

Teshuva on Techeilis

by Rav Shlomo Eliyahu Miller שליט"א

Dr. Mendel Singer asked Rav Miller whether the *murex trunculus* might be considered the *chilazon* for the purposes of *techeilis*. Rav Miller's *teshuvos* are attached as well as the earlier articles on the topic by Dr. Singer.

שאיילות ותשובות תכילת – ר' שלמה אליהו מילר שליטי"א

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אודות התכלת החדשה כבר הייתי שם במקום שעושים התכלת ולדעתי כל מש"כ בזה אין שום הוכחה שזהו תכלת, אדרבה יש ב' ראיות גדולות שאינה תכלת. א', דבגמרא ורמב"ם מבואר שיש בדיקה להבחין בין תכלת לקלא אילן, ומה שעושין תכלת החדשה הוא ממש קלא אילן אלא שעושים את זה ממין "מורקס" ומשנים הריר עד שיהא דומה ממש לקלא אילן ואין שום חילוק ביניהם באופן כימי וע"כ א"א להיות שום בדיקה להבחין ביניהם, וכל מה שדחו ראיה ברורה זו אין בו לא טעם ולא ריח.

ב', מה שעושין היום שאחר שבירת קצת מן הקליפה הם חותכין קצת מן החי וטוענים שכן מצאו הרבה כזה בחפירות מימים קדמונים, הנה בגמרא מפורש שמלבד איסור צידה ליכא שום איסור בפציעת חלזון ובנטילת הצבע, ובאופן שהם עושים הלא הוא גזיזת דבר מן החי שלכל הדיעות הוי מלאכה מן התורה בשבת כמו הסרת ערלה מן החי, וחייב או משום נטילת נשמה, או משום גוזז לפי"ד הש"מ בכתובות, וא"כ מפורש שמה שהם עושים אין זה באופן שעושים תכלת.

גם מפוי בגמ' שאופן פציעתו הוא באופן נטילת נשמה, אלא שאינו מכויין לנטילת נשמה והוי מקלקל או פס"ר דלנ"ל לגבי נטילת נשמה, והצבע שעושים הלא גם לדבריהם הלא הוא טוב ומועיל גם שעה או שעתים אחר המיתה, וא"כ גם מזה מוכח שאין תכלת שלהם תכלת של הגמ'.

גם יש להעיר מדברי תשובת ר"א בן הרמב"ם בברכת אברהם ליישב דעת אביו דחובל וחולב חייבים משום תולדות דדש, אף שאין דישה אלא בגדו"ק ומה"ט ליכא חיוב דישה מחלזון כמפורש בגמרא. וביאר דדישה ממש בעינן גדו"ק אבל תולדות דישה אי"צ גדו"ק. וכפי הנראה נטילת הריר מן החלזון אינו דישה ממש, ולכל היותר הוי תולדות דישה אשר אי"צ בהן תנאי גדו"ק לדעת הרמב"ם.

והנה יש מחלוקת הראשונים כמה חוטין בעינן לתכלת, א' משמונה או ב' משמונה [דהיינו א' מד' חוטין שבציצית], או ד' חוטין מח' [דהיינו ב' חוטין שלמים תכלת ובי' חוטין לבן]. והנה לדעת הרמב"ם דבעינן פתיל א', ע"י אור שמח ריש הלכות ציצית שכתב בדעת הרמב"ם דחוט א' חציו תכלת וחציו לבן דלצובעו כולו תכלת א"א דפתיל א' ולא שנים. ונ' כוונתו דלהרמב"ם דפתיל הכוונה א' א"כ הוי בל תוסיף כשצובע ב' חוטין [מן הח' חוטין דהיינו חוט שלם], וא"כ אם התכלת כשרה ועושים יותר מחוט א' לדעת הרמב"ם אסור והוי בל תוסיף, אבל בזה שכתבנו שהתכלת פסולה הרווחנו שלא עברו על בל תוסיף לדעת הרמב"ם.

גם ראיתי שאחד מן המחזיקים בתכלת החדשה דחה דברי הגר"ח ז"ל שאמר דמצד סד"א לחומרא ליכא חיוב לעשות מעשה שהוא ספק מצוה. והיה סבור שסברות הגר"ח שבכל ספק מצוה ליכא חיוב סד"א לחומרא, ודחה דבריו מדברי הר"ן דגם בבהש"מ מחויב ליטל לולב ואתרוג אף דלא הוי אלא ספק מצוה. ולא הבין כלל סברת הגר"ח ואינו ענין כלל לדברי הר"ן. והי' לו לזכור הגמ' גברא רבה אמר מלתא אין מזניחין אותו. סברת הגר"ח הוא במצוה שמחויב בתורת ודאי, ויש לפנינו אופן לקיימו מספק, ואחר שיקיים מספק עדיין נשאר מחויב בדבר מדין סד"א לחומרא, א"כ ליכא חיוב מה"ת לעשות דבר שאף אחר עשייתו נשאר החיוב לעשות מוטל עליו. ואינו דומה כלל לדברי הר"ן דבהש"מ יש חיוב מספק וע"י עשייתו הוא פוטר עצמו מן החיוב ולא נשאר שום חיוב עליו. וא"כ אף אם היה ספק השקול אם זהו תכלת, לדברי הגר"ח ליכא חיוב מצד סד"א לחומרא להטילו בבגדו.

ובעיקר סברת הגר"ח נראה דתלוי בפלוגתא דרמב"ם ורשב"א אי סד"א מה"ת לחומרא או מדרבנן לחומרא, דלדעת הרשב"א דמה"ת לחומרא א"כ אם יטיל ספק תכלת בבגדו עדיין נשאר חיוב מצוה עליו מדין סד"א לחומרא, וכיון דלא יפטר מחיוב ע"י הטלת ספק תכלת ליכא חיוב עליו להטיל בבגדו ספק תכלת. אולם לדעת הרמב"ם דסד"א מה"ת לקולא, א"כ י"ל ע"י הטלת ספק תכלת נפטר מחיובו מה"ת ושפיר י"ל דחייב מה"ת להטיל ספק תכלת בבגדו לפטור חיוב תכלת שעליו. וידוע תשובת הר"ן לענין להתיר נדר בביהש"מ של יום חלות הנדר דתלוי בפלוגתא הנ"ל דלדעת הרשב"א דסד"א מה"ת לחומרא כבר חל הנדר ויכול להתירו מה"ת, משא"כ לדעת הרמב"ם דמה"ת סד"א לקולא. א"כ בביהש"מ עדיין מותר מה"ת וא"כ לא חל עדיין הנדר וא"א לו להתירו עדיין. אולם למש"כ החו"ד בסימן ק"י דהרמב"ם לא ס"ל דסד"א מה"ת לקולא רק בספק איסור, דמה"ת דוקא

ודאי אסור, אבל לענין קיום מצות מחויב לקיים באופן ודאי וספק קיום מצוה גם לרמב"ם אינו פוטר חיובו. וא"כ אף לדעת הרמב"ם אם יטיל ספק תכלת עדיין נשאר בחיובו מה"ת, וא"ש סברת הגר"ח דליכא חיוב לעשות דבר שאף אחר עשייתו נשאר החיוב עליו, ואף שיש ראיות מכמה פוסקים דלא ס"ל כסברת הגר"ח, וגם האדמו"ר מראדזין ז"ל כבר דן על סברא זו, מ"מ עיקר הסברא סברא ישרה וא"א לדחותו בקל.

ומה שטוענים שמצאו מיני המורקס בחפירות, יתכן מאד שהיה צבע ארגמן אשר עד לפני כ"ד שנה לא ידעו שיש אופן לשנות הצבע ולעשותו קלא אילן ממש, א"כ י"ל בימים קדמונים לא ידעו מזה אלא שעשו מזה צבע אחר. ובפרט שכבר כתבתי שלפי הראיות שהביאו גם בימים קדמונים היו עושים באופן שהם עושים, וא"כ הוי מלאכה דאורייתא כמו הסרת ערלה מן החי. ועיין בן איש חי בספרו בן יהודע על ב"מ דף ס"א שכתב ע"פ קבלה מדברי האר"י ז"ל דגוון קלא אילן יש לסט"א אחיזה [ורק בתכלת כשרה אין לו אחיזה], וע"ש שהאריך בזה, א"כ לדעתי שזהו קלא אילן יש קפידא על פי קבלה בדוקא שלא להשתמש בגוון זו שיש בו אחיזה לסט"א. מלבד הטעם ע"פ הלכה שאינו בגוון דכנף, דאם אינו תכלת בעינין לכתחילה שיהיו הציצית כגוון הכנף אין עושים רק ציצית לבנים וכמ"ש הרמ"א סימן ט' ס"ה אף בשאר גוונים של בגד ומה"ט מדקדקים לעשות טלית רק גוון לבן כיון דאין עושין ציצית רק לבנים.

והנה בעיקר מה שדוחקים המדעים בזה מפני שלא ידוע שום מין אחר וע"כ צריך להיות המורקס, אבל אין זה כלום לכל יודע דבר דתמיד מוצאים דברים שלא ידעו מתחילה, ובפרט חלזון שכבר אמרו עליו שאינו מנמצא עכשיו.

סוף דבר לדעתי יש קפידא בדוקא שלא להשתמש במין תכלת החדשה הבאה מן ה"מורקס".

ידידו,
שלמה אליהו מילר

לכבוד ידידי הרה"ג ר' זאב אריה קנאפלער שליט"א

קבלתי מכתבכם מלא וגדוש מכמה הערות אבל מחמת ריבוי הטרדות כמעט אין לי פנאי להשיב לך, אבל לכבוד רב זרזתי עצמי וע"כ השתדלתי להשיב איזה דברים הנוגע לד"ת ואין מטרתי להתוכח בעצם הענין שלדעתי הדבר ברור שאין זה תכלת ולשנות דעת המחזיקים בזה לדעתי לא יועיל בויכוח בזה ובפרט שכבר עשו מעשה וכבר כתב מהרלב"ח בקונטרס הסמיכה אחר שכבר עשו מעשה הם נוגעים בדבר לקיים דבריהם אבל להעיר בד"ת מש"כ עמ"ש דחתיכת קצת מן החי הוא מלאכה דאורייתא או גוזז או נטילת נשמה ובגמ' מפורש דליכא שום איסור בעשיית חלזון מלבד בצידה לדין דקיי"ל אין דישה אלא בגידולי קרקע, ומע"כ העיר ע"פ דברי הריטב"א דבחלזון אף שנטילת הדם הוא חובל וכמו כל חבורה לחייב משום נטילת נשמה וכמו שהק' התוס' והתוס' תירצו דדם חלזון שצובעים בו מיפקד פקיד ובריטב"א שהביא מע"כ דבחלזון דאינו בעל איברים ליכא נטילת נשמה במקצתו רק בכולו וא"כ שפיר טוען מע"כ דלפי דברי הריטב"א אין שום טענה דליתחייב משום נטילת נשמה. אולם כידוע תוס' ורוב ראשונים לא תירצו כן ואף לדעת הריטב"א [וכן הביא מהרמב"ן] מ"מ הלא כל ההכרח לחידוש גדול כזה שבעל חי שאינו בעל איברים ליכא חיוב נטילת נשמה רק בכולו ולא במקצתו הוא מכח הקושיא דניחייב פציעת חלזון משום נטילת נשמה מחמת הוצאת הדם כמו כל חבורה, וא"כ מפורש בדבריהם דדם חלזון הוא דם שממנו חי החלזון והוא דם ממש, אבל הריר שב"מורקס" אינו דם כלל ואין בו איסור נטילת נשמה כלל, וא"כ הלא מפורש בראשונים אלו שדם המורקס שהוא רק ריר בעלמא אין זה דם חלזון שבגמרא וא"כ ממנ"פ לפי המפורש בראשונים שיש בזה נטילת נשמה כמו כל דם של בהמה חיה ועוף אין להסתפק כלל ב"מורקס", ואם נתעקש שהראשונים טעו ולא ידעו שאין דם חלזון דם ממש אלא ריר בעלמא ולשון דם הוא לשון מושאל בעלמא כמו דם ענב תשתה חמר, א"כ אין שום מקור להכריח שבבריה קטנה כמו חלזון ליכא חיוב על נטילת נשמה במקצתה וא"כ שפיר יש לחייב מצד נטילת נשמה בנוטל קצת מן החי.

ומה שהעיר מע"כ דליכא חיוב גוזז בנוטל קצת מן החי דא"כ גם לאחר מיתה יתחייב גוזז בחותך קצת מן המת, וגם במילה גופא מצינו דבבן ח' ליכא חיוב מה"ת ואמאי אינו חייב משום גוזז והעיר מדברי כמה אחרונים שרק במילה יש גוזז דחשוב נטפל לגוף ישראל. אולם אף שצ"ל לדברי חת"ס בשבת הלא הי' גם לצ"ל לחת"ס בכתובות סוף ה': שכתב דגם יש חיוב תולש בנוטל מן החי א"כ יש לחייב כאן משום תולש. ובעיקר הקושיא ממילת בן ח' היה נ"ל לפרש דברי הש"מ דבכל חותך דבר מן החי הלא באמצע החיתוך הוא אבר המדולדל או בשר מדולדל דקיי"ל מיתה עושה ניפול ואין שחיטה עושה ניפול¹ וא"כ עכשיו אינו חלק גמור מן החי שהרי מיתה עושה ניפול, וגם אינו נפרד לגמרי שהרי אין שחיטה עושה ניפול א"כ חשיב כדבר הנטפל לחי ושייך בו גוזז, אבל אחר מיתה או בבן ח' דלא חשיב חי א"כ לא חשוב כנטפל אלא כחלק מן העיקר שנחתך מקצתו, ורק בחי שהנחתך אין לו חיות גמורה כמו החי בזה שייך תורת גוזז ולא קשה מידי כל הקושיות שהקשו על הש"מ. ואף דבציצין שפרשו רובן ליכא חיוב גוזז מה"ת כמבואר בשבת צ"ד: התם משום דקרובין לינתק וכמו שכתב רש"י שם, אבל בבשר או אבר שפרש רובו נראה דאינה קרובה לינתק ויש חיוב גוזז מה"ת.

ומש"כ אודות סברת הגר"ח לענין ספק דאורייתא לחומרא וצינת לדברי הרב מנחם זעמבא זצ"ל בספר גור אריה יהודה סימן ח'. באמת גם הגאון ר' מנחם זעמבא נזקק לסברא זו אבל כנראה לא הבין מע"כ מה שכתבתי וגם מה שכתב הגאון ר' מנחם זעמבא ואני אשתדל להסביר הסברא עוד הפעם ואינו ענין כלל לדברי הפרמ"ג שכתבת וכן כתב בספר גור אריה יהודה דאינו ענין כלל לסברת הפרמ"ג ע"ש בקונטרס שו"ת סימן ח' ס"ק ז'², והיינו דכל דין סד"א לחומרא הוא רק ע"י עשייתו נפטר מחיובו, אבל אין שום חיוב מד"ת לעשות דבר שאחר עשייתו עדיין נשאר בחיובו מתחילה. ולמשל אם מחוייב מד"ת במצות אתרוג ביום ראשון ועכשיו יש לו ספק אתרוג, ואחר שיטלנה עדיין מחוייב מדין סד"א לחומרא לחפש עוד אתרוג שיהא כשר בתורת ודאי, וא"כ ע"י נטילת הספק לא נפטר מחיובו, וא"כ מה"ת ליכא שום חיוב בזה. ואינו ענין לדברי המג"א והפרמ"ג לענין ברהמ"ז שאם אכל כדי שביעה שחייב מה"ת וא"י רק ברכה א' והוא ספק אם מעכבין זא"ז, דאף אם נאמר שם דחייב מדין סד"א לחומרא שאני התם שהרי ודאי קיים המצוה של ברכה אחת ואף אם לא יצא יד"ח מ"מ חלק זו

¹ ע' חולין דף עג
² עיין בס"ק ט' וי'

מן המצוה כבר נפטר מלעשותו. וכ"ז כ"כ הגאון רב מנחם זעמבא ז"ל ותמה אני על מע"כ אם כבר ראה דברי הספר גור אריה יהודה למה לא ראה מש"כ בסימן ח' ס"ק ז', וגם בספר פתיל תכלת שצינו לדברי גור אריה יהודה אבל לא העתיקו מש"כ להדיא בסימן ח' כנ"ל [ע' פתיל תכלת דף 81] ואינו ענין כלל לדברי הר"ן בסוכה וגם אינו ענין לדברי הפרמ"ג כנ"ל.

ומש"ה א"ש מש"כ דלכאורה תלוי בפלוגתא דרמב"ם ורשב"א אי ספק דאורייתא מה"ת לחומרא או רק מדרבנן דלדברי הרמב"ם כבר נפטר מחיוב מד"ת בעשיית ספק וא"כ מחוייב מה"ת לעשות ספק מצוה דבזה מה"ת נפטר מחיובו, משא"כ לרשב"א מד"ת עדיין נשאר בחיובו ומע"כ לא הבין מש"כ וכתב דמ"מ חייב מדרבנן ואינו ענין כלל לסברא שכתבתי. אולם כתבתי להח"ד וסייעתיה דס"ל דגם להרמב"ם בספק קיום מצוה אמרינן ספק מה"ת לחומרא דכמו באיסורים התורה לא אסרה אלא ודאי איסור ולא ספק, ה"נ במצות התורה חייבה ודאי אתרוג ולא ספק, וא"כ גם להרמב"ם לא יצא יד"ח ודאי מצוה, בעשיית ספק מצוה שהרי הוא נשאר חייב בעשייתה.

ולענין חשש בל תוסיף שכתבתי לדעת הרמב"ם ידוע שהעיקר בדעת הרמב"ם הוא דב' לולבים הוי בל תוסיף, וכל חזרתו בתשובה הוא רק לענין ערבה דאין כאן מנין מפורש בתורה אלא כתוב ערבי לשון רבים. וה"נ לרמב"ם פתיל תכלת א' ולא ב' ואם עושה ב' הוי חשש ב"ת לרמב"ם.

הנה אחרתי תשובתי זמן רב מחמת טרדות שונות ואפיסת כוחות ומ"מ התאזרתי עכשיו לגמור איזה מלים אף שיש מקום להאריך הרבה בכל דבריך.

בברכת כל טוב שלמה אליהו מילר

The Techeilet Trilogy

The following articles appeared in the *Journal of Halacha and Contemporary Society*, edited by Rabbi Alfred Cohen and published by the Rabbi Jacob Joseph School. The original article by Dr. Mendel E. Singer appeared in Vol. 42, Sukkot 2001. The response by Dr. Baruch Sterman appeared in Vol 43, Pesach 2002, and the author's reply appeared in Vol. 44, Sukkot 2002. The version of the author's reply that appears here is the original, unedited text with an addendum that was submitted but not published. In addition, the letter to the editor by Rabbi Yechiel Yitzchok Perr, Rosh Yeshiva of Yeshiva Derech Ayson in Far Rockaway, NY, that appeared in the Pesach 2002 issue, is included as an appendix. All of these articles are reprinted with permission at <http://www.chilazon.com>.

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Understanding the Criteria for the Chilazon

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Bio

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Background

The Torah commands us to wear a thread of blue, *techeilet*, in each corner of our *tzitzit*.¹ While *tzitzit* serve as a visual reminder to do the *mitzvot*, the blue thread reminds us of *Hashem*: “*Techeilet* resembles [the color of] the sea, and the sea the sky, and the sky the throne of glory”.² The Gemara informs us that the *techeilet* dye comes from a bodily fluid (lit: blood)³ of the *chilazon*.⁴ At some point it became forgotten which species is the *chilazon*. Exactly when *techeilet* ceased to exist is unknown. Though some have suggested this happened sometime between 500-700 C.E.,⁵ there is evidence that *techeilet* continued to be dyed in some places for another several hundred years.⁶

In the 1880’s, Rabbi Gershon Henoch Leiner, the Radzyner Rebbe zt”l, set out to identify the *chilazon* species. Although widely known for his talmudic expertise (e.g. *Sefer Sedrei Taharot*), he had studied biology, chemistry and engineering, and practiced medicine as well.⁷ Guided by the *simanim* (signs) provided by the Talmud and the *Rishonim*, he traveled across Europe, studying at the famed aquarium of Naples. He decided that the long lost *chilazon* is *sepia officinalis* (the common cuttlefish), believed by some to be the opinion of Rambam.⁸ He wrote three books on *techeilet*, comprising nearly 500 pages. In the words of one of his present day dissenters, “These books still stand as the definitive works on the subject, and form the halachic foundation of any discussion of the topic”.⁹ Even today Radzyn produces *techeilet* from the cuttlefish.

Rabbi Dr. Yitzchak Herzog z”l, a brilliant talmudist, Jewish historian and the Chief Rabbi of Eretz Israel from 1936-1959, was fluent in numerous languages and *techeilet* was the subject of much of his doctoral dissertation. Rabbi Herzog rejected the Radzyner Rebbe’s position, and concluded that the *chilazon* was a member of the *Janthina* species.¹⁰ However, the dye produced by the *Janthina* turned brown, and was not permanent. It appears that Rabbi Herzog did not pursue this matter further, and no *techeilet* was ever produced from the *Janthina*.

In recent years there has been a movement in favor of the *murex trunculus* snail as the *chilazon*. Fueled by the work of Dr. Irving Ziderman, an academic scientist at the Israel Fiber Institute, followers of this theory formed an organization, *Petil Tekhelet Foundation*. Based largely on archeological and scientific evidence, they have been active in publishing, lecturing and electronic dissemination.¹¹ Their work has, for the most part, gone without critical appraisal. This article will attempt to elucidate the criteria for identification of the *chilazon*, clarify what is required to meet these criteria, and then evaluate the theory that *murex trunculus* was the *chilazon*. The criteria will be presented in 4 categories. The first section will discuss the primary criteria, based on statements brought by the Gemara for the purpose of describing the *chilazon*. This is followed by an analysis of the Gemara’s chemical tests for *techeilet*. Secondary criteria will deal with those characteristics of the *chilazon* which can be deduced from statements made for other purposes. Lastly, there is a section for other evidence which might be brought to lend further credence to, or discredit a claim.

¹ Bamidbar 15:38.

² Menachot 43b.

³ Hebrew: *dam*. The *chilazon* has two “bloods”, one that is the life blood, and another that is stored in its own sac. This other “blood” is the source of the *techeilet* dye (Rabbeinu Tam, Tosafot, *Shabbat* 75a)

⁴ Menachot 44a, *Masechet Ketanot Masechet Tzitzit* Ch. 1 Halacha 10, Tosefta Menachot 9:16.

⁵ Rabbi Isaac Herzog, “Hebrew Porphyrology”, in Ehud Spanier, ed., *The Royal Purple and the Biblical Blue: Argaman and Tekhelet* (Jerusalem, 1987), p.112. Baruch Stermen, “The Science of Tekhelet”, in Rabbi Alfred Cohen, ed., *Tekhelet: The Renaissance of a Mitzvah* (New York, 1996), p.70.

⁶ The Radzyner Rebbe bases this on the fact that gaonim did not write about *halachot* that were no longer applicable, and two of the gaonim wrote about the laws of *tzitzit* based on *techeilet* (Rav Natronei Gaon, Rav Shmuel bar Chofni). He also notes that Rambam explained in a responsum the practical application of the laws of *techeilet*, implying they were wearing *techeilet* in Luniel. (Rabbi Gershon Leiner, *Sefunei Temunei Chol*. Published in *Sifrei HaTecheilet Radzyn* (Bnei Brak, 1999), pp. 5-6. A nearly complete English translation of this *sefer* can be found at <http://www.begedivri.com/techelet/Sefunei.htm>)

⁷ Chapter on Rabbi Gershon Leiner in Frenkel, Rabbi Isser, *Yechidei Segulah* (Tel Aviv, 1967).

⁸ Ludwig Lewysohn, *Zoologie des Talmuds*. (Frankfurt, 1858), pp. 283-285.

⁹ Stermen *ibid.* p. 73.

¹⁰ Herzog *ibid.*

¹¹ The Petil Tekhelet Foundation maintains an excellent online library on their web site, <http://www.tekhelet.com>. This library was the source for many of the pro-*murex* arguments cited here. Their great efforts at publicizing the neglected mitzvah of *techeilet* is inspiring.

Primary Criteria

The strongest criteria for identifying the *chilazon* comes from the Gemara *Menachot*, where the subject of *techeilet* is discussed extensively.¹² There, the Talmud cites several sources in order to describe the *chilazon*. These statements are of the utmost importance because they were cited for the sole purpose of describing the *chilazon*. *Chazal*, knowing which species was the *chilazon*, chose these statements to describe it. As such, in order for a candidate species to satisfy these criteria, it is not sufficient to meet these criteria in a minimalist sense. It must be reasonable that *Chazal* would have chosen these statements to describe it. In evaluating whether a particular species is the *chilazon*, a strong case must be made for all of the primary criteria. The primary criteria for the *chilazon* come from the following statements: “*Chilazon zehu gufo domeh l’yam, ubriato domeh l’dag, v’oleh echad l’shiv’im shanah u’bdamo tzov’in techeilet, l’fichach damav yekarim*”.¹³ This establishes four primary criteria for the *chilazon*:

1. the color of its body is like the sea
2. its form is like a fish
3. it comes up once in 70 years, its “blood” is used for *techeilet*, therefore
4. it is expensive.

As Rabbi Herzog points out, the first requirement uses the *lashon gufo*, meaning body or flesh.¹⁴ It does not refer to the shell, which is usually rendered *nartik* or *klipah*. The *lashon* here, *gufo domeh l’yam*, is similar to the statement just a few lines earlier in the Gemara, *techeilet domeh l’yam*, where it is understood that the color of *techeilet* is similar to the color of the sea. There the comparison is extended to the sky and the sapphire, indicating that *techeilet* is blue.¹⁵ If, just a few lines apart, dealing with the same subject, we find the same expression, *domeh l’yam*, it is reasonable to conclude that the meaning is the same in both cases. If *techeilet* and the body of the *chilazon* are both *domeh l’yam*, then the color of *techeilet* and the color of the body of the *chilazon* must be similar, i.e. both blue. This is supported by the *lashon* of the *braita* of *tzitzit*, which states “*gufo domeh l’rekiah*”.¹⁶ The body of the *murex* does not resemble the sea. The Petil group argues that the shell of the *murex trunculus* is sometimes covered with a sea fouling. The color of these organisms will vary from place to place, but is sometimes blue or green.¹⁷ This argument fails on three counts. First, the requirement is for the body, not the shell. Second, the color of the sea fouling is only sometimes blue. Since it is usually not blue, the Gemara certainly would not choose to describe it as blue. Third, it is implausible that *Chazal* would choose to identify the *murex trunculus* by giving a description of the sea fouling, which is neither a part of the creature nor distinctive, since it covers everything else in the area, as well.¹⁸ Some have tried to argue that the Hebrew word *yam* can also mean seabed. However, only the shell is colored like the seabed, not the body. Considering that *yam* almost always means sea, and is used as such in regards to the color of *techeilet* in many places, it is hard to believe it could be used to mean seabed here. In fact, the requirement that the color of the body of the *chilazon* be like the *yam* is just a few lines after the Gemara’s statement that *techeilet* is the color of the *yam*, which everyone, including the *murex* supporters, agrees means sea.

As for criterion 2, the statement in the Gemara is “*briato domeh l’dag*”. *Briato* means “its form”, as explained by Rashi and Rabbeinu Gershom.¹⁹ *Murex trunculus* in no way resembles a fish. Supporters of the *murex trunculus* theory suggest *briato* could mean “its creation”, since *murex* spawn like fish. Aside from relying on an interpretation of *briato* that is contrary to the classical *mefarshim*, there is another difficulty. Since most mollusks spawn, it is unlikely that *Chazal* would have chosen this characteristic to distinguish the *chilazon* from other species.

Regarding criterion 3, the requirement of once in 70 years, the Radzyner Rebbe says this means that there are times when the *chilazon* is abundant.²⁰ Likewise, Rabbi Herzog, citing also the *braita* of *tzitzit* that says the *chilazon* comes up every 7 years, is of the opinion that there should be some cycle, though not necessarily 7 or 70 years.²¹ *Murex trunculus* has no known cycle or times of unusual abundance. Petil followers have tried to argue that the Hebrew *sheva shanim* in the *braita* could also mean seven-fold, and Pliny the Elder mentions an optimal

¹² *Menachot* 41-44.

¹³ *Menachot* 44a.

¹⁴ Herzog *ibid.*, p. 70.

¹⁵ Although Rashi states that *techeilet* is green (*Shemot* 25:4), it should be pointed out that there were few color designations in the Gemara, and that green represented a color classification that includes blue (Herzog *ibid.* p.92). Indeed, elsewhere Rashi states the color of *techeilet* resembles the darkened sky at dusk (*Bamidbar* 15:41).

¹⁶ *Masechtot Ketanot Masechet Tzitzit* Ch. 1 Halacha 10

¹⁷ Serman *ibid.* p.69.

¹⁸ Serman *ibid.* p.69.

¹⁹ Rashi, Shita Mikubetzet and Rabbeinu Gershom, *Menachot* 44a; Herzog *ibid.* p.65.

²⁰ Leiner *ibid.* p.4.

²¹ Herzog *ibid.* pp. 69,73.

seven-month cycle for harvesting *murex* snails.²² This not only ignores the Gemara's expression of 70 years, but also assumes that seven-fold means seven one-month periods. They do not suggest a reason why the base unit should be one month. Clearly the intention of the Gemara and the *braita* is that it is unusual for there to be an abundance, and every seven months is hardly unusual or noteworthy.

Purple dye from all species of *murex*, including *trunculus*, was exceedingly expensive. This was because each snail possessed so little dye that it took about 8,000 snails to make one gram of dye!²³ In criterion 4, Rashi explains that the *techeilet* dye was expensive because of the *chilazon's* rare appearance, and not because of the minute dye quantity.²⁴ This follows from the language of the Gemara where the statement that the dye is expensive is introduced with the word *lefichach*, "therefore", and the preceding statement was about the once in 70 year appearance of the *chilazon*. Rabbi Herzog indicates that this requirement implies that the quantity of dye in the *chilazon* was not very small, which is inconsistent with *murex trunculus*.²⁵

Chemical Tests

In ancient times, there were unscrupulous individuals who would substitute an imitation *techeilet* dye known as *k'la ilan*, for the real *techeilet*. *K'la ilan* is widely understood to be indigo, traditionally derived from a plant.²⁶ Indigo was the predominant source of blue dye in ancient times, and was both readily available and relatively inexpensive. This counterfeit *techeilet* was virtually identical to the color of the real *techeilet*. Accordingly, the Rabbis proposed chemical tests that could distinguish between the chemical that made up the authentic *techeilet* and the chemical that made up the counterfeit *techeilet*.²⁷ These tests are based on subjecting the dyed wool to a fermentation process²⁸ and ruling it *k'la ilan* if the color worsens. Fermentation processes were used in the traditional method of dyeing indigo, and causes the blue indigo to change to a yellow solution.²⁹ Chazal used this knowledge to design tests that indigo would fail. The chemical test proposed by Rav Yitzchak the son of Rav Yehudah describes a fermentation vat typical of what was used in ancient dyeing of indigo. The main ingredient was fermented urine, *mei raglayim*.³⁰ Though the Gemara's *lashon* of "*ben arba'im yom*" could mean the *mei raglayim* had to be 40 days old (thereby sufficiently fermented), or it could mean the *mei raglayim* had to be from someone 40 days old, as Rashi notes³¹, the *mei raglayim* must be fermented.³² *Mei raglayim* of babies under 6 weeks old consists mostly of water, making it a poor choice for fermentation. Thus, the Gemara's use of "*ben arba'im yom*" could reasonably be understood either way. Regardless, it is clear that the Gemara's chemical tests were based on the chemical properties of indigo and were designed so that indigo would fail the test.

The Petil group uses mucus from the *murex trunculus* snail, and through a process creates indigo, chemically identical to plant indigo. In other words, Petil is saying that real *techeilet* and imitation *techeilet* are the same chemical, just made from different sources.³³ This position is untenable. Obviously, if the Gemara gives chemical tests to distinguish *techeilet* from *k'la ilan*, they cannot be the same chemical! Dr. Allen Kropf, a retired professor of pigment chemistry familiar with the Petil dyeing process, writes in a personal communication, "There should absolutely be no chemical difference between plant and snail indigo. Thus, any chemical test that posits a difference, is not valid, in my opinion". Therefore, the Gemara's chemical tests cannot possibly be testing plant indigo vs. snail indigo. This leaves two possibilities: plant indigo is not *k'la ilan* or snail indigo is not *techeilet*. Given the wide acceptance of indigo as *k'la ilan*, and the corroboration afforded by the Gemara's tests which are

²² R.J. Forbes, *Studies in Ancient Technology* Vol 4, 2nd edition (Leiden, 1964), p.120.

²³ P. Friedlander, "Über den Farbstoff des antiken Purpurs aus *murex brandaris*", *Berichte der Deutschen Chemischen Gesellschaft*. 42(1909):765-770.

²⁴ Rashi on *Menachot* 44a.

²⁵ Herzog *ibid.* p. 70.

²⁶ Aruch on *k'la ilan*; Nimukei Yosef *Baba Metzia* 34a; Herzog *ibid.*, pp.94-96, Responsa Ridbaz v2, 685.

²⁷ *Menachot* 42b-43a.

²⁸ Herzog *ibid.* p.102.

²⁹ Indigo, to be able to penetrate wool, must first be converted (oxygen removed) into its chemically reduced form, known as "indigo white" (which is really more of a yellow, or yellow-green). After wool is dipped into "indigo white", it is removed from the solution and turns blue upon exposure to the oxygen in the air. The chemical reduction of indigo into "indigo white" was done by immersion into a fermentation vat. The first of the two tests in the Gemara describes such a fermentation vat, which should reduce the indigo, thereby fading the blue color and failing the test. Descriptions of fermentation vats can be found in: Edmund Knecht, Christopher Rawson, and Richard Loewenthal, *A Manual of Dyeing*, Eighth edition, (London, 1925), and J.N. Liles, *The Art and Craft of Natural Dyeing*, (Knoxville, 1990).

³⁰ The ingredients of the test, fermented urine, juice of the fenugreek plant and alum, seem puzzling at first glance. It would not appear to be a convenient test if it involves waiting many days for the *mei raglayim* to ferment. However, knowing that this is merely describing a typical fermentation vat used for dyeing indigo the matter becomes clear. *Techeilet* dyeing was probably done at or near the dye houses. Anyone wishing to test *techeilet* could merely walk over to where indigo was being dyed and put it in a fermentation vat and check it in the morning. The second test uses a hard, leavened dough that has fermented as much as possible (Rabbeinu Gershom, *Menachot* 43a).

³¹ Rashi on *Menachot* 44a.

³² Rambam, *Hilchot Tzitzit*, Ch. 2, Halacha 5; Tosafot on *Menachot* 43a; Tosafot on *Nidah* 63a.

³³ The Petil writings and web site boast (bold print) of how their *techeilet* is chemically equivalent to indigo.

clearly based on detecting indigo, the only conclusion would seem to be that *techeilet* is not snail indigo. Nonetheless, Dr. Roald Hoffman, a Nobel-prize winning chemist does reach a different conclusion. Recognizing the impossibility of distinguishing plant indigo from snail indigo, he clings to the conclusion that *murex* indigo is *techeilet*. He writes of the Gemara's chemical tests, "These tests don't work, because the chemical is the same".³⁴ Since the Gemara's tests were clearly based on sound scientific knowledge and the tests were actually used ("Rav Yitzchak the son of Rav Yehudah used to test it thus..."³⁵), it would seem rather presumptuous to doubt the veracity of the Gemara's tests. It is the scientist's conclusion that *murex* indigo is *techeilet* that needs to be re-examined. Even Dr. Irving Ziderman himself, the chemist whose work led to the creation of the Petil group, acknowledges that *murex* indigo is guaranteed to fail the Gemara's chemical tests and therefore rejects the theory of *murex* indigo as genuine *techeilet*.³⁶ Petil writings have suggested that the chemical tests might be designed to detect impurities that might be found in plant indigo, but are not found in snail indigo. This logic demonstrates a lack of understanding of the nature of the chemical tests. It is clear from the above discussion that the Gemara's tests are based on the chemical nature of indigo, and not any remaining impurities. Thus, the *murex*-indigo used by Petil for *techeilet* will fail the Gemara's tests, rendering it invalid. However, a distinction must be made between evaluating whether a species is the *chilazon* and assessing whether a particular dye is *techeilet*. Even though *murex* indigo cannot be genuine *techeilet*, this does not by itself preclude the possibility that *murex trunculus* is the *chilazon*. There may be an as of yet undiscovered, alternative process that creates a different blue dye (i.e. not indigo) from the *murex trunculus*. Therefore, it is still necessary to evaluate whether *murex trunculus* meets the criteria for the *chilazon*.

An interesting side-note: the process used by Petil to make indigo from *murex trunculus* would also work for the other species famous for their use in ancient purple dyeing, *murex brandaris* and *purpura (thais) haemastoma*.³⁷ Indeed, none of the arguments presented in Petil writings appear to uniquely identify *murex trunculus*.

Secondary Criteria

There are other sources from which additional information about the *chilazon* can be deduced. These criteria can lend valuable support to a theory postulating a particular species as the *chilazon*. However, care should be taken in determining the weight placed on these criteria. These criteria were not brought for the purpose of identifying the *chilazon*, as was the case with the primary criteria discussed above. As such, it may be that a particular statement should not be understood literally or exactly. Unlike the primary criteria, meeting secondary criteria should only involve a plausible explanation, and does not have to bring out the uniqueness of the *chilazon*, and may be difficult to understand without already being familiar with the species. There is also the complication that it is not always clear when the Gemara's use of the word *chilazon* is speaking specifically of the *chilazon shel techeilet*. In some of these cases the classical *mefarshim* clarify this, in other cases it remains ambiguous.

Shell grows with it: The Midrash says about the *chilazon*, "its shell (*nartiko*) grows with it".³⁸ This would rule out hermit crabs, for example, since they do not grow shells but rather move into shells they find. This would also rule out species like the lobster that when outgrowing their shell, discard it and grow another. Elsewhere, the Midrash *Rabbah* says "when it grows, its *malvush* grows with it".³⁹ *Malvush*, garment, would appear to be some form of growth on the exterior of the *chilazon*. The term *malvush*, garment, seems to imply that it is not merely attached, but covers the body of the *chilazon*, or surrounds it. *Murex trunculus* has a shell of its own, but doesn't seem to have anything else that could be termed a *malvush*. It may be that the Midrash is using *malvush* as a synonym for shell. This would make sense in the context of the Midrash, which discusses the issue of whether the Jews in the desert outgrew their clothes. The *chilazon* is brought as an example to suggest that the clothes grew with the wearer. Referring to the shell as *malvush*, garment, would be consistent with the context. Based on this understanding of *malvush*, *murex trunculus* would appear to meet this criterion.

Hard shell: The Gemara discusses the case of someone who extracts the dye from the *chilazon* on *Shabbat*.⁴⁰ The verb used by the Gemara in describing the action of the person extracting the dye is *potzea*. *Potzea* is usually

³⁴ Hoffman, Roald. "Blue as the Sea". *American Scientist*, 78 (July/August 1990):308-9.

³⁵ *Menachot* 42b.

³⁶ I.I. Ziderman, "On the Identification of the Jewish Tekhelet Dye", *Gloria Manis* [Antwerp] 24(4): 77-80.

³⁷ P.E. McGovern, "Ehud Spanier: The Royal Purple and the Biblical Blue (*Argaman* and *Tekhelet*): The Study of Chief Rabbi Dr. Isaac Herzog on the Dye Industries in Ancient Israel and Recent Scientific Contributions", *Isis* 81:308 (September 1990):563.

³⁸ Midrash *Shir HaShirim Rabbah* 4:11.

³⁹ Midrash *Devarim Rabbah* 7:11.

⁴⁰ *Shabbat* 75a.

understood to mean to crush or crack open.⁴¹ This would imply that the *chilazon* has a hard shell, though this could be an external or an internal shell. Rashi says that the person squeezes (*docheik*) the *chilazon* in his hand to get out the blood (dye secretion). From Rashi's comment we can only infer that squeezing the *chilazon* can make the dye come out. Rashi's use of the word "squeeze" is difficult to understand since it seems to imply a soft substance, not a hard shell. This difficulty in understanding Rashi might be resolved if the *chilazon*, while being held in the hand, has a shell on one side, and flesh on the other. Thus, the person squeezes the fleshy side of the *chilazon*, and in the process may crack open, or crush, the hard shell on the other side. *Murex trunculus* has a hard, external shell that is cracked in order to get the dye out. The shell almost completely encloses the body. This would be consistent with the usual understanding of *potzea*, but not with Rashi's *docheik*.

Dye is better while chilazon is alive: We learn in the Gemara that people try not to kill the *chilazon* when extracting the dye because the dye is better if extracted while the *chilazon* is alive.⁴² From this Gemara we learn that there is a significant difference in the dye when extracted while the *chilazon* is alive and when it is extracted just moments after its death. Petil followers argue that the *murex* secretion (mucus) loses its dyeing power a few hours after the snail's death. This doesn't help since the Gemara is speaking not of a few hours, but mere moments after death. Another problem is Pliny's statement that the *murex* discharges its dye upon death.⁴³ If so, the reason not to kill the *murex* when removing the gland containing the dye is because otherwise the precious few drops of dye will be lost!

Hidden in the sand: The Gemara in Megilah states that the verse in Devarim 33:19, "*sefunei temunei chol*" ("hidden treasures of the sand"), refers to the *chilazon shel techeilet*.⁴⁴ It is not clear how restrictive this criterion is. It might only mean that the *chilazon* is considered to be a creature of the sand and that it is hidden. In this case, it would seem to be sufficient to be hidden by its own shell, and that it would not be necessary to bury itself in the sand. On the other hand, it might mean that it is hidden because it is buried in the sand. This is the understanding of the Radzyner Rebbe, citing the *Sefer HaKaneh (Hilchot Tzitzit)* as stating that the *chilazon* buries itself in sand with its head sticking out.⁴⁵ The *murex trunculus* lives on the sand, and simply by virtue of hiding its body in its shell could be considered hidden. There are times when it buries itself in the seabed, which might satisfy the general requirement of burying itself in the sand. Given that this is a secondary criterion, *murex trunculus* would seem to reasonably meet this criterion, though not in the manner described by the *Sefer HaKaneh*.

Color of the blood: Rambam states that the "blood" of the *chilazon shel techeilet* is black like ink.⁴⁶ Rashi states that the appearance of the "blood" of the *chilazon shel techeilet* is like the color of *techeilet*.⁴⁷ The Radzyner Rebbe reconciles the apparent contradiction between Rashi and Rambam by explaining that when Rashi says *maris damo*, "appearance of its blood", he is referring to the "blood" after it is prepared for dyeing, while Rambam refers to the original color of the "blood".⁴⁸ Supporters of the *murex* theory follow the lead of Rabbi Herzog who, unable to find a source to support Rambam's statement, speculated that Rambam was basing this on an erroneous statement of Aristotle, and dismissed this statement of Rambam.⁴⁹ However, it is not clear that the Petil group's *techeilet* meets the description of Rashi, either. The *murex* secretion is essentially clear. Left in the sun it turns purple-blue. When it is placed in a chemical solution it turns yellow. It is then exposed to ultraviolet radiation, after which the wool threads are dipped in the solution. The wool turns blue when it is removed from the solution and exposed to the air. Thus, the *murex trunculus* dye is never blue as a liquid, only turning blue after it is already on the garment. This might be reconciled by saying that when Rashi refers to the appearance of the blood of the *chilazon*, he means the dye as it appears on the *tzitzit* after the dyeing is completed. As a secondary criterion, this would seem to be an acceptable explanation of Rashi, although there is still the problem of dismissing the Rambam on a matter of science.

Treatment for hemorrhoids: The Gemara also tells us that the *chilazon* was used to treat hemorrhoids.⁵⁰ Rabbi Herzog states that modern pharmaceuticals knows nothing of the use of a mollusk to treat hemorrhoids.⁵¹ Rabbi

⁴¹ Leiner, *ibid.* p.27. Herzog *ibid.* p.57.

⁴² *Shabbat* 75a and Rashi ad loc.

⁴³ Aristotle, *Historia Animalium*, Book V, Ch. 15; Pliny the Elder, *Naturalis Historia*, Book 9, Ch. 60.

⁴⁴ *Megilah* 6a and Rashi ad loc. See also Midrash *Bamidbar Rabbah* 13:16.

⁴⁵ Leiner, *ibid.* p.29.

⁴⁶ Rambam, *Hilchot Tzitzit*, Ch.2, Halacha 2.

⁴⁷ *Chulin* 89a, Rashi.

⁴⁸ Leiner *ibid.* pp. 28-9.

⁴⁹ Herzog *ibid.* p.77.

⁵⁰ *Avodah Zarah* 28b.

⁵¹ Herzog *ibid.* p.59.

Herzog's comments are a bit puzzling. Given that this treatment was from the times of the Gemara, it would be likely that mention of this would be found now only in non-traditional medical sources, what might be deemed today to be "alternative medicine". Additionally, the Radzyner Rebbe had already written that cuttlefish ink has been used as a treatment for hemorrhoids since ancient times.⁵² Indeed, it is still sold today for this purpose.⁵³ As for *murex trunculus*, in ancient times it was considered to be bad for the bowels.⁵⁴

Tentacles bent like hooks: The Mishnah describes a chain hanging on the wall, with something called a *chilazon* attached to the head of the chain.⁵⁵ The *mefarshim* say it was called this because it was shaped like the *chilazon shel techeilet*⁵⁶, and *Tiferes Yisroel* explicitly states that this was an iron hook attached at the end which was used to hang the chain on a wall. The Radzyner Rebbe understands this to mean the *chilazon* has long tentacles that are bent like hooks.⁵⁷ No part of a *murex* snail would fit this description.

Snake-like extensions: The Gemara speaks of red flesh-like warts, forming a snake-like shape in the eye.⁵⁸ This disease is called both snake and *chilazon*. The Radzyner Rebbe states that the *chilazon* must have snake-like limbs or extensions, and have red warts.⁵⁹ This description does not fit *murex trunculus*.

Other Evidence

Aside from establishing criteria to identify the *chilazon*, it may be possible to find evidence to corroborate an opinion regarding the identity of the *chilazon*. The following paragraphs discuss this type of evidence in the context of the *murex trunculus* theory.

Archeological evidence: There can be little doubt that *murex trunculus* was used in ancient dyeing. It has long been accepted that *murex trunculus* was used for dyeing purple in ancient times.⁶⁰ There is significant archeological evidence to support this. However, all of the evidence suggests it was used for purple dyeing. There is absolutely no evidence to suggest that *murex trunculus* was used to dye blue. In fact, as Dr. Ziderman himself points out, it would be absurd to think that non-Jews would use *murex* to make indigo blue when they could make the same thing easier and cheaper using plants, as was done all over the world.⁶¹ One might argue that *murex*-indigo was used to make *techeilet*, while the identical but inexpensive plant indigo was used for all other blue dyeing. However, piles of *murex trunculus* shells have been found at many ancient dyeing sites, not just in the vicinity of the Jews. Certainly at those other sites they would only have used *murex trunculus* for purple. The notion that *murex trunculus* was used for making indigo is both illogical and groundless. Let us examine the archeological evidence.

Mounds of *murex trunculus* shells (as well as two related species, *murex brandaris* and *purpura haemastoma*) have been found at ancient dye sites in many locations. These shells were cracked in the exact spot to get the dye. This is solid proof that *murex trunculus* was used in ancient dyeing, but does not imply it was used for dyeing blue. A 13th century B.C.E. potsherd from Sarepta has a stripe of dye that is believed to be from the *murex trunculus* – it is a purple stripe, with no detectable blue (indigo) content.⁶² A vat from a dig at Tel Shikmona has purple *murex* dye on it, not blue as previously described in a brochure from the Petil Tekhelet Foundation (from the picture it is obviously purple, but the text erroneously said blue). Pliny speaks in great depth about dyeing with *murex*; different shades of purple, red and violet, but not blue. Petil followers point out that at one site the shells of *murex brandaris* and *purpura haemastoma* were together, but the *murex trunculus* shells were in a different area. They leap to the conclusion that *murex trunculus* must have been used for dyeing blue. They are ignoring Pliny (among others), who states that the famed Tyrian purple shade was produced by double-dyeing with *murex brandaris* and *purpura haemastoma*.⁶³ Thus, it was logical that those two species were found together, and apart

⁵² Rabbi Gershon Leiner, *Ein HaTecheilet in Sifrei Techeilet Radzyn*, pp.292-3. That this was known in the times of the Gemara can be confirmed in three 1st century texts: Pliny the Elder, *ibid.* Book 32:1; Celsus, *De Medicina*, Book 2:29; Dioscorides, *De Materia Medica*, Book 2:23.

⁵³ Sepia, cuttlefish ink, is sold in tablet form as a treatment for hemorrhoids. One such store is Vitamin USA of Findlay, OH (www.vitaminusa.com/pharmacy/03-06960-67713.html).

⁵⁴ Celsus *ibid.* Book 2:30.

⁵⁵ *Keilim*, ch. 12, Mishnah 1.

⁵⁶ *Idem*, Rav Ovadiah MiBartenura, *Meleches Shlomo*.

⁵⁷ Leiner, *Sefunei Temunei Chol* p.27.

⁵⁸ *Bechorot* 38a-b.

⁵⁹ Leiner *ibid.* p.27.

⁶⁰ P.E. McGovern, and R.H. Michel, "Royal Purple Dye: Tracing Chemical Origins of the Industry", *Analytic Chemistry* 57(1985):1514A-1522A.

⁶¹ Ziderman *ibid.*

⁶² McGovern *ibid.*

⁶³ Pliny *ibid.* Book 9, ch. 62.

from *murex trunculus*. How does that suggest *murex trunculus* was used for dyeing blue? In fact, it is hard to see how chemical analysis of archeological finds could ever support the idea that *murex trunculus* was used for dyeing blue. If the chemical is purely indigo, the natural assumption would be that the source was plant indigo, which was used around the world. If indigo was found with traces of purple, it might be suggestive of *murex trunculus* dye. *Murex trunculus* dye is naturally a mix of purple and blue, and has to be irradiated to induce a photochemical reaction from which blue dye results. If this process were not completed, the dye would be mostly blue with traces of purple. However, *murex trunculus* produces dyes with varying mixtures of indigo and purple (brominated indigo). Some batches of dye may turn out to be almost all indigo, and other batches might turn out to be all purple. Thus, even when the intention is to use the natural purple-blue of *murex trunculus*, a particular batch could turn out to be almost pure indigo. Also, mixing of dyes was common. A mix of blue and purple might be the product of *murex trunculus*, or it might be the mixture of plant indigo with purple dye from other *murex* species. Not only is there no archeological support for the notion that *murex trunculus* was used to dye blue, it may be that it is not even possible for archeological evidence to accomplish this through chemical analysis alone!

It has been suggested that the image of a *murex* shell on a Bar Kochba coin is “apparently irrefutable evidence” that *murex trunculus* was the source of *techeilet*.⁶⁴ Why else would a non-kosher species appear unless it was used for a mitzvah? *Murex* dyeing was a major industry, with some regions employing half their population in *murex* fishing.⁶⁵ Moreover, the *murex* was a status symbol, associated with wealth and royalty. Bar Kochba was not original: *murex* images showed up on coins from many places, both before and after Bar Kochba’s time.⁶⁶ It would appear that Bar Kochba used the *murex* image either for the same reason as others did (i.e. status symbol, commercial importance), or, perhaps, to give his government the appearance of more legitimacy by following the lead of other governments that printed coins with *murex* images.

Linguistic Proofs: Petil followers offer some linguistic arguments in attempting to support their position. The word *chilazon* is a general term for snail, not only in modern Hebrew but in some other languages as well. Aside from not pointing specifically to *murex trunculus*, it is not clear which species *chilazon* referred to at the time of the Gemara. It may have been a general term for mollusk. Did it only include gastropods, or could it have included cephalopods such as octopus and squid? This is unclear.

Petil writings also mention the Septuagint’s Greek translation of *techeilet* as *porphyros* (word used for purple or *murex*). Rabbi Herzog raises this issue and dismisses it rather handily.⁶⁷ He points out that everywhere else (including that same chapter) the Septuagint uses *iakinthos* for *techeilet* and *porphyra* for *argaman*, and shows how the Hebrew text they must have been given could not have matched our Masoretic tradition, and that the translation was probably given for *argaman*, not *techeilet*.

Some have suggested that Raavya (*Berachot* 9b *Siman* 25) equates *techeilet* with *porphyrin*, the Greek word for *murex*, though they do not supply a full explanation of this statement by Raavya and do not mention that in both Greek and Latin the word for *murex* and the word for purple are the same. Let us examine the passage in question. Raavya quotes a *Yerushalmi* (a part that is no longer extant) explaining the time for reciting the morning *shema*: “[from the time when one can distinguish] between *techeilet* and *karti*, between *porphyrin* and *parufinen*, which is a coat that is called in Latin *purpura*”. A logical explanation of this missing *Yerushalmi* is that the second comparison *bein porphyrin bein parufinen* is a color distinction that would be as hard to tell apart in the dark as blue (*techeilet*) and green (*karti*). *Porphyrin* is from the Greek word meaning purple. *Parufinen*, from the Raavya’s description, appears to be from the Greek *parufaino*, meaning “a robe with a hem or border of purple”,⁶⁸ which is consistent with the *hagahot* where this color is equated with *argaman*. Thus, *bein porphyrin bein parufinen* might mean to distinguish between the purple border of a robe and the rest of the garment.

Petil suggests that this *Yerushalmi* is equating *murex* with *techeilet*. Obviously they cannot mean that *techeilet* is the *murex*, but rather the source of *techeilet* is the *murex*. However, this logic would render the *Yerushalmi* as “between *techeilet* and *karti*, between a *murex* snail and a purple coat”. Aside from sounding bizarre, it is difficult to see how a purple coat could be the source of *karti*. *Karti* is usually understood to be green, like a leek.⁶⁹ There is a minority view that *karti* is not green, but a different color close to *techeilet*.⁷⁰ However, even if you rely on this view, which is based on a citation from *Aruch* which is no longer extant, to explain a *Yerushalmi*

⁶⁴ Rabbi Norman Lamm, “New Discoveries and the Halakhah on Tekhelet” in Rabbi Alfred Cohen, ed., *Tekhelet: The Renaissance of a Mitzvah* (New York, 1996), p.23.

⁶⁵ Franco Brunello, *The Art of Dyeing in the History of Mankind*, translated by Bernard Hickey (Venice, 1973), pp. 91-92.

⁶⁶ Found on Corinthian and Tyrian coins (Brunello, *ibid.*, p.92; Serman *ibid.*, p.64). Also found on a coin from Taras (Taranto), minted hundreds of years before Bar Kochba (Brunello *ibid.* p.105) - see coin at <http://www.geocities.com/~dougsmit/feac50tar.html>.

⁶⁷ Herzog *ibid.* p.78.

⁶⁸ Liddell-Scott-Jones Lexicon of Classical Greek, <http://www.perseus.tufts.edu>.

⁶⁹ See, for example, *Targum Onkelos Bamidbar* 11:5, *Sukkah* Ch. 3 Mishnah 6.

⁷⁰ Rabbeinu Yonah on *Berachot* 9b.

that is no longer extant, the wording still doesn't work. Additionally, this would require equating *karti* with *argaman*, which does not fit with any opinion. There does not appear to be a way to interpret Raavya's statement as equating *murex* with *techeilet*.

Proof by Omission: There is a simple logic that argues against *murex trunculus* as *chilazon*. At the times of the Gemara, purple dyeing with *murex* snails was pervasive throughout the region. This may explain why the Gemara does not mention the source of the *argaman* (red-purple) dye – everyone knew! *Murex* snails were famous: *Murex* dye sold for more than its weight in gold, its shell appeared on many governments' coins, royal edicts were issued to monopolize use of the dye, and Pliny wrote about the *murex* dyeing process. There was even a well-known term for the *murex* that was the same in Greek and Latin (*porphyra*, *purpura*). If this species was the source of *techeilet*, why didn't the Gemara tell us this? Why didn't the Gemara say that the *chilazon* was from the family of purple-giving snails? Wouldn't this have been simpler and clearer than the signs provided by the Gemara?⁷¹ It is implausible that the Gemara would choose to ignore a well known classification term, opting instead to describe the *chilazon* through a set of characteristics from which someone might be able to determine the correct species.

Summary

The identity of the *chilazon* was lost for many centuries. Without a tradition as to the correct species, and without a sample of ancient *techeilet*, it might not be possible to identify the *chilazon* with certainty.⁷² However, there are minimum requirements that can be expected to be met in order to seriously entertain the possibility of a particular species being the *chilazon*. Chazal, knowing the identity of the *chilazon*, chose several distinguishing characteristics to describe it. For a species to be considered as the *chilazon*, these criteria would have to be clearly met in such a way that it would have been reasonable for Chazal to have chosen these statements to describe this species. The Gemara also provides chemical tests to distinguish between genuine *techeilet* and *k'la ilan*, imitation *techeilet*. Any *techeilet* that would clearly fail this test could be rejected with certainty. It would also be reasonable to expect the species under consideration to fit most of the characteristics of the *chilazon* that can be deduced from sources outside of the *sugya* of *techeilet*.

Murex trunculus does not meet any of the primary criteria. Arguments brought in favor of the *murex trunculus* depend on new interpretations of the Gemara that contradict the classical *mefarshim* and even the precise language of the Gemara. Even with these explanations, it could not be reasonably stated that Chazal would have chosen these statements to describe the *murex trunculus*.

The *techeilet* dye produced by the Petil Tekhelet Foundation must fail the chemical tests provided by the Gemara since it is the exact same chemical as *k'la ilan*. Additionally, the Gemara's tests were designed to make indigo fail the test, and Petil's *techeilet* is indigo. Thus, *murex*-derived indigo as *techeilet* is an utterly untenable position. This is acknowledged even by the chemist whose work led to the Petil group's formation.

Murex trunculus meets few of the secondary criteria, and archeological evidence provides no support whatsoever for the proposition that *murex trunculus* was used in the ancient dyeing of blue in general, let alone *techeilet* in particular.

Since *murex* snails were famous for their purple dyeing and there was a well-known term for *murex*, it would seem rather odd that the Gemara chose not to use this term, instead providing descriptive statements that have failed to provide a consensus opinion for many centuries.

In summary, the case for *murex trunculus* as the *chilazon* has little merit. Indeed, the evidence against *murex trunculus* as the *chilazon* is overwhelming.

⁷¹ Herzog *ibid.* p.60.

⁷² The archeologist Yigael Yadin believed he found *techeilet* from the Bar Kochba era (circa 135). The unspun, purple wool that he found was subjected to chemical analysis and found to be made of indigo and kermes, a common red dye made from an insect. This combination was a common, inexpensive substitute for the expensive *murex* purple. It is puzzling why Dr. Yadin thought this was *techeilet*. The wool was just beginning to be spun. It was not attached to a garment. No white threads were intermingled. Despite Dr. Yadin's imaginative drawings of how this wool was actually partially completed *tzitzit*, any connection between this wool and *tzitzit* is pure speculation. See Yigael Yadin, *Bar-Kochba: The rediscovery of the legendary hero of the Second Jewish Revolt against Rome.*(New York, 1971).

A response to Dr. Singer's review of *murex Trunculus* as the source of *tekhelet*
Baruch Stermen, Ph.D.⁷³

We would like to thank Dr. Singer and Rabbi Cohen for allowing us to respond to the article, “*Understanding the Criteria for the Chilazon*.” The primary goal of the P’Til Tekhelet Foundation is to encourage and promote interest in the topic of *tekhelet*. Dr. Singer’s article would probably never have been published in a contemporary *halachic* journal a few years ago. We would certainly take this as an indication that the awareness within the *halachic* community has grown, and that the perception of *tekhelet* as an issue to be addressed is taking root within widening circles of Torah debate, and for that we are grateful.

We would like to divide our response into two parts. The first part will attempt to examine Dr. Singer’s main objections one by one and provide our understanding of each point. The second part will focus on the more general issue of which criteria are actually the most critical in determining the halachic acceptability of a specific *tekhelet* dye. For this, we will primarily rely on the Torah giants of past generations, and in particular, the objections that were raised by them against the Radzyner’s proposed *tekhelet*.

Objections raised by Dr. Singer

Dr. Singer makes a sweeping statement at the beginning of his article that cannot go unchallenged. He states that “the strongest criteria for identifying the *chilazon* come from the *Gemara Menachot*” and specifically from the *braita* found in Menachot 44a. This assertion is very difficult to reconcile with the fact that most *rishonim*, in their discussion of the topic, do not quote this *braita*. Both the Rif and the Rosh, who quote many other statements about *tekhelet* do not mention these criteria at all. Both the Rambam and the Smag selectively choose from among the criteria in the *braita*, ignore one of those criteria (i.e., that it rises once in seventy years), and add or alter the other *simanim*. The Maharil, when stressing how easy it should be to reintroduce *tekhelet* based on finding the *chilazon*, refers to the *simanim* brought in the Smag, and not those of the *braita*. Clearly the *rishonim* did take the criteria of the *braita* at face value. They treat these statements as general descriptive identifiers and not as distinct and essential of the *chilazon*. With this in mind, let us examine the arguments in detail.

1. The *murex Trunculus* is not the color of the sea.

First of all, Dr. Singer’s assertion, that the term *gufo* means the soft body of the mollusc, is not compelling. As mentioned, the *braita* provides general descriptive information regarding the *chilazon*. It would make most sense to describe the outward appearance of the organism before going on to its internal appearance. This, especially given that internal examination requires painstaking procedures (e.g., carefully breaking open the shell and extracting the snail). Moreover, the general description would most naturally be that of the *chilazon in situ* – covered in its characteristic sea-fouling (and not after it has been assiduously polished).⁷⁴ The *murex Trunculus* snail has a greenish color when it is alive in the ocean, and anyone who has seen it underwater is struck by its camouflage and resemblance to the sea. This fact is a perfect explanation of the term “*domeh l’yam*.” Indeed, this interpretation is not new; the commentary on the *Sefer Yitzirah* attributed to the Raavad similarly understands this passage.⁷⁵

Furthermore, the word “*domeh*” implies similarity and not absolute equivalence. When something is identical in property, the *Gemara* states it explicitly. For example, when the *Gemara* explains that the color of *tekhelet* is identical to the color of *kala ilan*, it states that only Hashem can distinguish between the two⁷⁶. The term *domeh* is not used. The *Chacham Zvi*⁷⁷ states clearly that the term *domeh* implies a certain “similarity” in a property and nothing more.

Some have even suggested that all the criteria enumerated in the *braita* come to explain the conclusion, namely why

⁷³ I would like to thank the members of P’Til Tekhelet for their comments and especially Rav Shlomo Taitelbaum and Mois Navon for helping to prepare much of this response. Rav Taitelbaum’s recent book, *Lulaot Tekhelet* deals with many of these issues, and is available from P’til Tekhelet (info@tekhelet.com).

⁷⁴ Dr. Yisrael Ziderman, “Reinstitution of the Mitzvah of Tekhelet in Zizit” (Hebrew), *Techumin*, Vol. 9 (1988), p. 430.

⁷⁵ Commentary on *Sefer Yitzirah* attributed to the Raavad, Introduction, *netiv* 8

⁷⁶ Bava Metzia, 61b.

⁷⁷ *Sha’alot U’tshuvot Chacham Tzvi*, responsum 56

tekhelet is expensive.⁷⁸ The fact that the snail resembles its surroundings would then explain why it is so difficult to obtain - since it would require highly trained fishermen or divers to search for it. This would make sense only if the outward appearance of the snail resembled the sea; the color of the hidden body would be irrelevant.

2. The *murex Trunculus* is not a fish.

Sea snails are *halachically* fish. The opinion of the *rishonim*, including the Rambam in some places⁷⁹ is that all sea creatures are fish. Furthermore, in *Hilchot Ma'achalot Asurot*⁸⁰ where the Rambam distinguishes between sea animals, fish, and sea *sh'ratzim*, shellfish fit in to the more focused subdivision of fish. The examples he gives of sea animals are all larger creatures that have limbs for leaving the water (seal, frog, sirens); the *sh'ratzim* are the likes of worms and leeches. Sea snails do not fit either of these— and thus fall into the remaining category of “fish”.⁸¹

And so they were called for centuries. Oxford Dictionary in the first entry under Fish defines it:

In popular language, any animal living exclusively in the water; primarily denoting vertebrate animals provided with fins and destitute of limbs; but extended to include various cetaceans, crustaceans, molluscs, etc. In modern scientific language (to which popular usage now tends to approximate) restricted to a class of vertebrate animals....”

After the definition there is a note: “Except in the compound shell-fish, the word is no longer commonly applied in educated use to invertebrate animals.” To say that *murex/chilazon* is not a fish, is an anachronism. As such, the *murex* mollusc fits neatly into the description “*briato domeh l'dag*”.

3. The *murex* does not have a 70 year cycle.

Both the Radzyner and Rav Herzog dealt with this problem and did not feel that it was a sufficient reason to disqualify their candidates for the *chilazon*. As previously mentioned, the Rambam does not bring it when citing the *braita*. As Rav Herzog himself puts it, “Science knows nothing of such a septuagenarian ‘appearance’ of any of the denizens of the sea.”⁸² Rav Herzog and the Radzyner suggest that the cycle mentioned refers to periods of greater or lesser availability or accessibility, but that the animal itself is always obtainable⁸³.

Though no intrinsic characteristic of the *murex* would explain this cyclic property, the archeological evidence may offer a clue. At the sites where ancient dye installations have been found, the crushed shells were often used as part of the walls of adjacent buildings. (It is not clear if this was to strengthen the matrix of the material, or as an adornment.) One finds that the size of the snails decreases over time. This fact indicates that the snails suffered from over fishing, and that they became increasingly hard to obtain over time. This extrinsic feature might explain the periodicity, that due to over fishing, the *murex* population would need time to replenish itself before a new expedition could reasonably hope to procure a sufficient amount.

Interestingly, the Rambam replaces this criteria with the phrase, “and it is found in the salty sea”, which most interpret as the Mediterranean. Perhaps the Rambam understood the phrase, “and it comes up once in seventy years,” in terms of its compliment – namely, if you can find it on land very infrequently, then the rest of the time it is found in the sea.

4. The amount of dye in each *murex* is too minute.

How minute is too minute? Approximately two tons of snails will provide enough dye for ten thousand sets of *tsitsit*. A small village in Greece consumes that amount for snacks in one week. Is that too much or too little?

⁷⁸ Y. Rock, “Renewal of *Tekhelet* and Issues on *Tzitzit* and *Tekhelet*” (Hebrew), *Techumin*, Vol. 16 (website expanded version), p.15, n.57.

⁷⁹ See *Hilchot Tumat haMet* 6,1 and compare to *Hil. Keilim* 1, 3.

⁸⁰ 2, 12.

⁸¹ *LT*, 126-36.

⁸² Herzog, *The Royal Purple*, page 69.

⁸³ I should point out that there are those who explain that this is referring to a supernatural exodus onto land (Chida, Ptach Aynayim, Menachot 44a).

5. The chemical tests to determine true *tekhelet*.

Based on discussions with scientists and Talmudists it is clear that no one completely understands the chemical tests brought by the *Gemara*, and interpreted by the Rambam and Rashi, to distinguish between *tekhelet* and *kala ilan*. One thing is clear though: a sample subjected to the described procedures that does not fade, passes the *tekhelet* test. We have tested *tekhelet* dyed with *murex* according to the analysis described by both the Rambam and by Rashi, and it did not fade. Therefore, there is no challenge that arises from this criterion to *murex tekhelet*.

The fact is, however, that indigo (*kala ilan*) dyed wool also passed the chemical tests. To reiterate, this is not a problem as far as *murex tekhelet* is concerned, but rather an academic problem in understanding the Rambam and the *Gemara*. I personally have proposed that although there may be no difference molecularly between the two, and therefore according to the methods currently used to dye wool, there is no discernible difference in quality between them, historically, this was not always the case. When dyeing according to natural methods in the ancient world, *tekhelet* was dyed in a completely different manner than indigo. The former was fermented together with the meat from the snail. Current research by John Edmonds in England has shown that bacteria present in the snail meat plays an active part in the reduction of the dye. On the other hand, indigo was chemically reduced in an entirely different manner. Consequently, it is quite reasonable that the quality and fastness of wool dyed with *tekhelet* according to the method employed in vat dyeing with snails, would have differed from that of *kala ilan*. This may have been the basis for tests that attempted to distinguish between the two. Nobel Chemist Prof. Roald Hoffman has told me that he finds this proposition to be plausible.

It should also be stressed that regardless of one's opinion as to the efficacy of these tests in differentiating between *tekhelet* and *kala ilan*, one incontrovertible fact must be understood: *tekhelet* and *kala ilan* are visually indistinguishable.⁸⁴ And since the blue dye from the *murex* is molecularly equivalent (and needless to say – visually equivalent) to *kala ilan* dye, the *murex tekhelet* is undoubtedly the exact color of the *tekhelet* of *chazal*. This fact is a sufficient condition for the determination that *murex tekhelet* is kosher - even if there may be another *tekhelet* which would also be kosher. This will be explained more fully in the discussion of the 8th criterion.

6. *Tekhelet* comes from a live *chilazon*.

This is one of the more powerful proofs supporting the *murex* as the *chilazon*. The enzyme required for dye formation quickly decomposes upon the death of the snail, and so the glands that hold the dye precursor must be crushed while the snail is alive or soon after. In experiments, we have seen that as soon as two hours after death, the quality of the dye is severely degraded. Dr. Singer's assertion that "the *Gemara* is speaking not of a few hours, but mere moments after death" is totally arbitrary. That assertion is even more implausible considering that this property is mentioned by both Pliny and Aristotle specifically regarding the *murex*. Since the *murex* loses its dye quality a few hours after its death, and those scholars express that fact by saying that the dye must be obtained from live snails, it follows that the *Gemara's* use of the same terminology would certainly sustain a two hour *post mortem* limit.

7. Equating *tekhelet* with *purpura* and the color of *purpura*.

The *Chavot Ya'ir* in his *M'kor Chayim*⁸⁵ states clearly that the *chilazon* used for dyeing *tekhelet* is the *purpur*. The *Shiltei haGiborim* also states explicitly that it is the *purpura*⁸⁶. The *Musaf la'Aruch* defines *purpura* as the "Greek and Latin word for a garment of *tekhelet*". The *Midrash haGadol* from Yemen⁸⁷ quotes Rav Chiya as saying, "the *purpura* of the kings is made out of *tekhelet*", and the *Aruch* suggests that the word "Tyrian" (apparently Tyrian purple) is Latin and Greek for the color *tekhelet*. The *Ramban*⁸⁸ also says that in his time only the king of the nations (i.e. the Emperor) was allowed to wear *tekhelet*, thus equating it with *purpura*. The Radzyner Rebbe notes⁸⁹ that the

⁸⁴ *ibid*.

⁸⁵ 18, 2.

⁸⁶ Ch. 79; see *Lulaot Hatechelet*, Shlomo Taitelbaum, *P'Til Tekhelet*, Jerusalem, 2000 page 100 for more information about this work.

⁸⁷ *Bamidbar* 4, 5.

⁸⁸ *Sh'mot* 28:2.

⁸⁹ *P'til Tekhelet*, Introduction.

ancient chroniclers frequently mention *tekhelet* as a most precious dyestuff, perfected in Tyre. Obviously, he too believed *tekhelet* was *purpura*.

The other points raised by Dr. Singer regarding the identification of *purpura* with *tekhelet* are simply not accurate. Vitruvius specifically states that one of the shades that can be obtained from the *purpura* is blue (*lividum*).⁹⁰ Moreover, we have noticed that one can obtain a blue color from *murex Trunculus* without even exposing it to sunlight – simply by steaming the wool immediately after the dyeing. It is hard to believe that we amateurs, who have been dyeing for less than a decade, would know more than the ancient dyers who made their livelihood working with these dyes for more than 2,000 years. Furthermore, one would not expect to find anything but purple archeological stains since while the glands are being stored for dyeing, and during the fermentation process, the vat color is purple. Only during the very short dyeing stage itself (and possibly, not until after the dye process was completed, if steaming was used), would the dye turn blue.

In addition, Dr. Singer's question as to why the ancients would have wanted to dye blue with *murex* when indigo was more readily available is anachronistic, since *murex* dyeing in the Mediterranean dates back to the time of Avraham whereas indigo reached the region only 1,500 years later. (Though ancient Egyptians used a blue coloring for eye makeup, there was no blue dyeing of garments with any material other than the *murex*.)

8. The equivalence of *murex tekhelet* with *kala ilan* - indigo

As stated previously in the introduction, the primary *halachic* guides for any discussion of *tekhelet* are Rav Gershon Henokh Liener and Rav Herzog. Both of them are unequivocal in their assertion that *tekhelet* was the color of the mid-day sky. Rav Herzog clearly identified the color of *tekhelet* as identical to indigo and claims that this is also the opinion of the *Rambam*⁹¹. The *Gemara* itself explains that only Hashem can distinguish between *tekhelet* and *kala ilan* (i.e., indigo).⁹²

Furthermore, both the Radzyner and Rav Herzog state that if one finds a candidate for the *chilazon* that satisfies these two criteria - that the color of the dye is sky-blue, and that its dye is fast and strong - then that organism **must be acceptable as a kosher source for *tekhelet***. To quote the *Radzyner*:

If after searching, our hands will obtain the blood [secretion] of any kind of *chilazon* from which we may dye a color similar to *tekhelet*, a dye that retains its beauty and does not change, we will surely be able to fulfill the *mitzvah* of *tekhelet* without any doubt.⁹³

Both Rav Herzog and the Radzyner offer the same line of proof for this assertion. If there were another *chilazon* that satisfies these criteria, but is not kosher for *tekhelet*, then why would the *Gemara* not warn us regarding its use? The *Gemara* cautions us only of *kala ilan*, a plant substitute for *tekhelet*, but never mentions any alternative sea creature that might mistakenly be used for *tekhelet*. Either that hypothetical species is also kosher, or there is only one species in the world (or in the Mediterranean) that satisfies both those criteria.⁹⁴ *Murex Trunculus* provides a dye which is the color of *tekhelet*. Its dye is among the fastest dyes that exist.⁹⁵ It was well known throughout the ancient world and is found off the coast of Israel. There can be no doubt, then, that according to Rav Herzog and the Radzyner, this species must be a kosher source for *tekhelet*.⁹⁶

⁹⁰ *Vitruvius*, De Architectura (ed. H. L. Jones), Loeb Classical Library, Cambridge, London 1930) Book VII, c. VII-XIV, p. 113-129

⁹¹ *Ibid*, page 94.

⁹² Bava Metzia, 61b.

⁹³ *Sefuny T'muney Chol*, page 14, 1999 edition

⁹⁴ Herzog, *ibid*, page 73

⁹⁵ Personal correspondence with the late Prof. Otto Elsner, professor of Ancient Dye Chemistry at the Shenkar College of Fibers.

⁹⁶ Though Rav Herzog studied the *murex trunculus*, he provisionally rejected it; primarily because the process for obtaining blue dye visually equivalent to *kala ilan* was not then known. The process was not discovered until 1980 by Professor Otto Elsner of the Shenkar College of Fibers. I should also point out that there is no other species other than the *muricae* currently known that produces a dye similar in color to indigo and neither is there any archeological evidence for other species being used in the ancient world for dyeing. In order to assume that the *chilazon* of *chazal* is different than the *murex*, one would need to accept both the fact that knowledge of that

Let us not forget the fact that *tekhelet* has been lost for 1,300 years and therefore much of what has been written is based on assumptions and conjecture. It is highly doubtful that any and every statement regarding *tekhelet* or the *chilazon* will suitably apply to any candidate. Nevertheless, it is our opinion that the *murex Trunculus* fits the descriptions of *chazal* in an overwhelming majority of instances.

Criteria for determining kosher tekhelet.

There are numerous descriptions found throughout the *Gemara*, Midrash, Zohar and other Judaic sources regarding *tekhelet* and the *chilazon*. In order to begin to apply them it is important to understand, first and foremost, that it is essentially impossible to reconcile all of those sources with any candidate, or, for that matter, with each other. For example, the *Gemara* asserts that the *chilazon* is found in the Mediterranean⁹⁷, the Zohar claims that it is found in the Kinneret⁹⁸, while the Rambam states that it is to be found in the “*yam hamelach*.”⁹⁹ Needless to say, there is no species that lives in all three habitats.

Secondly, it is essential to distinguish between *aggadic* statements versus *halachic* statements. For as with every issue in Jewish thought, though we must strive to understand the *aggadic* material, we are bound in deed by the *halachic* instruction. One method to determine if a statement is *halachic* in nature is to find its use as the basis for an actual *halacha*. Conversely, if a statement is never used in a formal *halacha*, it quite often remains in the realm of a non-binding *aggadic* statement. For example, the *Gemara* relates that the *chilazon* and the proficiency in *tekhelet* dyeing were a special gift to the tribe of Zevulun. Nevertheless no certificate of *yichus* proving descent from that tribe is required before accepting *tekhelet* from a dyer! In this case, the “criterion” lies clearly within the *aggadic* realm.

On the other hand, the following are a number of statements relating to *tekhelet* and the *chilazon* which do find their way in to formal *halacha*, and these must be related to with due rigor.

1. ***Tekhelet is the color of Kala Ilan.***

All of the laws regarding *kala ilan* are based on this fact including the *sugyot* in *Bava Metzia* (61b) and *Menachot* (40a and 43a).

Tekhelet obtained from *murex Trunculus* is identical in color to *kala ilan*.

2. ***Tekhelet is a fast dye that does not fade.***

The *Gemara* bases its chemical tests on this fact (*Menachot* 43a) – “*lo ifrid chazute, keshayrah* - if it does not change its appearance, it is kosher [for *tekhelet*].” The Rambam states this explicitly “*tzviyah yeduah sheomedet b'yafya* - a dye which is known to be steadfast in its beauty” (*Hilchot Tsitsit*, 2:1).

Murex tekhelet has been tested by independent fabric inspectors at the Shenkar College of Fibers and received excellent marks for fastness. I can personally testify to my own *tekhelet*, worn every day for the past ten years, that has not faded or changed color at all.

3. ***Tekhelet dyes on wool, but does not take to other fabrics.***

The well-know *halachic* principle of “*assay docheh lo'tassay* - a positive commandment takes precedence over a negative commandment” is based on the fact that the *tekhelet* dye adheres to wool but not to linen (*Yevamot* 4b – “*tekhelet amra hu - tekhelet is [dyed] wool*”).¹⁰⁰

Murex tekhelet binds exceedingly tight to wool, but not to cotton or synthetic fibers.

organism eludes modern science as well as the fact that the detailed archeological survey of the Mediterranean has not uncovered any hint of such an animal.

⁹⁷ Shabbat 16a.

⁹⁸ Zohar, II, 48b.

⁹⁹ Hilchot Tsitsit, 2;2

¹⁰⁰ Rashi does not follow this reasoning. On the other hand, the Yerushalmi Kelim (9:1) says “*Ma pishtim k'briata af tsemer k'briato*” just as linen remains its own color, so to wool (only can become *tamei nigei b'gadim*) in its natural color (and not dyed).” We see from there that only wool is dyed, not linen.

4. ***The dye from the chilazon is more potent when taken from a freshly killed chilazon – but one must kill the animal in order to extract the dye.***

The *Gemara* in *Shabbat* (75a) bases one of the fundamental principles of *hilchot shabbat* on this fact, namely *p'sik reisha d'lo nicha lei*- an inevitable act [lit. cutting off a head] that is undesirable.

As mentioned previously, the enzymes responsible for transforming the precursor of the dye into actual dye upon exposure to oxygen, do not survive long after the death of the snail. Consequently, within a few hours after death, the *murex* can no longer be used for dyeing.

5. ***Tekhelet was not “hidden” until the days of Mashiach, but rather can be obtained at any time***

The *Maharil*¹⁰¹ rules that even though *tekhelet* is no longer available, one is still prohibited from wearing a linen *begged* for *tsitsit*. This is because *tekhelet* is “easily available” and one need only find the proper *chilazon* in order to reinstate the *mitzvah* of *tekhelet*. There is nary a *posek* who argues with the *Maharil* in practical terms and allows a linen *begged* for *tsitsit*.

Finally, it is instructive to mention two not commonly referred to sources which provide an important perspective on this discussions. Both were written in the early 1890's as critiques of the Radzyner's *tekhelet*. The first is an article entitled “*Tekhelet me'Iyay Elisha*” by Mordechai Rabinovits and the second is a book called “*P'til Tekhelet*” by Hillel Meshil Gelbshtein¹⁰². Both of these works discuss the various sources and measure the Radzyner's *tekhelet* against them. Both are highly critical of the Radzyner's *tekhelet*.

Although numerous challenges to the Radzyner's *tekhelet* are raised, the most forceful objections are based on the fact that Radzyn *tekhelet* did not meet the “*halachic*” criteria enumerated above. The authors of these works contend that (a) Radzyn *tekhelet* is not the color of the sky, (b) that it fades when washed with soap, and (c) that the material from the dye can obtained from dead *sepia Officinalis*, (and not exclusively from live organisms). On the other hand, as has been demonstrated herein, *murex tekhelet* would indeed be acceptable precisely according to all these criteria.

It is our hope that these and other issues relating to *tekhelet*, to the identification of the *murex Trunculus* as the *chilazon*, as well as the investigation of other candidates, will continue to spark discussion within the walls of *batei midrash* all over the world. Any argument that is for the sake of Heaven has great merit and will serve to unite *klal yisrael* in its search for truth and proper *kiyum hamitzvot*.

¹⁰¹ *Shu"t Maharil HaChadashot* (M'chon Yerushalayim), #5, 2.

¹⁰² Hillel Meshil Gelbshtien, Introduction to *P'til Tekhelet*, printed in *Abir Mishkenot Yaakov* by the same author. The Gelbshtien family is currently reprinting the entire book which should be available by January, 2001.

Author's Reply

I would like to thank Dr. Sterman for agreeing to respond to my article, thereby affording the readers both sides of the story. I would also like to thank the editor, Rabbi Cohen, for devoting so much space to this issue. In fairness to the editor I will endeavor to be brief, while trying to cover most of the essential points.

Criteria from the sugya of techeilet

Dr. Sterman prefaces his comments with the rather startling assertion that we can essentially ignore the descriptions brought by Chazal in *Menachot*(44a) because many *Rishonim* do not cite these criteria or omit one of them. There is only one *sugya* in the entire Talmud that deals explicitly with the details of *techeilet*. Nowhere else in the Talmud do Chazal cite statements for the primary purpose of describing the *chilazon*. How can these statements of Chazal not be important? Dr. Sterman has said that the writings of the Radzyner Rebbe and Rabbi Herzog must form the foundation of any halachic discussion of *techeilet*. These criteria are the heart of Rabbi Herzog's criteria, essential to the Radzyner Rebbe's criteria, and have been considered of unquestioned importance even in most, if not all prior writings by supporters of the *murex trunculus* theory. How can Dr. Sterman now claim they are not essential? While horns are not essential to the *halachot* of the burnt offering brought by the Kohen Gadol on Yom Kippur, that animal must be a ram, and would, therefore, have horns. Similarly, it is not surprising that when writing about *techeilet*, some *Rishonim* may mention that *techeilet* must come from a *chilazon* without describing the *chilazon*. Nonetheless, the *chilazon* must possess the characteristics that Chazal have ascribed to it. Rashi brings down all of these criteria in multiple places, and it would be presumptuous to assume that those who omit one ("rises once in seventy years") did so because they felt it could be ignored. Indeed, the Radzyner Rebbe explains why some omit the seventy year criterion.¹⁰³ Let us briefly examine these criteria.

"*Its body resembles the sea*": Dr. Sterman's argument as to how *murex trunculus* meets these criteria is based on three false premises, namely, that the expression *domeh l'yam* can mean green, that the expression *gufo* ("its body") can refer to external organisms living on the shell of the *chilazon*, and that the resemblance is to the living organisms in the sea and not the sea itself. Regarding *domeh l'yam*, the same expression is used just a few lines earlier in the *Gemara* to refer to the color of *techeilet*. Dr. Sterman is asserting that "resembles the sea" can mean blue in one phrase and a few lines later, dealing with the same subject, mean green. This is both illogical and groundless. Rambam clearly indicates otherwise since he writes that the *chilazon* itself resembles *techeilet*, i.e. blue.¹⁰⁴ Similarly, the *braita* of *tzitzit* states that the color of the body of the *chilazon* is similar to the sky.¹⁰⁵ Dr. Sterman suggests *gufo* cannot mean the soft body since it would be impractical to describe the color of the body which can only be viewed by the careful breaking of the shell and extraction of the soft body. Of course, this presupposes the *chilazon* is completely enclosed by a hard exterior shell. Also, it would only be necessary to check the color of the body to identify the correct species. It would not be necessary to check every animal that is used. While Dr. Sterman's claim that *gufo* could refer to the shell is not entirely unreasonable, it is quite a different matter to say that "its body" means the external organisms covering the shell. Whereas it would indeed make sense to describe the outward appearance, it would hardly be helpful to describe the external sea fouling if it looks like everything else. While *murex trunculus* does blend in with its surroundings due to the greenish sea fouling, this means it resembles the sea fouling and plant life living in the sea, but not the sea itself.

"*Its form is like a fish (dag)*": Dr. Sterman's response is that according to *halacha*, *murex trunculus* is a fish, therefore this statement is true by definition. This renders meaningless the statement of Chazal. Why would Chazal say "the *chilazon*, which is a fish, resembles a fish"? Clearly the intent is to inform us that the form of the *chilazon* has some similarity to what is characteristically true of fish. No such argument can be made for the *murex trunculus* snail.

"*Comes up once in seventy years*": Dr. Sterman admits that there is no characteristic of the *murex trunculus* that would meet this criterion. Dr. Sterman's unfounded speculation about the replenishing of the snail population suggests a steady pattern of increase in the population and not an unusual abundance. Rabbi Herzog cites a 3-6 year cycle for his candidate species.¹⁰⁶ As for the Radzyner Rebbe's choice of *sepia officinalis*, since the Rebbe's death a periodicity has been noted and there have been rare reports of mass "invasions" and "strandings" of cuttlefish.¹⁰⁷

¹⁰³ Rabbi Gershon Leiner, *Eyn HaTecheilet*, published in *Sifrei HaTecheilet Radzyn* (Bnei Brak, 1999), p.387.

¹⁰⁴ *Hilchot Tzitzit* 2:2.

¹⁰⁵ *Masechet Ketanot Masechet Tzitzit* Ch. 1 Halacha 10.

¹⁰⁶ Herzog *ibid.*, p. 73.

¹⁰⁷ David H. Tompsett, *Sepia* (Liverpool, 1939), p. 143, citing the work of Grimpe; *Transactions of the Royal Society of Edinburgh*, Vol. 61, Part I, 1943-1944. (No. 9), pp. 247-260.

“*It is expensive*”: The Gemara states the dye is expensive because of the lack of abundance (“comes up once in 70 years”). One of the reasons Rabbi Herzog rejects *murex trunculus* is because of the minute dye quantity it produces.¹⁰⁸ The Gemara clearly states that the reason *techeilet* is expensive is because of its infrequent appearance or abundance and not because of the minute dye quantity. Dr. Sterman’s answer that a small village in Greece consumes 2 tons of snails in a week, enough for 10,000 sets of *techeilet*, is amusing, but merely underscores my point. That small village in Greece is eating the snail, not extracting the dye. *Murex* dye was not expensive due to scarcity but due to the work involved in extracting the dye from exceedingly large quantities of snails to produce small amounts of dye.

Chemical test for *k’la ilan*

Rabbi Herzog, with the aid of renowned dye chemist Dr. A.C. Green, recognized that the Gemara’s tests have the aim of chemically reducing indigo. In this state indigo is yellow, thus the Gemara’s stipulation that if the color fades it fails the test and is suspected to be *k’la ilan*. Since snail indigo and plant indigo are the exact same chemical, *murex* indigo should also fail this test. Indeed, *murex* indigo would be expected to fail *any* chemical test that plant indigo fails, let alone the Gemara’s test which is clearly designed to detect indigo. Dr. Sterman posits that it is theoretically possible that some snail meat remaining in the *murex* indigo could keep it from failing the test. Since the Gemara’s test only requires the color to fade, not to be entirely reduced, the snail meat would have to completely inhibit the chemical reduction in order to pass the test. Dr. Sterman offers no reason why the snail meat might have this effect. In fact, the one statement he makes is that snail meat may have played an important role in aiding reduction. Dr. Sterman suggests that Nobel chemist Dr. Roald Hoffman has deemed his explanation plausible. I contacted Dr. Hoffman, and he merely maintains that the presence of bits of snail meat makes it theoretically possible to develop chemical tests to distinguish snail indigo from plant indigo, not that it was at all likely for the snail meat to have any impact in the chemical test of the Gemara. Even Dr. Irving Ziderman, the chemist who did so much of the pioneering work on the *murex trunculus* theory, acknowledges that snail indigo would fail this test. Although Dr. Sterman says that he has recreated the Gemara’s tests and *murex* indigo passed, he then acknowledges that regular indigo also passed, thereby proving that he had not recreated the test correctly. It is my hope to accurately reproduce these tests and report the findings on my web site.¹⁰⁹ Thus we are left with sound scientific reason to suggest *murex* indigo would fail the Gemara’s tests versus the unfounded speculation that it is a theoretical possibility it would pass.

Other statements of Chazal regarding the *chilazon*

There are a number of descriptive comments made by *Chazal* which clearly do not describe *murex trunculus* and were not addressed by Dr. Sterman. Rambam, the Midrash HaGadol and Philo (who was alive when *techeilet* was made) state that the color of the blood of the *chilazon* is black, while Rashi states that the appearance of the blood is blue.¹¹⁰ When dyeing *techeilet* with *murex* indigo the dye solution is never blue. After wool is dipped in the dye vat, removed and exposed to air, the dyed wool turns blue. The Gemara also tells us that the *chilazon* was the source of a treatment for hemorrhoids, yet *murex trunculus* was known in ancient times to be bad for the bowels.¹¹¹ The Mishnah in *Keilim* tells us that a metal hook attached to the “head” (*roshoh*) of a chain was called *chilazon* because of its shape, which the Radzyner Rebbe understands to mean that the *chilazon* has hook-shaped tentacles coming out of its head.¹¹² Again, *murex trunculus* does not fit this description. Finally, we have the problem of why the Gemara, when choosing to describe the *chilazon* did not say that it was *purpura*? The species and its name were famous. Further, according to Josephus and others, it appears that *murex* snails were the source of *argaman*.¹¹³ If so, why didn’t the Gemara state that the *chilazon shel techeilet* was from the same family of snails as that used for *argaman*?

Equivalence of *murex techeilet* with *k’la ilan*(indigo)

Dr. Sterman notes correctly that since *murex techeilet* is the same chemical as *k’la ilan*(plant indigo), its color is visually indistinguishable from plant indigo. He then makes the assertion that both the Radzyner Rebbe and Rabbi Herzog are of the opinion that if one finds a candidate for the *chilazon* that produces a dye that is sky-blue and is a fast dye, then it is automatically kosher *techeilet*. The statement from the Radzyner Rebbe is taken out of context.

¹⁰⁸ Rabbi Isaac Herzog, “Hebrew Porphyrology”, in Ehud Spanier, ed., *The Royal Purple and the Biblical Blue: Argaman and Tekhelet* (Jerusalem, 1987), p. 70.

¹⁰⁹ www.chilazon.com

¹¹⁰ Rambam *Hilchot Tzitzit* 2:2; Midrash HaGadol *Shemot* 25:4; Philo, *De Congressu*, as cited by Herzog, *ibid.*, p.87; Rashi *Chulin* 89a.

¹¹¹ *Avodah Zarah* 28b; Celsus *ibid.* Book 2:30.

¹¹² Leiner, *ibid.*, *Sefunei Temunei Chol*, p. 27; *Keilim* 12:1 and *Tiferet Yisroel ad loc.*

¹¹³ Flavius Josephus, *Antiquities of the Jews*, Book 3 Chapter 7.

The Rebbe concludes that section with the comment that it will be further explained in the following section, where the Rebbe states that the statements of *Chazal* must be satisfied, but if they are all satisfied and the dye meets the requirements then it is definitely kosher.¹¹⁴ As for Rabbi Herzog, he places great importance on the criteria from *Menachot*. Rabbi Herzog states that the inquirer equipped with knowledge of the secular sources “will go to the Talmud only for a confirmation of the identification of the *techeilet*-species with *murex trunculus*. But there is a surprise in store for him”.¹¹⁵ Rabbi Herzog then dismisses *murex trunculus* because it fails to meet any of the criteria from the *sugya* in *Menachot*.¹¹⁶ As for the problem with the Gemara needing to warn us about *murex* indigo like it did for *k’la ilan*, this poses no difficulty for several reasons. First, the Gemara doesn’t need to warn us about anything that did not happen. Whereas counterfeiting *techeilet* with *k’la ilan* was a real problem, counterfeiting with *murex* indigo is a theoretical problem with no indication that *murex trunculus* was ever used to dye blue in any context. Even if the ancients did make *murex* indigo, why would people have used it to counterfeit *techeilet* when they could achieve the same results more cheaply with readily available plant indigo? However, there is an even stronger answer. Since *murex* indigo is equivalent to plant indigo, it would also fail the Gemara’s tests, so there was no need for a special warning. However, the Gemara’s need to warn us of other counterfeit dyes does pose a problem for P’til. The process used by P’til will produce indigo from any of the purple giving mollusks. If *murex trunculus* indigo was true *techeilet*, why doesn’t the Gemara warn us of the perfect imitations that could be produced by related species?

Dye is superior if extracted from a live *chilazon*

The Gemara speaks explicitly about the case where a live *chilazon* is squeezed or crushed to get the dye out, and the person tries not to kill the *chilazon* in the process because the dye is better, or clearer, if taken while the *chilazon* is still alive.¹¹⁷ How long does it take to extract the dye from the *chilazon*? Seconds? Minutes? Yet, if the *chilazon* dies during this short process, the dye will not be as effective. Dr. Sterman’s argument that *murex* dye loses its power over several hours hardly satisfies this condition. This time frame ignores the fact that the Gemara speaks of the *chilazon* dying during the extraction process, a matter of minutes, not hours. Even more troubling is Dr. Sterman’s misrepresentation of Pliny and Aristotle. In my article I correctly state, as Rabbi Herzog also does, that Pliny and Aristotle warn that the dye should be extracted from the *murex* while it is alive because it discharges its dye when it dies.¹¹⁸ Dr. Sterman cites the first half of their statements, but then ignores the reason they explicitly state and instead supplies his own reason. In fact, these classical sources do not say anything about the dyeing power of the *murex* diminishing after death, their reason being at odds with the Gemara’s explanation regarding the *chilazon*.

Ancient blue dyes

Dr. Irving Ziderman states that it would be absurd to think the ancients would use *murex* indigo when they could make the same dye cheaper and easier by using plant indigo.¹¹⁹ Dr. Sterman responds with a series of unsupported statements claiming that Egyptians used *murex* for blue dyeing but not indigo, that *murex* dyeing in the Mediterranean dates back to the days of *Avraham Avinu* whereas indigo reached the region only 1,500 years later. There is a good reason Dr. Sterman fails to provide references for these statements – they aren’t true. There is absolutely no record of *murex* being used to dye blue in ancient times. All of the archeological evidence cited in P’til writings merely demonstrate it was used for purple dyeing, as is well known. In the classic work, *The Art of Dyeing*, by Franco Brunello, we find four sources of blue dye in ancient Egypt – none of them are *murex*.¹²⁰ On the other hand, Brunello and others cite sources that conclude that indigo was used in Egypt over 1,000 years before *Yosef’s* arrival there, long before shellfish dyes were ever used.¹²¹ As for Dr. Sterman’s claims, they might be based on the work of late 19th /early 20th century Austrian Egyptologist, Alexander Dedekind, of whom P’til speaks highly. Dr. Dedekind’s claims about Egyptian use of shellfish dyes has been completely refuted and even ridiculed at length.¹²² Dr. Gillian Vogelsang-Eastwood is probably the world’s leading expert on Egyptian textiles and has

¹¹⁴ Leiner, *ibid.*, pp. 14-17.

¹¹⁵ Herzog, *ibid.*, p. 65.

¹¹⁶ Herzog, *ibid.*, p. 70.

¹¹⁷ *Shabbat* 75a and Rashi ad loc.

¹¹⁸ Herzog *ibid.*, pp. 74-75; Aristotle, *Historia Animalium*, Book V, Ch. 15; Pliny the Elder, *Naturalis Historia*, Book 9, Ch. 60. For a picture of a *murex* snail discharging its dye upon death, see Nira Karmon, “The Purple Dye Industry in Antiquity” (hebrew), in Chagit Sorek and Etan Ayalon, eds., *Colors from Nature: Natural Colors in Ancient Times* (Tel Aviv, 1993), p. 85.

¹¹⁹ I.I. Ziderman, “On the Identification of the Jewish Tekhelet Dye”, *Gloria Manis* [Antwerp] 24(4): 77-80.

¹²⁰ Franco Brunello, *The Art of Dyeing in the History of Mankind*, translated by Bernard Hickey (Venice, 1973), p. 43.

¹²¹ Brunello *ibid* p.43; Helmut Schweppe, “Indigo and Woad”, in Elisabeth West FitzHugh, ed., *Artists’ Pigments: A Handbook of Their History and Characteristics*, vol. 3 New York, 1986), p.83.

¹²² Meyer Reinhold, *History of Purple as a Status Symbol in Antiquity*, (Bruxelles, 1970), pp. 13-14.

analyzed ancient Egyptian clothing from many eras, including those found in the tomb of King Tutankhamun. In a personal communication she confirmed that the only blue dye she has found on Egyptian clothing is indigotin (from the indigo or woad plant), and that she has not found any evidence of purple shellfish dye in Egypt until the Roman era, about 1,000 years after the exodus from Egypt. There has been evidence of rare use of purple dye in Pharaonic Egypt, but this was found to be a mixture of indigo(blue) and alizarin(red).¹²³

Techeilet, purpura and the color of purpura

Dr. Sterman brings an assortment of different sources that purportedly equate *techeilet* with *purpura*. Some of these statements make no mention of *purpura*, such as the statement he cites from the Radzyner Rebbe. The Ramban's statement that even in his time only the King was allowed to wear *techeilet* hardly equates *techeilet* with *purpura*.¹²⁴ In fact, during the Ramban's lifetime (Middle Ages), there were efforts in several countries to restrict the use of blue to royalty and the very wealthy much like *murex* dyes during some periods of the Roman empire.¹²⁵ One must also be careful when dealing with the word *techeilet* since it may at times indicate a color with no specific origin. This is clear from the cited Ramban, since there was no kosher *techeilet* in the Ramban's lifetime, yet he used the word *techeilet* to discuss contemporary blue dye. Other statements cited by Dr. Sterman are merely examples of *purpura* being used to connote Royal attire, as is commonly found in the Midrashim, and is used to refer to Mordechai's royal clothing of *techeilet*, where the color of *techeilet* is implied, but not necessarily *chilazon* origin.¹²⁶ This is the simple explanation of Dr. Sterman's quotes from the Aruch and Midrash HaGadol. Since the Midrash Hagadol, like Rambam, says that the color of the blood of the *chilazon* is "black like ink", it would not make sense to suggest that it supports the notion that a *murex* snail is the *chilazon*.¹²⁷ Dr. Sterman cites the *Makor Chaim* (by the author of the *Chavot Yair*) and the *Shiltei HaGiborim* as explicitly stating that the *purpura* is the *chilazon shel techeilet*.¹²⁸ There are several problems with this. Both of these *seforim* are from *kitvei yad* that were discovered hundreds of years after they were supposedly written. Aside from possible issues concerning authenticity, and the more likely problem of the integrity of every word, in both cases the statements about *purpura* appear in isolation, i.e. there is no discussion of *chilazon* and *techeilet*, just a single statement. Both of these sources, especially the *Baal Chavot Yair* ("dam *chilazon* is not blue, but purple"), seem to be of the opinion that *techeilet* is purple, hence their conclusion as to the origin. Unfortunately, there is no discussion of how this species fits *Chazal*, or how the color of the blood contradicts the writings of Rashi and Rambam. Could there be errors in transcription? The *Baal Chavot Yair* seems clear, but the *Shiltei HaGiborim* would read quite naturally with *argaman* instead of *techeilet*. Seeing as how the notion of *argaman* coming from a mollusk was not well known, could an editor or copyist have inserted the word *techeilet* after seeing the word *chilazon* used in conjunction with dyeing?¹²⁹ In light of the fact that at the times they would have been written it was not known that blue dye could be made from *murex* snails, the simplest explanation is that they held the position that *techeilet* is purple and then made the natural corollary that the source was the famous purple-fish. Unfortunately, there is no evidence that either sage ever pursued their hypothesis in treatise or practice.

In my article I refuted efforts by P'til to demonstrate that *murex* snails were used to dye blue in antiquity. Dr. Sterman has not responded to my refutations, but instead offers another possibility. Vitruvius writes that depending on the location, *murex* purple could come out one of four different shades: black, red, blue and violet.¹³⁰ From the context it is clear that he is speaking of shades of purple, and is not suggesting that *murex* was used to dye blue or black. This is consistent with modern writings citing this work, as well as with Rabbi Herzog's understanding of Vitruvius' remarks.¹³¹ Rabbi Herzog also demonstrates that Vitruvius was not speaking about *murex trunculus*, but of other *murex* snails.¹³² Additionally, according to Vitruvius, the shade of purple associated with Tyre and Israel is red, not blue.

¹²³ Gillian Vogelsang-Eastwood, "Textiles", in Paul T. Nicholson and Ian Shaw, eds., *Ancient Egyptian Materials and Technology* (Cambridge, 2000), p. 279.

¹²⁴ Ramban *Shemot* 28:2.

¹²⁵ Daniel V. Thompson, *The Materials of Medieval Painting* (New Haven, 1936), p. 127.

¹²⁶ *Esther* 8:15; Midrash *Esther Rabbah* 10:12; Chidushei Rada' *Bamidbar* 13:18.

¹²⁷ Midrash HaGadol *ibid.*

¹²⁸ *Makor Chaim* 18:2; *Sefer Shiltei HaGiborim* ch. 79.

¹²⁹ Josephus *ibid.*

¹³⁰ Vitruvius, *De Architectura*, Book 7 Chapters 7-14.

¹³¹ Thompson *ibid.*, p. 156-158; Herzog *ibid.*, p. 26.

¹³² Herzog *ibid.*, p. 34.

Dr. Sterman's new set of criteria

Dr. Sterman proposes a new set of criteria. As stated earlier, Dr. Sterman says that Rabbi Herzog and the Radzyner Rebbe form the basis of any *halachic* discussion of *techeilet*. Their writings, as well as virtually all prior P'til writings, were based largely on the *sugya* in *Menachot* and other Talmudic sources. Dr. Sterman now dismisses those sources as *aggadata* and offers his own set of four criteria (the fifth "criterion" merely states that *techeilet* is not hidden and can still be found). As we will see, they not only form a peculiarly small and arbitrary set of criteria, but two of these criteria are not even valid.

"*Techeilet* is the color of *k'la ilan*": Dr. Sterman seems to be unaware that there is no single shade of color produced from indigo. Indigo was used in ancient times to produce a wide range of blues, from light to dark blue. The fact that indigo can imitate *techeilet* does not tell us the color of *techeilet*. It merely tells us that one of the many colors produced by indigo is that of *techeilet*.

"*Techeilet* is a fast dye that does not fade": Dr. Sterman's quotation from the Rambam is appropriate and merely states that the dye is fast. The Radzyner Rebbe discusses this issue and understands it to mean that the mere passage of time in and of itself will not cause the dye to fade, though certain chemicals or repeated prolonged exposure to the sun could cause the dye to fade.¹³³

"*Techeilet* dyes on wool, but does not take to other fabrics": Dr. Sterman's sources do not support this statement. The Gemara deduces from *p'sukim* about the garments of the *Kohen Gadol* that *techeilet* must be wool, but does not say or imply that *techeilet* dye cannot dye other fabrics.¹³⁴ That *techeilet* can dye linen is clear from the Ibn Ezra who states that *techeilet* can be wool or linen.¹³⁵ Why Dr. Sterman proposes this criterion is especially surprising since indigo can dye linen, so *murex* indigo should also be able to dye linen.

"The dye from the *chilazon* is more potent if taken from a freshly killed *chilazon*, but one must kill the animal in order to extract the dye...": This is puzzling. The Gemara states that the dye is better if extracted from the *chilazon* while it is still alive, as discussed earlier. The *chilazon* may die from being crushed, but the desire is to extract the dye while it is alive. As demonstrated earlier, *murex trunculus* fails to meet this criterion. Since the classical commentaries do not explicitly state that this *sugya* is speaking of the *chilazon shel techeilet*, and this property of the *chilazon* was not brought for the purpose of description, it is not clear why Dr. Sterman gives such prominence to this criterion over other references in *Shas* where the purpose is to describe the *chilazon shel techeilet*.

Objections to the Radzyner Rebbe's position

Dr. Sterman cites two obscure *seforim* in raising three objections to the Radzyner Rebbe's *techeilet*. Since neither my article nor his response treated the issue of the Radzyner's position it is not clear why he chose to include these points, but since he took the liberty of raising these objections, I will take the liberty of rejecting them.

"Radzyner *techeilet* is not the color of the sky": Prussian Blue, the pigment formed by Radzyner *techeilet*, can be either royal blue or sky blue depending on the proportions of the ingredients.¹³⁶ Further, it is hardly obvious what the color of *techeilet* should be. It is likened to the color of the sea, the sky and the sapphire. Dr. Sterman himself states that the term "*domeh*" only indicates a similarity in property. Indeed the Ibn Ezra says the color of *techeilet* slightly resembles the sky.¹³⁷ It is interesting to note that in artist pigments, indigo can be so similar to Prussian Blue, that a chemical test is required to distinguish the two.¹³⁸

"It fades when washed with soap": While this sounds at first like a strong criticism of Radzyner *techeilet*, this appears to be a known characteristic of true *techeilet*! As cited by Rabbi Herzog, Rabbeinu Gershom states explicitly that *techeilet* fades in the wash.¹³⁹ The Radzyner Rebbe also quotes the *Tosafot* who state that *techeilet* fades in soap, and that *k'la ilan* does not.¹⁴⁰

¹³³ Leiner *ibid.*, *Sefunei Temunei Chol*, p. 10, written before he produced his first batch of *techeilet*.

¹³⁴ *Yevamot* 4b.

¹³⁵ Ibn Ezra, HaPeirush HaKotzeir, *Shemot* 25:4.

¹³⁶ J.N. Liles, *The Art and Craft of Natural Dyeing*, (Knoxville, 1990), p. 49.

¹³⁷ Ibn Ezra *ibid.*

¹³⁸ Schweppe, *ibid.*, p. 94.

¹³⁹ Rabbeinu Gershom, *Menachot* 43a.

¹⁴⁰ Leiner *ibid.*, *P'til Techeilet* p. 82; *Baba Kama* 93b; *Tosafot Zevachim* 95a; *Nidah* 62a.

“The dye can be obtained from dead *sepia officinalis* (and not exclusively from live organisms)”: This is confusing. First Dr. Sterman cites the Gemara as stating that the dye is better, or clearer, when taken from a live *chilazon*. Then, in his new set of criteria, he says that it must be taken from a freshly killed *chilazon*, implying that it is taken from a dead *chilazon* and not a live one. Now, he says that it is impossible to get dye from a dead *chilazon*. The Gemara merely states that the dye is superior if taken while the *chilazon* is alive. The fact that it is possible to extract cuttlefish ink from *sepia officinalis* after it is dead is irrelevant. The issue is how effective it is in dyeing when it is extracted after death. The Radzyner Rebbe explains that when the cuttlefish ejects its ink it ejects the best of the dye and leaves behind the undesirable parts.¹⁴¹ Italian chemist Dr. Rodolfo Nicolaus is one of the pioneers of sepiomelanin (cuttlefish ink) research, and in addition to the vast amounts of information on his web site, he was kind enough to provide scientific explanations of the Rebbe’s answer in a personal communication.¹⁴² When cuttlefish ink is ejected it has more mature melanosomes, and is the purest representation of natural sepiomelanin. When the ink is extracted from the sac, it is likely to be in contact with other components that cause transformations and degradation of the melanin. When the cuttlefish dies, this transformation takes place and the resultant ink is chemically very different from natural sepiomelanin.

Conclusion

Murex trunculus meets virtually none of the known characteristics of the *chilazon*. There is no evidence that *murex trunculus* was ever used to dye blue until recent times. P’til writings have suggested that people wear *murex* indigo based on the principle of *sofeik d’oraita l’chumra*. Given the overwhelming evidence against *murex trunculus*, there appears to be little *sofeik*.

Addendum (not published)

Tosafot (*Shabbat* 75a) suggest that the reason a person is not *chayiv* for trapping a *chilazon* on *Shabbat* is because when it is caught it jumps about, thereby hastening its death. As Rabbi Mordechai Kornfeld, Rosh Kollel of Kollel Iyun HaDaf, points out, a snail does not fit this criterion of Tosafot (see <http://www.shemayisrael.co.il/dafyomi2/shabbos/insites/sh-dt-075.htm>).

Above, it was argued that it is meaningless to claim the color of *techeilet* is the color of indigo since indigo can be used to make a vast spectrum of blues depending on the dipping technique. This is supported by Tosafot (*Chulin* 47b) where it is stated that indigo, which resembles the sky, only slightly resembles (*domeh k’tzat*) *techeilet*, and that one can distinguish between indigo and *techeilet* some time before sunrise. This suggests that the true color of *techeilet* is not the shade of blue most commonly associated with indigo, though indigo can be made to imitate *techeilet*.

¹⁴¹ Leiner *ibid.*, P’til *Techeilet* p. 54.

¹⁴² www.tighrope.it/nicolaus

Appendix

Letter to the Editor

Rabbi Yechiel Yitzchok Perr

Bio

Rosh Yeshiva, Yeshiva Derech Ayson, Far Rockaway, NY

Having spent much spare time over the past several years studying murex trunculus *techelet*, I was most gratified to find that I had arrived at the same conclusion, and for many of the same reasons, as Dr. Mendel E. Singer; namely that murex trunculus is not the *chilazon*.

Although the space of a letter does not permit some of the other arguments against murex trunculus, nevertheless, allow me to add some points to Dr. Singer's essay.

On page 11, Dr. Singer writes about the small amount of dye produced by a single murex snail, only 4 or 5 drops. It should be pointed out that the discussion about the culpability for *disha* in *Shabbat* 75a is thus completely without basis, since the minimal volume required for culpability is that of a *grogrit*, a dried fig. And clearly, the Gemara is discussing extracting the mucus of a single *chilazon*.

On page 16, Dr. Singer assumes that the "*nartik*" or *malvush* of the *Midrashim* is a shell. Despite the fact that we lack an adequate explanation for these words, there is only the one opinion, that of Rabbi Binyomin Mosufa, that *nartik* means a shell. All the other *Rishonim* and *Acharonim* refer to the *chilazon* as a fish, ignoring the word *nartik*. No doubt this is because there is a perfectly good word for snail in the Mishnah *Shabbat* 77b, "*shavlul*". This is also used in an Aramaic form in the Gemara *Menachot* 42b, "*shavlulita*". The contention that the Sages of the Talmud held the *chilazon* in their hands, and did not use the word snail for it, but chose to call it a fish, is completely untenable.

On page 17, Dr. Singer discusses the meaning of the word "*potze'a*", and he accepts Rabbi Herzog's understanding that there is a connotation in *potze'a* of cracking a hard shell. Sad to say, Rabbi Herzog was inexplicably mistaken in this understanding. In both biblical and mishnaic usage, *potze'a* carries no connotation of a hard object. One of numerous such examples is the Mishnah *Ketubot* 43b, "*Patza'a Bifaneha*", "he wounded her face". According to the Radak's *Sefer Hasharoshim*, *Potze'a* refers to incising a smooth surface, splitting, cutting, wounding, or causing a fissure. See also Rashi, *Shemot* 21:25 and *Shir Hashirim* 5:7. It is the usage of "splitting", that is found in *Shabbat* 122b, "*Liftzo'a Egozim*", to split, not to crack, nuts.

A small experiment demonstrates why the Gemara there speaks of using a *kurnos*, a blacksmith's hammer, for opening nuts. When a walnut is struck smartly with a light ¼ lb. Hammer along the seam where the halves join, the shell at the contact point is crushed. But when it is merely tapped with a heavy 1 ¼ lb. Hammer, it splits in half all the way around.

In other places *potze'a* is used for splitting the limbs from a tree or splitting a stretched string.

On page 19, Dr. Singer discussed the color of the "blood". The murex mucus is not blood, neither biologically nor in color. P'til advocates attempt to cope with this problem by writing the word thus, "blood". The implication here is that the "ancients" were imprecise in their use of language. However, there happen to be excellent words used in the Talmud for mucus: *Rir*, *Leicha*, and *Maya* are some of them.

On page 22, Dr. Singer quotes Dr. Ziderman that it is absurd to think that non-Jews would use murex dye, when indigo was available. IN this reasoning Dr. Ziderman was already preceded in the response of the Radbaz. But the most trenchant proof is from the prophet Yechezkel, who informs us in chapter 27 verse 7 that in the sixth century B.C.E., at the height of the Tyrean commercial hegemony over the Mediterranean Basin, Tyre was importing, not manufacturing *techelet*.

On page 27, Dr. Singer writes of the silence of the Gemara about the murex. The *Beit HaLevi* of Brisk, quoted in the forward to *Ein Hatechelet* page 13, rejected the Radzyner's *techelet* based on a most penetrating question. He asked, how is it possible that the *mesorah* (tradition) could have been lost, that this commonly available squid is in fact the fabulous *chilazon*? And since it is common, the *Beit HaLevi* continued, then there is a *mesorah* that the squid is not the *chilazon*!

Tyrean dye faces even more severe objections, since it was massively produced throughout the Middle East, and continued to be produced in Constantinople until May 29, 1453. Beside the omission from the Talmud, there is not one hint by Rashi, the Rambam, or any other *Rishon*, that Tyrean purple manufactured in the sunlight was actually the much sought-after *techelet*. The proposition that the sages of the Talmud and the *Rishonim* were

ignorant of facts on a subject of deep concern to them, facts that were commonly known in the world around them, is a proposition that is impossible to accept.

In note 11, Dr. Singer pronounces P'til Techelet's efforts as "inspiring". I find their efforts rather distressing. P'til is attempting to foist on an unexpert public a halachic practice through marketing methods and thereby establish the precedent of a *Minhag*. At the same time, their stand ignores the words of the *Rishonim* and exhibits a cavalier attitude towards the Gemara itself. The Gemara *Menachot* that gives the description of the *chilazon* is dismissed by P'til as "homiletic". If P'til succeeds, they will have contaminated the halachic process.