ROYAL PURPLE OF TYRE

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Aside from being excellent navigators and keen merchants, the Phoenicians often excelled other ancient peoples in processing and manufacture of five products: dyes, fine fabrics, glasses and ceramics, bronzes, brasses, and ivories. We need not stress their age-old commerce in cedars of Lebanon.¹

Perhaps only mild objections might be raised to the thesis that Tyrian or Phoenician purple was first and foremost esteemed and desired product—esteemed not only by themselves but also demanded by the nabobs of the ancient Mediterranean and Middle Eastern worlds.

The immediate interest here then is the "Purple of Tyre"—the dyes that did so much to fossilize the ancient caste system. The wearing of royal purple robes in Imperial Roman times, at least, was forbidden by harsh laws to all but the inner circle of the ruling classes. The cost of purple robes would preclude acquisition by the many, but a few wealthy climbers desiring the status badge eventually penetrated the vertical bars of law.

Our personal interest in the murex dye first came about in an uncomplicated way. On a spring afternoon at Sidon some years ago our attention was drawn to some children at play on the shore. They were dyeing rags with a mash of murex sea-snails. The youngsters mixed the snail extract with lemon juice and produced "chiffons" dyed with colors reminiscent of the splendor of the defunct Caesars.²

Looking around about the coast, huge mounds could be discerned, earth-covered and overlain by centuries of the turmoil of nature and man. When digging into these ancient mounds billions of shells of murex sea-snails can now be found, deposited there by the ancient dye-workers of the "Coastlands of Tyre and Sidon."

Our imperfect knowledge of the art of murex dyeing begins with ancient myths of 4,000 years ago, affording us relaxing glimpses through spectral slits of time and space. The industry was still viable in the time of Charlemagne (A.D. 768–814), whose Venetian merchants imported "Tyrian Purple" from the Muslims of the coastlands of Lebanon. And this 180 years after the victories of Islam! The Muslims did not value purple but did not destroy these factories. Difficulties of commerce and use of other dyes together with the old and uncertain laws governing supply and demand crumbled this ancient artful industry.

The story of purple is replete with legend³ and history but, unfortunately, not with precise technology. Perhaps we can simplify our subject somewhat by describing the murex snails, their pigments (called biochromes), habitat, and the views of ancient and modern dye chemists. We

¹ It may be gratifying to recall Woenam's voyages from Thebes to Byblos (circa 1100 B.C.) in quest of cedar logs. (Breed, Ancient Records, IV (Chicago, 1900), §§ 663–91.)

² Children dyeing cloth in this way was noticed by Louis Lortet, La Syrie d'aujourd'hui (Paris, 1884), p. 127.

³ Purple was always associated with dress of the gods and royalty in records from Homer (Iliad IV, 141–45) down through Hellenistic times to the end of the Western Roman Empire and eventually the Byzantine Empire.

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shall include something about the wearers of purple, together with a few historical facets of the intrepid old Phoenicians—ancestors of some modern Lebanese, Syrians, and other Arab groups.

Today one can still dream in the “rosy-fingered dawn” of the coastlands when holding small craft and large oil tankers lying off-shore from Sidon, etched in foam profiles awaiting the clear light of the rising sun. Their petroleum cargos and guests have tossed with the times. Their chief navigational guide is no longer the North Star in the constellation of Ursa Minor, grouped earlier as the Tyrian cynosure, first used by the Phoenician shipmasters from Byblos to Gades (Cadiiz).

THE MUREX MARINE SNAILS

There are uncounted species and variants of carnivorous marine snails, like the colored dog-whelk of our Florida waters. Many of these vicious snails can drill holes in mollusks or can force the valves to open. Some of the genera secrete a poisonous narcoticizing toxin paralyzing their prey. Rachel Carson called this substance purpurin. This may not be the dye, however, because the dye does not act as an anesthetic or paralyzer. Specific experimentation has revealed the non-identity of these substances. It is known that carnivorous sea-snails not possessing dye attack their prey in the vicious manner of murex.

The dye-producing snails used in ancient times for the varying colors of “Tyrian purple” were of several genera and species: (a) Murex brandaris, found chiefly in the shell mounds of Tyre; (b) Murex trunculus, the commonest shells now found in the shell mounds of Sidon and often along the entire Mediterranean coastal regions; (c) Helix aspersa, a small-shelled species of snail related to Murex, found near Beirut and also in middens around Tyre, which produced a violet dye; (d) Purpura lapillus, a source of dye which was not “fast” but valuable, found also along the coast from Mt. Carmel north to Ugarit (Ras Shamra). In this connection it is of interest to recall another species of Purpura, the West Indies P. patula, producing a brilliant violet dye, which, with extracts from other sea snails, was used by pre-Columbian Indians of meso-America and Peru for dyeing their fabrics. Prehistoric peoples of Britain and Norway used the purple of another variant, Thais lapillus, for dyeing cloth and perhaps themselves, although wood was generally used. The Romans termed some sea-snails “Buccinum” which may now be equated with Thais hemastoma.

No one knows when the purple dye was first used in the sea-side cultures of the protoliterate period, but certainly the source was known very early. At Minet el-Beida, the port of excavated Ugarit (B.C. 1200–1000), now so famous in historical and religious circles, mounds of crushed murex shells still to be seen accumulated before the sixteenth century B.C. Philologists tell us that the earliest occurrence of a word for purple may be an Indo-European word, but obviously this does not denote discovery and invention.

Minoans and Greeks also utilized the sea-snails for dyes, but Phoenician trading posts in pre-Hellenic Greece and the islands like Salamis, and other Semitic-named sites, tinture the picture deeply in favor of a Phoenician or Canaanite origin—the
Phoenicians and Canaanites being the same north-west Semitic peoples. Presumably, the east Mediterranean was already Levantinized by Linear Script A times.

R. W. Hutchinson lists *Murex brandaris* and *Murex trunculus* in Crete, exploited for the purple dyes. He found shells of both species on a Middle Minoan III "dump" at Knosos (B.C. 1700-1650). Observing that Cretans eat murex, he found that both species are indeed edible, but *Murex brandaris* is the better food.

An old Greek legend tells that Helen of Troy, when strolling along the beach to while away her captivity, noticed that her dog belonging to Hercules had chewed a large sea-snail. The dog's mouth shortly became stained a deep purple. She adored the color. Helen then screened her suitors with a request for a dress dyed with *porphyra* before pairing off with the winner—reminiscent of the minx and her mink coat.

The widespread distribution of the dye-containing snails was taken advantage of by the ancients along the whole Mediterranean basin, but the Phoenician coastland was the habitat of varieties possessing pre-eminent fast colors. This activity also may have been due to Phoenician art or technology and accumulative "know-how."

The Hercules of the Greeks was in fact, as Alexander the Great declared, the original god of Tyre. A Tyrian variation of the "purple myth" told of Hercules' sheep-dog biting into shell-fish. Hercules observed the dog's mouth to be stained a bright crimson. He ordered a gown to be dyed with the new-found color. The honor of discovery then will have to await a sound chronology from radio-carbon dating of suitable, uncontaminated layered shells of the mounds and the date of Phoenician migrations and other ethnic movements to the coastlands. Historians have dated the beginnings in Crete at 1600 B.C.; Egypt 1400 B.C., and some of the Ugarit-Phoenician deposits somewhat earlier.

The habitat of the desired murex extended from Mt. Carmel to Sidon, but the very best sources of fast brilliant dyes were processed from the gatherings between Haifa and the Ladder of Tyre. Some varieties preferred deep water up to 25 fathoms, and others, shallows of the shores. All provided good leuco-bases (which will be described) of white to cream-colored extracts for processing into five or six colors.

The modern scientist riding and walking along the coast roads is always impressed by these murex mounds representing astrophysical numbers of shells processed patiently by the diligent folk of so long ago. Shell mounds enormous in size are to be seen by the old walls of Sidon (Saida) and the Sidonian south gate. Near Tyre and in fact, intermittently along the coast from Acre to Latakia, large heaps are or were visible, but some only discoverable by probing.

The Phoenicians' merchant craft manned by skilled, courageous navigators sailed (and rowed) to the "ends of the earth," i. e., from the Black Sea to Cadiz (and

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10 *Economist Cret* (Baltimore, 1952), p. 239. The *Murex* species and their eggs are avoided as food by marine life. These marine snails contain the dibrom-indigo, indican-indoxyl-indol series as well as allergens, bromine, and a nauseating poison, all of which possess toxic properties depending upon the doses ingested. An Eastern Mediterranean sea-food soup, colorful, tasty, and mysterious, can contain morsels of octopus, squid, whelk, and a chance list of other invertebrate organisms. The ancient proverbial *de gustibus non est disputandum* has ever been applicable to man at every cultural level.


Britain) establishing settlements where trade with natives could be profitable or where murex beds were plentiful. Sources of murex for their dye factories, Pliny tells us, were their chief inspiration for search. When they located beds in quantities, as in Tarentum and Palermo, they promptly established factories and posts. To the purple dye works of Tarentum in South Italy and Callipolis in Sicily are due the ancient heaps of snail shells still to be seen there. Some of these sites afterwards became important cities. They colonized Malta (still more or less “Phoenician”), Sicily, Sardinia, Corsica, Utica, Carthage, Atlantic Morocco, numerous sites in Spain like Malaga, Ibiza, Seville, Cadiz, and perhaps some of the lost Tarshish sites. At Saguntum, now Murviedro, local Phoenician coins have been found with pictured shells, as well as imperial coins of Tyre. At these sites, as well as in scores of other small western Mediterranean harbors, middins of murex shells are often discernible.

French archeologists studying the murex dye industry of the Phoenicians (Punics) along the coast of North Africa say that the dye there was obtained from the decaying flesh of the murex. This is not the case because, as we shall see, only the live snail (fresh tissues) provided good dye. The cast-off portions decayed. For instance, in a town-site with shell heaps at Dar Essafi near Kerkouane (Tunisia) at a small harbor near the mouth of Wadi, numerous ancient vats hollowed out of solid rock are observed. These were never used after the fall of Carthage. The vats were situated supposedly down-wind because of the “smell of the dye-works.” Strabo says the dye-works of Tyre and Sidon smelled so badly that these cities with their tall insulae

While rich, were “unpleasant for residence.” He also mentions murex dye factories along the north African coast (late first century B.C.), doubtless an inheritance from the Carthaginians.

The Lebannese or Punics never knowingly divulged their Atlantic island discoveries to the Greeks, Etruscans, Romans, or Egyptians, who were at least to understand the nature and inexhaustible supply of the coveted purple and other dyes, but rumors of the western isles of the blessed and Atlantis did reach Greece. Much later Plato started on its way the persistent myth of Atlantis. Their discovery of the Azores is also attested to by a modern archeological find of a pot of ancient Punic coins on Corvo under the foundation of a sea-side ruin. The Portuguese rediscovered the Azores in the fifteenth century A.D. The Punics (Phoenicians-Carthaginians) on their far-ranging Atlantic trips discovered the Canaries and Madeira, where they found the famous litmus and dragon-tree whose resin provides a deep-red inferior dye. The old tree in Teneriffe which was blown down in a storm in 1668 was known as their tree (estimated perhaps inaccurately to have been 6,000 years old).

**Processing the Murex**

Phoenician and their Punic colonists’ sources obviously tell us very little about their millennia of experience in testing and processing the murex. The Indo-European language sources now available are conflicting in part, but Pliny provides us with a workable outline of procedure. Again; some procedures in Hellenistic-

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14 Strabo *Geography* XVI, 2, 23, 757; XVII, 3, 18.


Roman-Byzantine times were developed independently of the "Syrians" by working local coastal beds.\textsuperscript{17}

The gathering of murex took place in early spring during the reproductive period just before the snail or whelk began laying its eggs; this weakened the dye since some of the dye substances pass into the egg capsules. The mature egg capsules also contain a great deal of the rich red-purple dye which may have been a secret source utilized by the Phoenicians. These eggs are avoided by all fish and marine life and thus have great survival value. Wicker basket traps like lobster pots were set in the sea baited with mussels, oysters, animal flesh, frogs, etc., to attract the voracious murex. When enough of the sea snails had penetrated the baskets, they were hauled up. The extraction began immediately while the creatures were still viable because the leuco-base was lessened in quantity and color-potential in the dead snail. The smaller shells were also crushed immediately and in case of the larger snails the dye-bearing portion was taken out by hand. (Grave skin irritations and allergies must have reft from intimate contact with these noxious tissues.) The live murex often "spurted" a drop or two of fluid when disturbed. Sometimes the larger shells were cracked open for easier extraction of the tissue. This tissue was the hypobrachial gland mass in the mantle cavity containing the principal leuco-base. This gland varies greatly in size in the various species. The odor of the fresh juice is not pleasant, and a chemist accustomed to "laboratory effluvia" might mutter: "A mixture of a whiff of garlic breath and dilute bromine gas."

One modern source\textsuperscript{18} states that purple dye of murex was manufactured really very simply. The murex were piled in heaps and left to die, and from these dead decaying sea snails the purple liquid ran off and was collected. Also it is stated that the supply was over-fished so that the Phoenicians had to find new beds of murex. This, of course, was not generally the ease. The supply never gave out in Lebanon (Tyre, Sidon, Arvad, Beirut, et al.). The eggs of murex have great survival value and moreover the supply of purple never met the demand in ancient times. New beds were always sought after. Restocking the old beds by use of offal may have been practiced.

In large-scale processing the crushed chromogenic tissues and extracted juice were salted with one and one quarter pounds of solar sea salt to 100 pounds of mash. After three days the macerated pulp was placed in stone or lead vats (brass, bronze, and iron vats caused unwanted colors through oxidation by cuprous-ferrous compounds). A hot water pipe (plumbum) coiled in the vat kept the mass simmering. The dross of coagulated proteins coming to the surface was skimmed off, and, at the end of about ten days, the fluid was clear with about 500 pounds of fluid remaining of the original 8,000 pounds of raw, wet material. At this stage the color was "dark" with a reddish tinge. Washed wool was then dipped into the fluid for testing the tintorial strength, penetration, and color after exposure to strong sunlight.\textsuperscript{19}

There are many fragmentary hints extant of the processing, and none is in agreement with another. This is to be expected. The "Tyrian Dye Trust" whose "patents" could only be concealment of crucial processes did not omit declaring too much to the customers of the known civilized and barbaric world. (Some of the German chemical patents seized by the

\textsuperscript{17} D.A. W. Thompson, A Catalogue of Greek Fishes (London, 1947); see "Murex".


\textsuperscript{19} Pliny Nat. Hist. ix. Chap. 62.
were piled in from these dead, pure liquid rather than solid material. This was stated that the beds of murex. Uncle, the case, the "great Persepolis" or "the Great Persepolis." A recent experiment using about 12,000 Murex brandaris and employing the refined technique yielded 1.5 grams of crude dye. It is difficult to equate costs in antiquity with inflationary currency of today. An educated guess would equate the cost of one gram in 200 B.C. at about $30.00 or $13,000.00 a pound (1961). The dyed textiles were very costly as we shall see. When Alexander the Great conquered Persia, he found in the royal treasury of Susa and Persepolis "hundreds of talents worth" of Tyrian purple-dyed textiles of all sorts.

**Chemistry of Royal Purple**

During the past seventy-five years European chemists have been interested in Tyrian purples. Among them were Letellier, Dubois, Verne, and the famous Abderrahmen. The leuco-base was shown to be mainly 6, 6'-dibromindigo:

![Dibromindigo](image)

However, other pigment bases and moieties are present in varying amounts in the several species—some in the deep cells of the gland and other blue pigments in the rectal epithelium. For instance, under solar radiation the latter pigment becomes deep blue but the gland leuco-base becomes red. Purple colors (modern concept) are produced by mixing red and blue coloring matter. Shades of purple are effected by varying the proportions of these two colors. If one extracts Murex brandaris tissues with alcohol a fraction is obtained which does not form color. The alcohol-insoluble fraction is also inactive but, when the two fractions are mixed in salt water, i.e., ionized, a deep purple is formed. Boiling the salt water extracts weakens the leuco-base and at times greatly nullifies its properties in the fresh snail tissues before the three day brining.

The red color from Murex brandaris forms well in strong sunlight whereas the M. trunculus chromogen often forms a blue-violet color in diffused light and even in the dark. There is little doubt that some of these biochromes or leuco-bases of marine snails are, under certain conditions, multiphase indicators, i.e., oxidation-reduction, adsorption indicators and acid-base indicators.

When the fresh biochrome bases are exposed to strong sources of light, i.e., photo-chemical action, a strong odor resembling "garlic-bromoform" is emitted. Enzyme fractions (purpurases) from each type of snail when acting on the leuco-bases of other and their own biomogens produce a complexity of color reactions in direct sunlight and in diffused light. Small wonder the Phoenicians attempted to standardize their processing! We can readily understand why they also worked up so many colors and shades of dyes!

For example, let us carefully extract the chromatogenetic tissue of Murex brandaris or
Murex trunculus, with a forceps, press out the “juice,” and apply to a number of fabrics, wool, silk, or linen and cotton. Then expose the acidified moist cloth to strong noonday sunlight. At first the color is green, then blue, red, and purple-red. Wash in soapy water and a fast bright crimson comes out which is the permanent or end-color. However, at times the end color is blue-purple!

We shall not complicate matters with mordants. This phase of the Phoenician dye industry is practically unknown. Modern dye chemists know how important mordants are for fastness to water and light, penetration, color, and luster. That the Phoenician used seaweeds from Crete and Cyprus as mordants and color adjuvants is recorded, but whether they extracted or calcined the weed is not known.21

Over a half century ago Dubois,20 experimenting with the purpurase (enzyme) biochrome systems of the dye snails, observed a green pigment first formed in any intensity of white light, i.e., daylight. Then the chromogens changed to wine-red and purple. In blue light the color changed to blue pigment; in green light to blue pigment; in violet light to violet-blue pigment; in red light to currant-red. In yellow light no changes occurred at all from the original greenish color. Other chemists could not regularly duplicate Dubois’ results.

It must be recalled that the Phoenicians heated (simmered) their preparations which would inactivate some of the labile enzyme systems. But the extracts were not heated for several days during the salting period. The leuco-bases form color with oxidizing agents, but we are in the dark about oxidizing substances available to them. Also alum and acids like lemon juice, vinegar, and tannic acid bring out textile colors and were available from very early times as we know from the histories of tanning and of citrus and lemon trees and other citrus fruits22 (a “late” painting discovered in Pompeii depicts a lemon tree). Crude urea also served as a mordant. Surnisses indicate that preliminary salting and the judicious addition of acid-alkali-salt, heating, and atmospheric oxidation accelerated by solar radiation produced the play of colors.

The alkaline waters of Hierapolis, Phrygia is so “soft” that it cleans hands without soap. In Roman times it was said to be excellent for dyeing the rich wools of the countryside particularly in the purple. Professor R. Campbell Thompson23 showed that technology in the early Near East already encompassed the use of numerous organic vegetal drugs, chemicals, and oils. Arsenic, antimony, sulphur, mercury, and alum were in general medical use as were “numerous alkalis” and dyes (sumac, crimson from insects, madder, indigo, murex). The Egyptian Pharaoh Amasis (d. 526 B.C.) made rich presents to the temple at Delphi among which was a thousand talents weight of alum.24

We shall spare the reader the voluminous literature on modern chemistry and physics of dyeing including basic and acidic mordants (alum and tannic acid), compound dyes, structures of chromophores and auxiliary structures, dye salts, di- and meta-chromatism, fixation roles, etc.22

21 W. F. Leggett, Ancient and Medieval Dyes (Brooklyn, 1944), pp. 56–60.


23 R. C. Thompson, Cambridge Ancient History, III (1925), 240.


25 C. Lammens, and M. F. Mallette, Basic Bacteriology (Baltimore, 1953), see Chap. 5, on Dyes and Staining for Basic Theories. For staining of textiles see: E. L. Valko, “Physical Chemistry of Dyeing,” Colloid Chim., VI (1946), 394-419.
Application of much of this knowledge to illuminate obscure ancient technologies is obviously difficult. Unless our ignorance is personal, it also appears that funds are not available to revive a small pilot-plant scale research for a “useless cultural project on Tyrian Purple.” Sir Julian Huxley asks why this subject has been neglected by classical historians (and biochemists).26 We are still obliged to proceed from a molchill of fact to a mountain of surmise (until specialists clarify the subject in a group research).

It has been conjectured that the intense summer sunlight on the coastland was ideal for the purpose, but obviously other Mediterranean lands were equally favored.

As would be expected the murex brandaris compound resembles the ancient vegetal dye, indigo, very closely. Indigo from Indigofera and Isatis (woad) and related plants was produced from indican in the plant tissues by natural enzyme action yielding indoxyl. The macerated plant extract first becomes green and then dark blue in air through oxidation. It has now been made synthetically for eight decades. Indol is one of the basic substances of these many compounds. In man and murex they are excretions. But back to Royal Purple. As we have noted, Tyre (Sourou) factories appear primarily, to have used Murex brandaris, which formed a dull-red dye. Sidon (Saids) used principally Murex trunculus which usually formed a purple (not red) dye. Beirut furnished the small Helix ianthina producing a deep violet and sometimes amethyst dye called conchiliata by the Romans.27

It was customary to use portions of various dyes applied separately to cloth and threads to provide the colors in fabrics most desired by the privileged nationals of the ancient world. A color described by Pliny28 as very desirable was a rich dark purple of the color of coagulated blood but which when held up to light showed a crimson hue. We shall discuss in the sections to follow what the ancients meant by “purple.” Briefly “purple” meant reds, crimsons, but the designation often included rose, intense crimson, heliotrope, deep sea blue, violet, “concord grape” color, and even greenish colors.

One substance used in Tyre and Sidon as an adjuvant to color was orseille, a mixed litmus from lichens.27 Acids and alkalas turn the color red and blue. The substance in orchills seaweed called orchil from Roccella tinctoria, used in the processing, when boiled with natron (crude sodium carbonate) water changes to orsellinic acid, a chromogen.28 Orseille and dilute honey (6-carbon sugars of honey act as reducing agents when fermented by micro-organisms29) interrupted the oxidation change in shades, and this process yielded green or red or blue at will. Phoenicians also used double dips with other dyes of animal and vegetal origin. Imitators used double dyes (bimpha) of a crimson containing insect, madder, indigo, or berry juices which yet “fools” archeologists in case of purple mummy wrappings of Egypt. Kermes, or “little worm” (Latin, vermiculus), was a red dye obtained from a shield louse in the Near East, hence our words, crimson and vermilion. The type of thread-fabric, “Cos” silk, wools of different breeds of sheep, linens, mixed gold-wool-silk fabrics, etc., also influenced the shades and luster with wide variations.

Perhaps the reader may pardon a digression in this summary. The vexatious question of the antiquity of the distillation process comes into our picture. Professor

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26 J. Huxley, From an Antiques Land (New York, 1954), 73-76.
Philip K. Hitti, the noted authority on matters pertaining to Phoenicians and the history of the Arab world, wrote in his history of Lebanon that the dyes were painstakingly distilled and thus rare and expensive. Distillation was certainly carried out by loosely covering a heated vat with a slanting concave cover of larger dimensions than the vat and waved like corrugated metal of today. The condensate or run-off from the cooled cover was caught in several vessels around the "eaves." Devices like the Basra still or *curcubit* were known in Persian times and apparently the "flame throwing" Assyrians distilled petroleum into both dark and white fractions, i.e., Persian *naft*, which the Greeks afterwards called *naptha*. However, boiling the fresh leucobases often weakened the colors but upon three-day salting some stability occurred. Perhaps the distillation process was employed by them for reagents or for distillates of uses now unknown to us.

The major pigment of murex, 6, 6′-di-bromindigo, when prepared synthetically in the laboratory as a solid purple compound, sublimes at elevated temperatures. The sublimate is crystalline, and deep indigo-blue in color. Under these conditions it is insoluble in cold water but soluble in hot alcohol and petroleum solvents. Known modern data raise more questions than can be answered.

The excellent "Sidonians" were "cagey" about these matters, and we obviously have much to learn. St. Chrysostom said that men gather gold not only in lumps but also in minutest visible particles. These ancient Semites had a coy bright eye for business.

Charles Duff, an Irish historian, has discussed the antiquity of the distillation process. He believed that his evidence showed that knowledge of the process of distilling was brought to Ireland by Phoenician traders long before the Christian era. They were distilling *uiscbeathadh*, pronounced "ishkey-bah" or whiskey, the water of life in very early times.

We were taught in schools a half-century ago that Salerno of Salerno (A.D. 1130–1160) was the first to mention distillation and that the distillation process was unknown to the ancients. Partington and others describe Alexandrian and Near East treatises on chemistry showing diagrams for distillation, fusion, calcination, solution, filtration, crystallization, water and sand baths, sublimation, etc., etc. The Arabs inherited and extended this knowledge of al-chememia.

Another digression may preclude pardon, but the "play of Tyrian colors" brings up an observation of interest to artists (perhaps) and students of biochromes. Dr. W. Lee Lewis, the organic chemist, from whom *levulose*, the deadly war gas received its name, and the writer, while at the University of Chicago studying pigments formed by micro-organisms growing on tissues and fats, observed a curious phenomenon in coloration paralleling the murex dye of Phoenicia.

Certain cultures of yellow pigment-forming bacteria upon prolonged incubation in the laboratory caused a characteristic yellow discoloration of the fat. The pigment, which was obviously fat-soluble, diffused deep into the fat and facia. The fat became rancid with characteristic peroxide formation, and the pigment changed first to a greenish shade and eventually became purple, violet, red, or brown, depending on storage or conditions of use. This unknown pigment has been called "Murexide."

Rembrandt's countryman, Rembrandt the painter, was employed in the abattoir and painted with the purple-blue meat and meat juices as a background. He used them not as dyes but as part of the painting process. There are many and varied scientific uses of such pigments. Hemoglobin is a blue pigment in the blood cells of the body. Oxidation causes it to turn brown. The color is characteristic of the pigment and is not due to the red blood corpuscles themselves.

Colors are a mental concept, and the que notations are expressions of the saturation, group number, and system (e.g., "more," the...
of the distillation that his evidence of the process of to Ireland by long before the re distilling wise-“ishkay-bah” or life in very early schools a half-century alerno (A.D. 1130—mention distillation process was un-Partington32 and Adrian and Near an, fusion, calcination, crystallization, sublimation, etc., extended this t. may preclude pardon, "colors" brings up an to artists (perhaps) comes. Dr. W. Lee nemist, from whom ar gas received its while at the Un-studying pigments nisms growing on served a curious par of the fat. The previously fat-soluble, fat and facia. The with characteristic and the pigment reemish shade and story of Chemistry (New de ("Humanizing Science Press, 1949), pp. 64-65, eventually became blue and purple. These purple, violet, and blue discolorations on meats were a scourge when various meat and meat foods were kept too long in storage on land or sea, as on convey assignments to Britain during World War II. This unwanted discoloration had long been called “Rembrandt blue” and “Murexide.”35

Rembrandt (1606-1669), the great countryman of Leeuwenhoek, who often painted with photographic detail, shewed on one of his canvases the room of an abattoir and faithfully depicted streaks of purple-blue on the tissues of a dressed beef carcass hanging there. Artists were not able to interpret the anomaly. Rembrandt’s sketch of “The Slaughtered Ox” (also called “The Flayed Ox”) was painted in 1665. The sketch hangs in the Louvre, Paris, and the finished painting in the Glasgow Art Gallery (A. Bredius, “Art Catalog”, No. 457 and No. 458 (Vienna: Phaidon Verlag)).

There are many analogues in cell pigments, and parallelism is to be expected since all living cells have common deoxyribonucleic acid helices as well as ribonucleic acid helices—the coils of life. Hemoglobin much like that of our red blood cells is also found fully formed in cells of the root nodules of legumes!

COLORS AND WEARERS OF ROYAL PURPLE

The question of color nomenclature equating ancient pigment colors with modern data from color comparator instruments has not been satisfactorily answered. Scientific (and artists’) systems of color notations are not wanting. Hue, value-saturation, chroma-luminosity and color group numbers can be found in Munsell’s System (Munsell Color Company, Baltimore), the “Colour Index of Dyers and Colorists” of England and other charts based on spectrophotometric data and devices of the physicist.

Comparisons of natural colors of flowers, olives, blond, golden, yellow, and tawny hair, salmon and other fish, colored marbles, gems, ceramics, reds of dawn, et al. with the words and phrases of ancient poetry and other writings are not precise at all. Some progress has been made by philologists or linguists. It is known that the barbarians on the periphery of the ancient civilized world either did not possess color acuity or did not have words suitable to designate colors precisely. The “pink” flesh of salmon (laks-) designated various hues of pink to dark red in early Indo-European languages from India to Norway. Many of these tribes of Norse and other Gothenics called the color of the ocean, for example, “blaas” which meant both blue and black! Negroids and some “Moors” were called “blue-men” in early Irish-Norse Chronicles. There are other confusing examples of color designations. Differences in hereditary acuity and appreciation of color are still with us—especially color-blindness for red colors.

The most prized color in early Imperial Rome was amethyst royal purple—the color of the gem. Sustenious37 mentions that the disordered Nero once sent an agent on market-day to sell a few ounces of the forbidden amethystine Tyrian purple dye to dealers who upon purchase had their shops closed. “A lady wearing this illegal color at one of his recitals was dragged off and not only stripped of her clothes, but of her entire property.”

Royal purple meant a variety of colors to the ancients—the range being deep red-black to violet as we have seen. We
may also infer this from the lines in the
"Bravery of Diomed": "These were the
robes, many colored, the work of Sidonian
women; they from Sidon had come. . . ." 38
The ordinary "purple" was reddish, the
magical color used for 100,000 years in
Pleistocene burials then effected by oxides
of iron or ochre—"the "life color of blood,
muscle, red marrow and red membranes." 39
The fossil bones of Neanderthals and early
Homo sapiens still show the red ochre with
its pathetic promise of after-life.
Royal purple was often sea-blue and
violet in color, but dark green, heliotrope,
rose red, and black-purple colors were
highly prized by the privileged classes
from the Elbe to Casablanca, and India
to Spain. The Greek name, "Phoenician,"
"phoinix" (also date palm and color of
bay horse), and "phoinos," blood red,
indicating Phoenicians were allusions to
the skin color of our hardy Semitic sailors
and merchants. 40 Some writers conjecture
that the reddish complexion of their faces
were the results of exposure to sun, wind,
and sea spray. Others derive the names
from the murex dye of the Sidonians.
Canaan also means "red-purple." The
names "Canaanite" and "Phoenician"
were used interchangeably since they were
a single people, differing only in that
the Phoenicians were largely seamen,
the Canaanites, landlubbers and caravan
traders.
Writers of Hellenistic times understood
"purple" to mean several colors: dull red,
magenta, blue, and violet-purple. The
most expensive dye was Tyrian dull red.
At Sidon, where M. trunculus was used,
the purple dye was often like our modern
concept of purple.
Another clue came to mind when
38 Herodotus ii, "Bravery of Diomed."
39 Gertrude R. Levy, The Gate of Horn (London,
1948), pp. 6, 64, 68-70.
40 C. S. Coon, The Races of Europe (New York,
1948), p. 146.

watching the late-winter, early-spring
flood of the Adonis river just south of
Byblos. The old Venus-Adonis religious
legends told of the wounded god's blood
at this season of high water. The river
water is red and injects a large area of red
into the blue Mediterranean extending
for miles off-shore at times: 41

"Smooth Adonis from his native rock
Ran purple to the sea."

The color is that of the red, iron-bearing
soil up the river, and purple in this case
equates with "Venetian red!"
The Jews before Titus' destruction of
Jerusalem, the Temple and the land of
Judea, gave a precise name to the wanted
shade of Tyrian purple. This shade must
be the color of sea, air, and a clear sky or
blue, for the Temple priests. In the Bible,
blue and purple are often interchangeable
terms. The outer curtains and inner veil
of the Temple sanctuary (Dehbr) rent at the
Crucifixion were supposed to be of this
Tyrian color. Josephus (Antiq. vii:7) describes
the veils dyed with the "blood" of a
sea shell-fish, blue like the sky, and scarlet
of fire. In Wars (v:4) he calls one veil a
"Babylonian curtain" of "blue, scarlet,
and purple, a mixture of colors." The high
priest wore a "blue garment and a girdle
colored purple, scarlet, blue like the veils
of the Temple." (Whiston's old translation.)
After the fall of Jerusalem and the
Temple (Wars vi, 9, 3) Jesus Bar Thebus-
thus, a priest, and Phineas the treasurer,
for their security delivered to Titus some
of the hidden wealth of the Temple in-
cluding veils, priestly vestments and a
"great quantity of purple and scarlet for
uses of the veil." After the Triumph in
Rome (Wars vii, 6), Vespasian specifically
ordered that the "purple veils of the holy
place should be deposited in the royal
palace itself and kept there.” Josephus in his *Antiquities of the Jews* mentions many biblical personages who were honored by gracious permission of potentates to wear purple with the golden neck chains like Joseph in Egypt, Daniel in Babylon, and Mordecai in Haman’s bailiwick.

Only in the last 150 years has purple meant a definite shade with two permissible variations. Perhaps in the distant future, provided that the same measure of archeological assemblages and records are preserved in the measure antiquity bequeathed us, some scholar will note that the cardinal bird was purple in A.D. 400, red in A.D. 1962, but in A.D. 4000 has mutated to crimson. We can readily understand now that purple of the Phoenicians meant generally dyes obtained from the sea-snails but not of uniform or specific color. It was a generic term no doubt fostered by the Phoenicians for obvious reasons.

We are not directly concerned with the kinds and styles of clothing worn in the Near East and Mediterranean lands. It is, however, worthy of notice that the Greeks bought and copied Phoenician garments of woven, dyed wool called *ketons* by the Byblos folk. The Greeks’ later form of the the word was *chiton,42* the dress or kilt still worn by the Royal Guards of Greece.

Roman togas43 differed in color. Specifically the *toga picta*, the purple mantle of Jupiter, was first worn by Julius Caesar whenever he wished. From Augustus onward the emperors retained the privilege but only on state occasions. The senators wore the *toga praetexta*, a white woolen toga with a hem of purple and red sleeves, colors restricted to this office. The *toga trabéca* with a red hem, but no purple was worn by augur priests and knights. They must not wear purple. Plain citizens wore a white toga often stained with every day living. The chief Vestal Virgin wore a purple-edged head veil (*strophium*) when offerings were made to Vesta. On other occasions all the Vestal Virgins wore snow-white robes. Strict laws regulating the wearing of the purple were in force for a long time, as we know from the Beirut Roman Law School codes of Justinian’s reign.44 Generally the purple was restricted to regal and ecclesiastical uses, but influential groups often were permitted to wear a few stripes as the Empire aged and declined. Martial records the cost of an ordinary purple robe at $2,000.00 (1961). Later on Diocletian purchased three hundred and twenty-eight grams of purple silk from Sidon for $3,000.00 (1961). The demand for purple silk in the Empire of A.D. 300 raised the price of this silk woven and dyed at Sidon (commodity called *metazabathos*) to $35,000.00 a pound! A simple contrasting picture of Republican Rome and Imperial Rome can perhaps be seen in the eighth chapter of I Maccabees.

“The Roman senate of 320 men in Council consulting always for the people did not wear diadems, neither did they clothe themselves in purple to be magnified thereby.” With the ascendency of the Caesars and subsequent Roman rulers, purple became the symbol of authority and finally the color of religion.

Alexander the Great would not wear purple when he conquered and destroyed Tyre. Finally, when he conquered the King of Kings, Darius of Persia, Darius remarked before he was hunted down and murdered by one of his own officials: “It passes all understanding that this Macedonian dresses only in white.” Alexander soon made up this deficiency!

Pliny45 and Tacitus46 noted that the

Gallic leaders used Tyrian purple fabrics and German women of rank wore "trailing garments striped with purple." Searches of ancient records vouchsafed us and secondary works reveal hundreds of references to purple. We would be proxix to cite all of these items. Those who were privileged to be set apart fell into many categories among which were: Ladies like Helen of Troy and Cleopatra, kings and kinglets, Jewish high priests before A.D. 70, Caesars and emperors, Byzantine nababs, pagan high priests, generals, flattered barbarian chieftains, and later on Latin Cardinals and Oriental church Patriarchs. The Byzantines went overboard with the significance of purple. Their royal babies must be born in purple rooms, i.e., "born to the purple."

Athenaeus writes as an aside that purple was used extensively by Roman ladies and playboys as a lipstick and rouge. Cleopatra's royal ships' sails at the battle of Actium were dyed purple. A few of the early Christians like the early Muslims to follow abhorred purple as a symbol of luxury and sin. St. Clement of Alexandria wrote of purple robes in early Christian times: "I am ashamed to see so much treasure expended to cover shame."

There is much confusion about the importation of silk into the ancient Mediterranean and Near Eastern countries, chiefly the time of entry. It is now known that the women of the Greek island of Cos late in the fourth century B.C. learned the art of unwinding cocoons of wild silk worms and weaving the filaments into silk. There is an early notice of "silk of Cos and Tyre." 47 Also if Ezekiel (16:10, 13) is correct, silk was known in Tyre in the sixth century B.C. Aristotle mentions silk in his Historia Animalium. Real Chinese silk from the land and sea routes makes its appearance in quantities by 115 B.C. Pieces of real Chinese silk dyed with Tyrian purple have been found in a tomb at Palmyra, dated A.D. 83.

Ephesus was described as a rich city with merchandise of fine linen and purple, silk and scarlet. The purple dye and fabric retail business had passed to other Semites, mainly the Diaspora Judeans and "Syrians" in New Testament Roman times who were active commercial people throughout the Roman Empire and Persia. In Acts 16:14, "Lydia" from Tyatira, a Macedonian colony in Asia Minor and a great market of purple dyes and textiles, aided St. Paul in Philippi of Macedonia. She is called a "seller of purple" and was obviously very wealthy and a devout Jewess. She was the principal contributor for Paul's upkeep. The great French romanticist and orientalist, Joseph Ernest Renan, has the lady marrying St. Paul. The Church owes much to her lucrative business in purple. 48

Zeno (342-270 B.C.), the Phoenician founder of Stoicism who anticipated St. Paul by 350 years on the Areopagus of Athens, 49 was a merchant of purple on Cyprus before he became a Greek philosopher. The numerous inscribed pagan and Christian tombs excavated under the Vatican, once the necropolis near Nero's Circus, one is the sarcophagus (third century A.D.) of Ostoria Chelidon, a pagan daughter of a Consul. After so many centuries the body is still richly embalmed, wrapped in a shroud interwoven with gold, and dressed in purple. 50 Another tomb from Roman times at Germa (ca. A.D. 300).


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in the Fezzan out in the Sahara near the Germa mausoleum yielded some murex-dyed purple woolen textiles among other grave goods, apparently those of a lady of rank. The great silk industry of Asia Minor and Lebanon, according to the historian Procopius of the coastlands, had its origin sometime between A.D. 527-65 when two monks brought some precious cocoons from China in hollow staffs. Soon mulberry trees (the leaves being the silk worms’ food) were planted where they could grow. Lebanese mulberry trees were numerous and good to behold until quite recently when the business was eradicated by introduction of chemically produced plastic fibers into world markets.

The Byzantine rulers held trade monopoles on most articles of commerce, and purple-dyed cloth and threads were among these items. As we have noted, the Byzantine emperors had always been born in the purple room at the palace in Constantinople or raised to the purple like Justinian. The title *Porphyrogenitus* was added to the name of those who were born in the purple, i.e., purple swaddling clothes and the purple room with purple draperies. At the Constantinople Museum of Antiquities, in its garden are two vast purple sarcophagi made of imperial porphyry in which the Byzantine emperors lie buried. When the great Turkish leader Osman married Theodore, daughter of the Byzantine emperor Cantacuzene, her father describes the “dishonor of the Purple” in the Imperial Camp. Constantine V *Copronymus* was born to the purple but forfeited


the title *Porphyrogenitus* at the font during baptism.

The Arabs and their Turkish leaders attached little value to the imperial dye, and the “dye trust” disintegrated as world commerce fell off. Still the tradition was not totally lost, since, as mentioned before we had seen children of Sidon in their play crudely dyeing scraps of cloth with the juice of the murex. Early Islam cared little for Roman or Christian ostentation. Purple, and supposed polytheism of the Cross were viewed with apprehension if not disgust. The ancient dye industry began falling off long before the fall of Constantinople.

In the time of venerable Bede (A.D. 637-735) in Britain, purple dye from *Purpura* was known and used to a limited extent. “Cookles of which a scarlet dye is made, a most beautiful colour which never fades with the heat of the sun or the washing rain, but the older it is the more beautiful it becomes,” 53, 54. The Crusaders are said to have brought some of the art to England.

An import merchandise list in tenth century Britain as given by the homilist Aelfric in his *Colloquy*, runs: “Purple robes and silk, gold, precious stones, spices, wine, glass, etc., etc.” In the late seventh century Wilfrid of Ripon had the four gospels in letters of purest gold on purpled parchment and illuminated. His altar at Ripon was vested in purple woven with gold. Purple in the Middle Ages was used for sacred and royal purposes throughout Christendom, as it had been used in antiquity and classical times.

Purple was produced at a few British sea villages until the seventeenth century.

When Byzantium fell to the Turks in A.D. 1453, the commerce in purple was no more, and Pope Paul II permitted his cardinals to substitute cochineal scarlet for their robes and hats. Cardinals still wear purple in Lent, Advent, and in Conclave. After 1464, the Sacred College was put in cochineal scarlet. Shortly afterward John Evelyn, an Englishman in Rome, reported in his Diary that Jews were forced to wear red hats but the color was changed to yellow when a near-sighted member of the Sacred College saluted one of them thinking he was a fellow cardinal. Present-day Romans tell us that purple birettas were instituted for bishops in 1869 who had previously worn black as do ordinary priests. At the recent death of Pope Pius XII, the cardinals did not wear their red robes, but wore the purple which may partially differentiate for us the ancient purple from red. The ancient Phoenician colors thus have a long history in the Mediterranean areas. Today from fundamentalist pulpits we may often hear Revelation thunder about "purple and scarlet."

Lebanese-Syrian students of theology on Patmos can still view the famous Codex Porphyrius of the gospels now under glass protection. It still beams the good message on its purple pages with gold and silver letters. Centuries ago these pages of purple parchment were a vivid reddish purple from murex dye, but today the color has faded to blue-gray and the silver uncialis no longer glow with mundane luster. Over 200 pages were carried off to Europe and Russia and 33 remain to the once great library of Patmos.

An old Lebanese scholar of Sidon who remembered traditions, was reported to have made the famous verbal arabesque about color and man: "Murex and Man!" "Yes, man the colorful: purple in anger, red in shame, green in nausea, and blue from the wind of Mt. Hermon's icy peaks. . . . Murex did all this for his garb without the wear and tear in Bokrat's (Hippocrates') realm of medicine."  

And so we close these notes and fragments with the thought that a bad-mannered sea-snail with the help of the "Sidonians" could influence history all out of proportion to its lowly existence. The Phoenicians said "gold is where you find it." They were among the first great princes of Serendip, that is to say, commercial technologists who trespassed successfully into the principality of Serendipity and guarded their secrets well.


37 Overheard in Beirut, Lebanon.