Has Tekhelet been Found?

By: MENACHEM EPSTEIN

While thousands of Jews around the world have recently begun adding what they are convinced is tekhelet to their kippot, a recent article published in Flatbush and distributed throughout America (Halacha Berurah vol. 9, issue 2, “The Search for Techeiles”) claims that no one “has presented any concrete proof that the murex techeiles is genuine,” and “that there are clear indicators that neither the chilazon nor techeiles have any connection to the murex techeiles.” In this article, the author demonstrates why these statements are entirely baseless.

The possibility of the murex snail being the chilazon of tekhelet has been under consideration for a considerable amount of time. Until recently almost all rabbis rejected this possibility out of hand simply because the dye of the murex is purple. From our tradition we know without a doubt that tekhelet is blue.1 In 1983 a startling discovery was

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1 Rav Herzog in his doctoral thesis written in 1913 suggested that the murex would be the most likely candidate, if not for the fact that it produced a purple dye. This manuscript was later edited and published as “The Royal Purple and the Biblical Blue” by Keter 1987. Almost all scholars today agree that tekhelet is blue. The Septuagint translation of the Torah translates tekhelet as iakanthos, which is a blue flower. At that time tekhelet was still being used. Professor I. Zeiderman presents a paper in Tehumin vol. 9 arguing that tekhelet is purple with a bluish shade.

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made. When the dyeing process of the murex trunculus was performed outdoors, the resulting color of the dye was blue. This discovery opened the door to performing the mizvah of kīrērān mīzvāh of zātikāb.

The first part of this presentation will focus on the arguments that support the claim that the murex snail is the renowned hillazon from which tekhelet was produced. The second part will present the arguments against this claim—and we will refute them.

Evidence that the Murex Trunculus is the Hillazon

The main reason for believing that the murex trunculus is the hillazon is the characteristics of the dye produced from it, particularly its color. Hazal (Menahot 42b–43a) state that there is an exact look-alike for tekhelet—a plant called kela ilan. The consensus today, based on

However, he also agrees that the murex was the snail used for tekhelet. Rabbi Yehuda Rok of Yeshiva Har Etzion in the article לוונינו לשלח את שולח תהלים, published in Techumin vol. 16, brings many proofs that tekhelet is blue. See also note 4, that many rishonim identify kela ilan with indigo. See also The Renaissance of a Mitzvah, YU Press: January 1997.

Thus it is possible to produce both purple and blue dyes from the same snail. The ancients also knew this. See Vitruvius De Architectura (ed. H.L. Jones), Cambridge: Loeb Classical Library, 1930, Book VII, c. VII-XIV, pp. 113–129: “For it does not yield the same color everywhere, but it is modified naturally by the course of the sun. As we proceed between the north and south it becomes a leaden blue.” There were a number of Roman Imperial decrees restricting the use of murex dyes to the nobility (see appendix). We can now understand the Roman decree against wearing tekhelet mentioned in the gemara (יומא 6b) not as an anti-religious decree, but because tekhelet was produced from the same murex snail as the royal purple dye. Because the snail was becoming extinct (See paper by Susan C. Druding at Seminar presented in Seattle Washington at Convergence 1982 titled “Dye History from 2600 BC to the 20th Century”), the Romans decreed not to wear anything made from the murex. Without this explanation, one would have said that the Romans made their decree against tekhelet out of pure anti-Semitism without having any understanding as to why they chose this particular mitzvah.

Interleaved with these arguments will be a response to the article in Halacha Berurah vol. 9, issue 2, “The Search for Tekhelet.”
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many risbonim, is that the dye produced from the kela ilan plant was indigo. The gemara states clearly that the color of tekhelet is virtually indistinguishable from kela ilan. Since the dye produced from murex trunculus is exactly the same color as the indigo made from plants, it is clear that the color of its dye is the true tekhelet color. However, there is a Tosefta that states that tekhelet not produced from the hillazon is pasul, invalid. Thus we must also show that the murex trunculus is the hillazon of Hazal.

Hazal (Shabbat 26a) state that the location where the hillazon is known to be found is between Tzur and Haifa. Additionally, the area is identified as belonging to Shevet Zevullun. The murex is indeed found in that area. In fact, hundreds of yards of murex shells have been found there, an indication that it was the site of an ancient dye-

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4 יוסי נמוקי ב"רד" ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"ה ד"h

5 Actually, the molecule that acts as the coloring agent in both indigo (the plant) and the murex (snail) is identical. See Tekhelet by Baruch Sterman, which describes in detail the chemistry involved in producing the purple dye (dibromide indigo) and the indigo dye.

6 Text: " heleh ein mishra ela min halalot; shele el halalot somelah. She halalut min halalut shehurim bekei. Shele el halalut shehurim somelah.

7 There is a possibility that the term hillazon here refers not to a specific species but to a generic term for any snail. See footnote 24. If so, even if the hillazon of the tekhelet in the Talmud does not refer to the murex, it would still be usable for ziz. The Tiferet Yisrael (Hakdamah to Seder Mo'ed, pp. 15b–16a) and others go so far as to suggest that any dye of the proper color and steadfastness can be used for ziz.

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9 J. Wilfrid Jackson, F.G.S. in an article entitled “The Geographical Distribution of the Shell-Purple Industry,” vol. 60, part II of Memoirs and Proceedings of the Manchester Literary and Philosophical Society, session 1915–1916, writes that archeologist L. Lortet reported (La Syrie d’aujourd’hui, Paris 1883 page 102) finding in the vicinity of Sidon great banks, a hundred yards long and several yards thick, composed of broken shells of murex trunculus. H. B. Tristam (The land of Israel, 1882, p. 48) reports that large quantities of crushed murex Brandaris shells were discovered in Tyre. The article reported a finding of large quantities of murex Brandaris shells that give off a reddish purple dye. In a separate area were found large quantities of murex trunculus shells that give off
Another characteristic known from Hazal is the steadfastness of the dye. Both the gemara (Menahot 43a) and Rambam (Hilkhot Zizit 2:1) mention that it is a dye that does not lose its color. The gemara distinguishes tekhelet from kela ilan because the tekhelet dye does not fade. The murex trunculus tekhelet has been tested by independent fabric inspectors at the Shenkar College of Fibers and received excellent marks for fastness (see footnote 15).

The ability to produce a dye from a specific living creature is rare. It would be a highly unlikely coincidence for there to be in existence two separate dyes of the exact same color produced from two different sea animals in the same area. Thus it is highly probable that the murex is the true hillazon.12

In addition, we do not find in Hazal any mention of a pasul source of tekhelet besides kela ilan. Since the skill of producing a blue dye from the murex snail was known in their time, Hazal would

the bluish purple dye. Scientists thought this was for tekhelet, but our tradition says it was blue.

10 The purple and blue dyes produced from the murex snails were a prized material and were not used exclusively for ziz. See www.ancientroute.com/resource/cloth/dye.htm for a list of ancient dyes. Of the less than 10 listed, only one was from a sea animal (murex). Another was from an insect, and all others were from either a plant or a mineral. See Rabbi Twersky (footnote 30), "Encyclopedia Britannica, entry “Dyestuffs and Pigments,” which mentions 10 to 12 materials in use prior to the 19th century.

11 This argument is convincing from a logical perspective, and it also has a halakhic aspect. In halakham, identification of an object can be made through סימנים. They can be used to identify lost objects or a deceased husband. An object that has a ביותר מובהק סימן is considered a good סימן התורה מן לשלך אבוניער סימן העזר (מ"ר ס"ז עד ק). Of the thousands of fish and mollusks that were studied to date, no other fish has been found that can produce the tekhelet color. Seeing that the ability to procure a tekhelet dye from a given fish is an occurrence of one in many thousands, we can consider this property as a beyoter mahak simon that identifies the murex snail as the true hillazon.

12 See footnote 2.
have told us explicitly that the murex is *pasul*\(^\text{14}\) if a different animal were the real source of *tekhelet*.

The second argument for the authenticity of the murex is from the *gemara’s* statement (*Shabbat* 75a) that the *pillazon* must be kept alive while the blood is extracted in order for the dye to turn out right. A similar property has been discovered in the murex. In experiments performed thereon, the quality of the dye severely degraded within two hours after death. The enzyme required for the formation of the dye quickly decomposes upon the death of the snail, and so the dye precursor must be extracted while the snail is alive or soon after death.\(^\text{15}\) In the article written for the *Halacha Berurah* (see footnote 3), the argument is made that from this *Gemara* “it is clearly implied that the dye begins to degrade at the moment of death.” This may be true, but both Pliny’s and Aristotle’s descriptions\(^\text{16}\) of the murex state that the dye must be obtained from live snails. It is clear the ancients believed (and maybe correctly so, given how they extracted the dye) that the murex must be kept alive during extraction!

The third argument is from literary sources that identify the *pillazon*. *Ravya* on *Berakhot* \(^\text{17}\) quotes a Yerushalmi in that *masekhta* as follows: לכרתי תכלת בין, פריפינין ובין פורפורין. *Ravya* then comments: בלשון שקורין מעיל והוא פורפורה. The simplest understanding of this Yerushalmi is that it is giving two practical examples of items, one that has the color תכלת, and the other with the color הכרת. Based on the explanation of *Ravya*, the *Gemara* is saying a commonly used garment called *פורפורה* bore the color of *tekhelet* that is mentioned in the *Mishnah*, while *פריפינין* was the color of *כרת*. Thus the Yerushalmi identifies *tekhelet* with *פורפורה*. Since *purpura* is a Greek word that

\(^{14}\) In *לד סוכה* point out that the *צפצפה* is *pasul*, and there are additional cases where *Hazal* point out the *pasul* of other objects.

\(^{15}\) Article by Baruch Sterman titled “A response to Dr. Singer’s Review of murex trunculus as the Source of Techelet.”

\(^{16}\) Pliny the Elder *Natural History* Book p. IX and pp. 40–45. Aristotle in *Des Animilibus Historia* describes the Phoenician dyeing process of the purple dye in detail.

\(^{17}\) ראובן ברוך הכהן הירושלמי שorney ישيرא איגרבי בי מטלת הכרת בין פורפורה בין פורפורה ובין פורפורה וזו שধכרת בין פורפורה וזו שדכרת בין בבלשון שקורין.
means either the murex snail or the color purple that comes from it, we have clear evidence of a link between the murex and the color tekhelet. The article in Halacha Berurah differs, claiming that “the supporters have purportedly misinterpreted a Yerushalmi quoted by the Ravya.” Although admitting that פרפירין פרפרים and פורפירין פורפירים are not giving examples of cloths colored with תכלת and כרתי, but are rather another comparison of two pieces of clothing with totally different colors. He does not explain what prompts him to change the simple explanation but just states, "ההשלים והبعث כי ואמות". That this new comparison should just happen to be with a material produced from the murex, which can also be a source of the color of tekhelet, would be a coincidence of major proportions, however. In addition, the Musaf Arukh translates the word פרפר as תכלת.

There are many additional sources indicating that the hillazon used for dyeing tekhelet is the purpur snail. The Havot Ya’ir of the 17th century states that tekhelet is a purple dye that comes from the purpur.18 The Halacha Berurah article argues that “the Havot Ya’ir, who was under the impression that tekhelet was purple, came to this conclusion on his own.” Precisely so—the Havot Ya’ir was so convinced that tekhelet was made from the murex, he was willing to contemplate that tekhelet was purple despite the fact that this conclusion went against our tradition! Clearly he felt that the evidence in favor of the purpura was overwhelming. (Other rabbis could not accept this rejection of tradition despite the evidence and thus declared that purpura could not be the source of tekhelet.) The recent discovery of the possibility of extracting blue dye from the purpura completely resolved this contradiction between the evidence and tradition.

Rav Avraham Harophe, who also lived in the 17th century, states explicitly that the purpura is the hillazon of tekhelet.19 The Halacha Berurah article claims that “Passing halachic rulings based on kitvei ha-yad discovered long after the author has lived is itself quite dubious...
in the eyes of the poskim, as the authenticity and integrity of each word is questionable.” This generalization is unwarranted. The Ḥazon Ish—brought as support to this statement in the footnotes—is discussing only whether, because of newly found kitvei yad, one can change examined and accepted texts that have been used for many years. He is saying that, because the newly found text might be corrupt and was therefore rejected by previous generations, we do not change our established text that was passed down through gedolei olam. All this is obviously irrelevant to our case, where we have no previous text! In our case the known evidence is consistent with the pesak in the ketav yad, so why should we question its authenticity?20

Rav Tevger in his book K’lil Techelet21 argues that marine biologists have continually searched the Mediterranean Sea for new species of all types of mollusks, and none have been discovered for many tens of years. The likelihood of a new mollusk being discovered is extremely low. Given that the murex trunculus conforms to all these characteristics, it is almost certain that we have found the right one.

Arguments against the Murex being the Ḥillazon

1. The strongest argument raised against the murex’s being the hillazon is that the gemara (Menahot 42b) describes a test to distinguish

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20 One could have possibly brought a different proof from the first letter of the Ḥazon Ish in אסימן כלאים הלכות where he says that new kitvei ha-yad should not be used to change the minority to a majority opinion. In that letter, however, he does not question the authenticity of the kitvei yad, but rather mitigates the importance of a technical majority of poskim for a number of reasons. First, there is no halakhah of רוב על ברי out outside of beit din. Thus, each community uses its particular poskim even when they are the minority. The known major poskim are considered the Rabbanim moshakim of Klal Yisrael and thus their opinions carry more weight than others even when they are a minority. Also, the personal logic of the present day Posek carries weight in deciding which opinion to follow. Second, it is impossible today to determine the real majority opinion of previous generations, simply because not all poskim wrote their opinions in books and not all books survived.

between the tekhelet produced by the hillazon and the tekhelet produced by אֵילַן קְלַא. If placed in a certain combination of substances, the אֵילַן
יִלְאַזְל dye would be ruined while the tekhelet would remain intact. The
problem is that both the indigo plant and the murex snail produce
the same indigo molecule as the basis of their dyes. How could they
react differently to Hazal’s test? This problem bothered the original
Talmidei Ḥakhamim who worked with the murex. Rav Tevger dis-
cussed the issue with Professor Elsner, an expert on dyeing textiles,
who stated that although the coloring agents of the dyes are identical,
there are differences in the makeup of the accompanying substances.
In other words, the fastness of a dye is affected not only by the
molecule that attaches to the fabric and gives it a new color but also
by the accompanying substances that assist in that molecule’s attach-
ing, i.e., the reduction process.22 The Halacha Berurah article claims
that “it is highly unreasonable that Ḥazal would make a test that was
based on impurities, as the test will vary from batch to batch.” But
we are discussing not impurities but differences in the dying material,
albeit differences that do not affect the color.

2. The Gemara says the hillazon is a דג. Is a snail a דג? There are
several proofs from Ḥazal that the hillazon is not a fish but some sort
of mollusk, and most probably a snail. Firstly, the midrash says the

22 Rabbi Twersky quotes a correspondence from Baruch Sterman (foot-
note 30): “Though we are not one hundred percent certain, it would
appear that snail tekhelet and indigo were reduced in different ways.
Tekhelet, since it comes from a snail, may have been reduced chemically
using lead and tin pots with the sulfuric reducing agent found in the
glands of the snails. (This seems to be what Pliny describes.) Indigo, on
the other hand, comes up from a plant and has no proteins or sulfur
compounds. Up until a few years ago in America, and still in some Af-
rican countries, indigo is reduced by fermentation, using bran, madder
and sugars to cultivate the bacteria necessary to reduce the dye. These
differences may have had something to do with either the way the dye
adhered to the wool, or perhaps some extraneous chemicals found in
the dyed wool (maybe in the snail tekhelet, or just possibly in the plant
indigo).” Baruch Sterman quotes Nobel Chemist Professor Roald
Hoffman, who sees as plausible the proposition that the steadfastness
of the two dyes may be different depending on the method of extrac-
tion (footnote 15).
shell of the *billazon* grows with it. If it has a shell then it is a mollusk of some sort. Secondly, the word *billazon* normally means snail. 

Thirdly, the Ran says the *billazon* used for tekhelet has a body with no bones and is a slow-moving sea creature. The Ritva and his Rebbe (presumably the Ra’ah) describe the *billazon* in the same terms as those of the Ran. This means the *billazon* is a snail. Therefore, since the *billazon* is referred to as a דג, we see that all these Rishonim held that a snail is a דג. For more proofs that the snail is considered a fish in other areas of halakhah, see footnote 15.

3. The Gemara (Shabbat 75a) states clearly that it is considered צידה to capture a *billazon*. The question arises, how can there be צידה on an animal like a snail that can be taken אחת בשחיה? Rav Shlomo Fisher uses this argument to dismiss the murex tekhelet. Yet the four major Rishonim just quoted above must hold that by capturing a slow-moving mollusk one can be ציד משום חייב. We find in Rashi that צידה is any process where tricks or special strategies are needed to catch an animal. The murex snail burrows itself into the sand at times, and even people using scuba diving equipment have a very hard time catching this snail since it blends in with the background. In fact, fishermen today use nets with traps to catch it. These rishonim hold that when you need tricks to trap the animal it is not considered אחת בשחיה.

4. The Gemara (Menahot 44a) describes the *billazon* as דימה. The color of the murex shell, however, is not the color of the sea. So how can it be the true *billazon*? The supporters explain that...
the color of the hillazon is the same as the color of the seabed upon which it lies when living in the ocean. Only after being taken out of the ocean and drying out do the shells turn a whitish color. The different color of the snail while still in the ocean is probably due to algae that attach to its shell when the snail is alive. This provides it with a perfect camouflage. The Halacha Berurah article states that “even if one were to argue that it can also refer to the shell since this is what first meets a person’s eye, it is unreasonable to extend this untenable idea to also include foreign organisms such as algae that become attached to it. Hazal would not refer to it as gufo, but would have been more descriptive.” First of all, any scientist or layman would definitely consider a shell that grows with the snail to be part of its body. Calling this position “untenable” is completely unwarranted. With regard to the algae that attach to the shell, it must be understood that they are firmly imbedded therein and cannot be easily washed or scraped off. Rashi defines “gufo” as מראה נפש, the “look” of its body. Even if we view the algae as not being a part of the snail’s body, we can still say that the murex looks like the sea due to the algae attached to it. Any observer of a live hillazon would say that the color of its shell is blue-green.

5. The Gemara (Menahot 44a) relates that the hillazon comes up out of the sea once every 70 years. This phenomenon has not been observed by the murex snail, so how can it be the hillazon of Hazal? First of all, it is clear from the Gemara (Shabbat 75a) that in addition to coming out of the sea every seventy years, the hillazon was also hunted with normal methods at other times. Plus, there are those who say that the coming out once every 70 years was a supernatural occurrence. If so, it is reasonable that this miracle does not occur. In fact, the Radvaz explains that this phenomenon occurred only during the time of the first Beit ha-Mikdash. At the time of the exile this special occurrence stopped, and from that point on the hillazon was trapped only with normal methods. Alternately, if we un-

31 See Rav Herzog, The Royal Purple p. 69.
32 חדה מהת נ phiên ב שזר
33 רדב"ז סומכطرف ה.
derstand the coming out of the *ḥillazon* to be a natural event,\(^34\) then it is possible that changes in ocean conditions and/or the drastic reduction in the quantity of the murex snails in their habitat\(^35\) caused this event to cease.

### Reinstating a Mitzvah

The *Midrash Tanhuma* relates that the tekhelet was *גֶּנֶג נָנָנָנָנָנָנ*.\(^36\) Is it possible to reinstate a mitzvah that was *גֶּנֶג נָנָנָנָנ*?\(^37\) Radvaz\(^38\) and Maharil\(^39\) both say that tekhelet is theoretically available and one need only identify and find the *ḥillazon* in order to reinstate tekhelet.\(^40\) Additionally, the Raavad\(^41\) records exactly how Rav Natrunai Gaon would tie his tekhelet. Rav Natrunai is clearly referring to something actually performed in his day since he says about a particular detail נוהי לְעָשֹּׁת. Therefore, we know that tekhelet was extant at around 850 CE, or 100 years after the *Tanhuma* was completed. Exactly what the word *גֶּנֶג נָנָנָנָנ* means is now unclear, since tekhelet was extant after that time.

### Wearing Tekhelet as a Safek

Assuming that murex tekhelet has the status of safek, there is a question whether or not the rule of *לחומרא דאורייתא ספק* applies. The *Halacha Berurah* article states that “Quite a number of poskim maintain

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\(^{34}\) The Radzhiner Rebbe and Rav Herzog have suggested that 70 years is not meant as a precise number, but rather means that the *ḥillazon* would come out of the sea at infrequent intervals.

\(^{35}\) The murex snail is currently considered an endangered species in Israel.

\(^{36}\) מדרש תנחומא מדרש ראב"ד מדרש ראב"ד מדרש שולח ב. מדרש תנחומא מדרש ראב"ד מדרש שולח ב.

\(^{37}\) This question has been an issue ever since the Radziner Rebbe started looking for the lost *ḥillazon*. For a full discussion see *Luloot Hataheles* pp. 19–35.

\(^{38}\) שו"ת הרבר"ה ושובת תורפה

\(^{39}\) שו"ת מדרי"ל Trọng הלכה פין וירושלמי 5:2.

\(^{40}\) These two *Poskim* clearly disagree with the opinion (said in the name of the *Beit ha-Levi*) that even if we knew what the *ḥillazon* is, we would not be able to use it because of the lack of *Masorah*.

\(^{41}\) ראב"ד על חומץ הלכח ציית פרק אנ'.
that there is no requirement to perform a mitzvah with an item regarding which there is a doubt whether one can fulfill a mitzvah with it.” However, the Ran\(^{42}\) says that if one has not done the mitzvah of lulav and it is bein hashmoshos, one should do it without saying a bracha since it is a ספק. Rav Shlomo Miller\(^{43}\) in a previous article addresses this point with the following argument:

I disagree on several counts. Firstly, even if you accept the distinction made by Rabbi Miller, in the case of murex tekhelet we have done as much as possible to perform the mitzvah because there is no better candidate for tekhelet that we know of. Thus, after tying murex tekhelet no חיוב remains. Secondly, the Mishnah Berurah\(^{44}\) cites a Pri Megadim that if one has tefillin that have fallen in water, there is a safek whether he can accomplish the mitzvah, and he should put them on without a brakhah. This is exactly an analogous case to the murex, and still the Pri Megadim and Mishnah Berurah say to perform the mitzvah—even though there is a safek! Lastly, his distinction is made without any proof from a primary source. The aronim bring down the Ran without making any distinctions.

Two additional reasons are given by the Halacha Berurah article for not wearing murex tekhelet. A) For kabbalistic reasons one should not wear tekhelet made from indigo.\(^{45}\) B) “Halacha mandates that lekhathilah, unless genuine tekhelet is being used, גיזע should be

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42 The article presumes that tekhelet made from the murex has the same status of kela ilan as far as Kabbalah is concerned. This assumption is arguable. In general, the role of Kabbalah in halakhah needs its own discussion, which is beyond the scope of this article.
the same color as the garment." Clearly, both of these reasons apply only if we are convinced that murex tekhelet is not authentic. If we consider murex tekhelet to have a good chance of being genuine, then the possibility of fulfilling this great mizvah overrides these considerations.

**Summary**

A sea creature has been found with many of the critical characteristics of the billazon recorded by Hazal. It is found in the proper location, it matches the billazon linguistically, and it produces the proper color. We know of no other animal of which we can make the same claim.

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46 This statement is itself questionable. The רמאש קרמא תטשיה ה רמא in actually writes that one should wear white גיזית even if the garment is colored.
### APPENDIX

An approximate timeline is outlined below so that the reader may get some perspective as to when some of the main events occurred. Most of the following information has been taken from the Timeline on the www.tekhelet.com site.

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1750 BCE (circa Avraham’s lifetime)</td>
<td>Archaeological evidence now available suggests the origins of the purple-and-blue-dyeing industry can be traced to Crete. This implies that tekhelet was well-known at the time the Torah was given.</td>
</tr>
<tr>
<td>1200 BCE (Jews entering א״י)</td>
<td>Chemical analysis of an ancient vat at Tel Shikmona proves to be molecularly equivalent to dye from murex snails.</td>
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<tr>
<td>1200–900 BCE</td>
<td>Vat from Tel Shikmona, as well as other archaeological finds at numerous sites, reveals an advanced dye industry using murex snails on the Canaanite coast.</td>
</tr>
<tr>
<td>100 BCE–68 CE (End of 2nd Temple)</td>
<td>Caesar (100–44 BCE) and Augustus (63 BCE–14 CE) restrict the use of dyes to governing classes. Nero (37–68 CE) issues a decree giving the emperor the exclusive right to wear purple or blue garments.</td>
</tr>
<tr>
<td>300 CE</td>
<td>Under Constantius (337–362), restrictions on use of tekhelet are strictly enforced. Edicts by Gratian, Valentinian &amp; Theodosius make the manufacture of higher-quality purple and blue a state monopoly.</td>
</tr>
<tr>
<td>500 CE (End of Talmud)</td>
<td>The Talmud tells of tekhelet being brought from Israel to Babylon in the days of Rav Achai (506). No reference to its discontinuance mentioned in Talmud.</td>
</tr>
<tr>
<td>639 CE</td>
<td>Arab conquest of Israel is suggested to have brought an end to the snail-source dyeing there.</td>
</tr>
<tr>
<td>Date</td>
<td>Event</td>
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<td>---------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>750 CE</td>
<td>Midrash Tanhuma, 750, laments, “and now we no longer have tekhelet, only white.”</td>
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<tr>
<td>850 CE</td>
<td>Rav Natrunai gaon writes how he tied his tekhelet onto his zizit. This description is recorded by the Raavad.</td>
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<tr>
<td>1500 CE</td>
<td>Rondelet Guillau (d. 1566) is the first to identify Pliny’s purpura with the species murex brandaris. Fabius Columna (1616) suggests that murex trunculus was utilized in the ancient dyeing process. William Cole (1681) notes a colorless fluid in the hypobranchial gland of mollusks (purpura lapillus) found off the coast of Britain that converts to a red color upon exposure to light, thus revealing the sensitivity of mollusk-based dye to light.</td>
</tr>
<tr>
<td>1864</td>
<td>At Sidon are found shells of the murex trunculus snail that fill an area hundreds of yards long and several yards deep. The shells are broken at the spot that gives access to the glands from which the dyestuff is obtained. At some distance a separate and distinct massive mound of murex brandaris and thais haemastoma is found. Since a reddish-purple dye is most readily obtainable from the murex brandaris and thais haemastoma, as opposed to the bluish-purple obtained from the murex trunculus, Egyptologist A. Dedekind (1898) viewed this as undeniable proof that the murex trunculus was the snail used for tekhelet and the others for argamon (purple or reddish purple). Rav Herzog concurred.</td>
</tr>
<tr>
<td>Date</td>
<td>Event</td>
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<tr>
<td>1888</td>
<td>Rabbi Gershon Henoch Leiner pioneers a quest for tekhelet which led to the isolation of a certain type of squid as its source. Subsequent analysis of the dye, however, reveals the source of the blue color to be not the squid but ingredients added to the dye. Rabbi Leiner did the pioneering work on tekhelet on which all subsequent investigation has been based.</td>
</tr>
<tr>
<td>1919</td>
<td>German scientist Paul Friedlander identifies the chemical structure of the purple dye from the murex snail as dibromide indigo.</td>
</tr>
<tr>
<td>1983</td>
<td>Professor Otto Elsner from the Shenker College of Fibers in Israel and Ehud Spanier of Haifa University discover the secret of producing a pure blue color (indigo).</td>
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</tbody>
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