indigo.

## Kala Ilan and archaeology

In 1961, Yigal Yadin excavated a cave near Ein Gedi which served as Bar Kochba's command center. Yadin found an archive of letters, documents and other artifacts that shed light on the life of the leaders and participants of the Great Rebellion against Rome. One of the finds was "a bundle of wool... wrapped in a piece of woollen

mantle with colored bands and a linen cloth." The chemical analysis of the wool showed it to be dyed with a mixture of indigo and kermes (which is the Biblical *tolaat shani*). Yadin came to the conclusion that "this wool was intended for the

*petil techeiles* of the ritual tassels (*tzitzis*)." Since the wool was dyed with plant indigo and not that derived from a chilazon, Yadin came to the conclusion that this was in fact *kala ilan*, and not real *techeiles*.

Subsequent investigation and deliberation regarding Yadin's find have raised serious doubts as to whether the bundle of wool was intended for use as *tzitzis*. Professor Feliks also wonders why the fraudulent dye ostensibly used in place of the more expensive genuine color would incorporate *tolaat shani*, which was at least as costly as *techeiles*! Yadin also "proves" that the wool was used for *tzitzis* from the fact that it was tied with a linen cord, and that this was done deliberately since *tzitzis* must be *shaatnez*. This, of course, does not correspond to the *Halacha* as we know it. Taking all this into consideration, the question of Yadin's find and its link to *kala ilan* and *techeiles* is still quite tenuous. (See Rav Menachem Borshstien's discussion of this in *Hatecheiles*, Sifraiti, 1988, pp. 73-74 and the picture of the actual wool found in the Cave of Letters on page 48 no. 8)

The indecisive nature of this find notwithstanding, people continue to refer to Yadin's find as categorical evidence of the discovery of ancient *tzitzis* with *techeiles*.

Significantly, archaeological excavations have uncovered *tzitzit* belonging to bar Kochba's soldiers. Only one of the eight strands was dyed *techelet*.

(Moznaim edition English translation of the Rambam, *Hilchos Tzitzis*, page 199 footnote)

This goes so far as to claim that Yadin found *techeiles* strings according to the *shitta* of the Rambam! Needless to say, this assertion is unsubstantiated.

## Kala Ilan as a basis for identifying true techeiles

*Kala ilan* and *techeiles* are impossible to tell apart (at least with the naked eye), and so one should be able to make use of this property when attempting to identify true *techeiles*. If one finds a candidate for the *techeiles* producing *chilazon*, the most important test would be to see if the color of the dye is the same as that of indigo. In fact, the argument can be taken one step further, namely, that if one finds any marine organism that yields a dye which is fast and the color of indigo, then that dye must be kosher for *techeiles*. This is the opinion of both of the greatest authorities on *techeiles* – Rav Gershon Henoch Leiner of

Radzyn and Rav Yitzchok Eizik Halevi Herzog. The Radzyner writes:

אם אחר החיפוש נשיג ידינו למצוא דם איזה מין חלזון שיהיה שנוכל לצבוע בו צבע התכלת צבע עומדת ביפיה ולא תשתנה, ודאי יכול לקיים מצות תכלת בלא שום ספק. (שפוני טמוני חול, עמ' י"ד)

### Origin of the term *kala ilan*

Rav Herzog (*Biblical Blue*, page 94) suggested a number of possibilities explaining the origins of the term *kala ilan*. *Kala* in Sanskrit means black or deep blue and *nilam* is indigo (similar to the Arabic *nil*). *Kala ilan* may mean the *kala* derived from trees (*ilan* in Hebrew) or perhaps it is a corruption of *kala-nil(am)*. Rav Herzog also posits that the Chinese *lan* (= indigo) might be involved. This may be leant additional support by the fact that in ancient Chinese, the term for indigo was actually *k'lan* which is very similar to *kala ilan* (*Indigo Textiles*, Gösta Sandberg, Black, 1989)



The Chinese character for indigo (*lan*) is made up of three elements – an eye, a person, and a vessel with water. Taken together, this represents a reflection in the water (perhaps of the sky).

If, after searching we would be able to find the blood of any kind of *Chilazon* that would enable us to properly dye the color of *techeiles* which would retain its original beauty and would not fade, then certainly we would be able to fulfill the *mitzvah* of *techeiles* without any doubt.

(Sefunei Temunei Chol, page 14, 1999 edition)

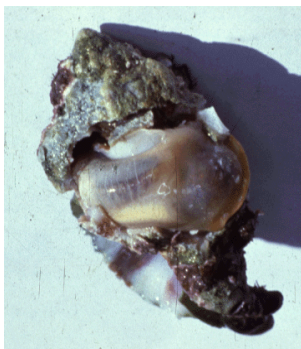
Both Rav Herzog (*The Royal Purple and Biblical Blue*, Keter, 1987, page 73) and the *Radzyner* offer the same line of proof for this assertion. If there is another *chilazon* whose dye satisfies these criteria, but is not kosher for *techeiles*, then why would *Chazal* not warn us regarding its use? The only caution recorded in the *Gemara* is with regards to *kala ilan* – indigo derived from a plant source – but there is no admonition against using another sea animal that is not the *chilazon shel techeiles*. Therefore, either that species' dye is also kosher for *techeiles*, or there is only one species in the world (or in the Mediterranean) that satisfies both those criteria. In either case, any sea creature which produces a fast dye the color of indigo must necessarily be kosher for use as *techeiles*.

### ***Dyeing Techeiles*** **Dr. Baruch Serman**

The Gemara in Menachos (42b) relates:

אמר ליה אבבי לרב שמואל בר רב יהודה: הא תכילתא היכי צבעיתו לה? אמר ליה: מיייתין דם חלזון וסמנין ורמינן להו ביורה [ומרתחין ליה], ושקלינא פורתא בביעתא וטעמינן להו באודרא, ושדינן ליה לההוא ביעתא וקלינן ליה לאודרא

Abaye said to Rav Shmuel bar Rav Yehudah: This thread of *techeiles*, how do you dye it? [Rav Shmuel bar Rav Yehudah] replied: We bring the blood of the sea creature *chilazon* and certain herbs, and we put them in a pot and boil it up. Then, we take a little bit of the dye in an eggshell and test it with a wad of wool. Then we spill out the dye left in that eggshell and we burn the wad of wool that was dyed for the purpose of testing.



The *chilazon* after being broken open (*petziah*) showing the gland where the precursor to the dye is stored.

The dye process recounted here is similar to that brought down by the ancient Greek and Roman scholars. Aristotle and Pliny the Elder describe the procedure used in dyeing the *porphyra*. Pliny elaborates on the method:

The vein of [the snail] is removed and to this salt

has to be added... and it should be heated in a leaden pot, and with 50 lbs of dye to every six

gallons of water kept at a uniform and moderate temperature by a pipe brought from a furnace some way off. This will cause it gradually to deposit the portions of flesh which are bound to

have adhered to the veins, and after about nine days the cauldron is strained and wool that has been washed clean is dipped for a trial. (*Natural History*, Book IX. LXII. 133)

This procedure has been reenacted recently by researchers in England who have been able to produce beautiful blue dyed wool. With the advances in our understanding of dye chemistry, however, much more efficient methods can be used which yield results in a consistent and reliable manner.



*Techeiles* belongs to a group of colorants known as vat dyes. These must undergo specific chemical processing before they can be bound to fabric. One of the main characteristics of *techeiles* is its fastness - it does not fade with time or wash out of the wool. The Gemara (Menachos 43a) explains that even after chemical testing *לא איפרד חוותיה* – its color does not fade, or as the Rambam puts it (*Hilchot Tzitzit* 2;1) *שעומדת ביפיה ולא תשתנה* – it remains beautiful and does not change.

This trait of steadfast stability in a dye translates chemically into the fact that the dye pigment does not readily bind to water or soap or other substances that could serve to remove it from the fabric. However, if a dye is hard to get *out* of the wool, it is equally hard to get it *into* the wool, i.e. to dye the wool in the first place! Overcoming this obstacle is the major difficulty facing the vat dyes.

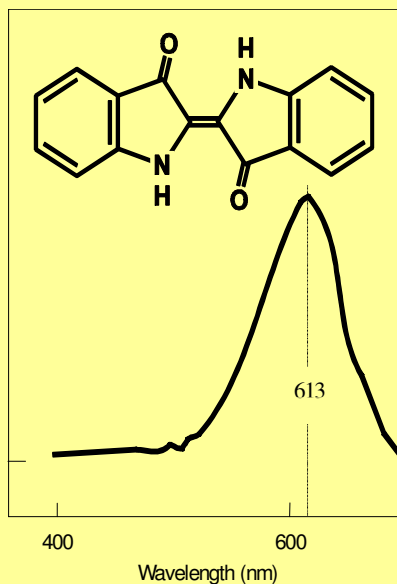


The *posuk* in *kriat shema* says that by looking at the *tzitzis* one will remember all of Hashem's *mitzvot*. Rashi explains that the word *tzitzis* is numerically equal to 600. Add to that the 8 strings and 5 knots, and you have 613, the number of *mitzvot* in the Torah. The Ramban and others disagree with Rashi and claim that it is actually the string of *techeiles* that serves as the reminder. The sky-blue thread evokes contemplation of the heavens and of God's throne and that leads one to remember the *mitzvot*.

Interestingly, recent work by Dutch scientists\* regarding the properties of the *techeiles* dye molecule, revealed a striking coincidence. The color of a substance is determined by way it reflects and absorbs light. No two molecules have the same pattern (called a wavelength absorption spectrum) which is measured in units called nanometers. *Techeiles* obtained from the Murex Trunculus snail derives its color from a sharp peak in its spectrum at exactly 613 nm.

\* J. Wouters and A. Verheeken, *JSDC* Volume 107, July/August, 1991.

Δ A



become the dye, two additional things are necessary; an enzyme called *purpurase*, which is also present in the snail, and air. The enzyme decomposes quickly if the snail dies, and so the dye must be extracted and exposed to air while the snail is alive or shortly after its death. This accords well with the *sugya* in *Shabbos* (75a) which discusses whether breaking open a *chilazon* and extracting its dye

In order to dissolve the *techeiles* molecule in water and introduce it into the wool, it must undergo the chemical process known as *reduction*. In ancient times this was accomplished through fermentation, where the meat and dye-containing parts of the snail were heated on a low flame for a few days (as described by the Gemara and by the classical scholars). Bacteria that live on the snail meat ferment the dye and reduce it. In modern times, that same result can be accomplished much more quickly by adding a strong reducing agent (such as sodium dithionite). In this reduced state, two important things can happen. Firstly, the dye molecule dissolves in water, and thus wool will absorb the solution and take up the dye. Secondly, the chemical bonds are weakened so that exposure to sunlight removes the purple tint from the dye molecule (that it has when taken from the snail) and leaves it the beautiful sky-blue that is *techeiles*.

When the dye is in the vat (יורה) in the reduced state, it does not have same color that it will ultimately have in the wool, but rather the solution has a yellow-green hue, as can be seen in the accompanying picture. This may help to understand the second part of Rav Shmuel bar Yehudah's statement (echoed by Pliny) regarding the need to "test" the dye by pouring out some dye into an egg shell and dipping wool into it. Why not just look at the dye solution and see if it is the right color? Since the dye in its reduced state gives no indication of the color that the dyed wool will have, the only way to accurately determine that is to actually dye some wool and bring it out of reduction by exposing it to the oxygen in the air. In the picture one can see the lustrous blue *techeiles* of the wool in its final state, while the bottom is still the same yellow as the dye solution.

The *chilazon* stores the compounds which can turn into *techeiles* inside a gland. (These compounds are actually part of the snail's digestion of its food.) In order to

should make one liable for the transgression of taking a life on *shabbos*, since killing the snail is actually detrimental to the dyeing process.

דכמה דאית ביה נשמה - טפי ניחא ליה, כי היכי דליציל ציבעיה

The longer it stays alive the more he is pleased in that the dye will be clear.

Additional educational material regarding *techeiles* is available from

P'til Tekhelet Foundation

P.O. Box 1373

Efrat, Israel

+972-2-9932136



- כליל תכלת – הרב אליהו טבגר
- לולאות התכלת – הרב שלמה טייטלבוים
- עבד המלך – הרב יהודה ראק
- Display of different *shittos* for tying *techeiles*
- Kit for actual dyeing of *techeiles*
- CD with approximately 300 articles on *techeiles* related topics
- *The Mystery of Techeiles* (Video or CD) available in English or Hebrew
- *Tying Techeiles* (Video or CD) available only in English