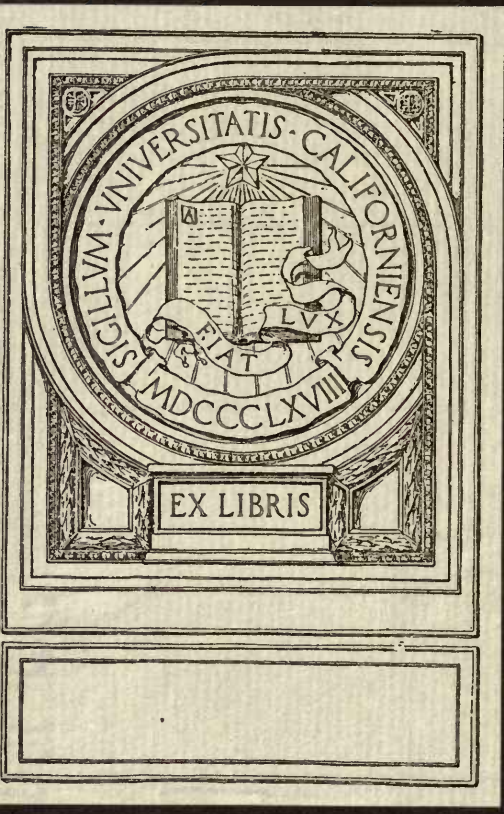
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On the Making of Silk Purses from Sows' Ears

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A Contribution to Philosophy

Arthur D. Little, Inc.
Chemists . Engineers . Managers
Cambridge, Massachusetts
1921

THE SILK PURSE WHICH CHEMISTRY MADE FROM SOWS' EARS
IN THE LABORATORY OF ARTHUR D. LITTLE, INC.

On the Making of Silk Purses from Sows' Ears

"You Can't Make a Silk Purse of a Sow's Ear"

EVER since somebody said it first — and that was centuries ago — it has been repeated with gusto. It has been quoted principally for purposes of discouragement. Whosoever has striven for betterment, to make something desired out of that which is held in low esteem, has had to feel the cutting edge of this hoary old saw. It has been bothering us for all the years that we have had a chemical conscience. We have felt that it is not true, in spite of tradition and public opinion and the so-called wisdom of the ages. We resolved some day to prove that it was false, and we have done so. We have made a silk purse of a sow's ear.

The first question to answer was: What does the silkworm do — how does it make silk?

It eats mulberry leaves and produces threads by a chemical process — by a very intricate chemical process.

If we watch it carefully we shall have abundant occasion to marvel; but science teaches us that to marvel is but the preliminary phase of observation. We cannot attain results by marveling alone; so closer study reveals the fact, long known to entomologists, that the silkworm has in its head two very fine ducts, or openings, that have a common external orifice.

When the time comes for it to make the Great Change, to transform itself from a gluttonous worm into a winged moth, to cease its gross existence as a creeping thing and to enter into an aerial life, to sip honey and to make love, it requires an envelope for hiding, for a dark and secret place, according to the command of Nature.

From certain glands at the back of its head it ejects two minute threads of a viscous liquid which become coated with another secretion flowing from two other convenient glands, and these two little streams are thus cemented to a double strand.

On reaching the air the thread coagulates and becomes a firm, continuous filament of silk. With this thread the caterpillar makes its cocoon, seals it up, and straightway goes into its mystic lepidopteran sleep. When the day of awakening is at hand the young moth softens the end of its cocoon by wetting it with an alkaline solution from its head, and so forces its way out. Then, ho, for moonlit gardens and a short life full of adventure, of cosmic urge, and of strange experiences!

The Chinese say it was a lovely and gifted queen who was the mother of the silk industry, and industry — whether out of the mind of the lovely queen or that of one of her followers, we do not pretend to know — has discovered that the moth destroys the continuity of the fibre by forcing its way out. Therefore industry foreordains the moths to death before they are born, if they are to contribute silk, by steaming them or freezing them or submitting them to dry heat.

The cocoon consists of a loosely woven outer layer called the "floss," which envelops the inner part called the "pod," which in turn encloses the sleeping, changing worm and finally the unborn moth. About one sixth of the cocoon is available for fibre, of which about one half can be unwound and reeled, while the remainder, from the floss and inner pod, is combed or carded and spun.

Our particular interest was in the silkworm as a chemist. It emits a viscous liquid which, on reaching the air, turns into a silk thread. This viscous liquid is very like glue — it hardens in the air like it and is becousined to it, chemically. This chemical cousinship is an important point.

Again, the sow's ear being chiefly gristle and skin, we have in it a natural raw material for glue. The first step, then, was to treat some glue so that it would behave as much as possible like the viscous liquid which the silkworm exudes as the last deed of its vermiforous life. This was done, and after some experiments we adopted the method which we shall soon describe.

Next we wrote to Messrs. Wilson & Company, of Chicago, who, it is needless to say, had a sow. Indeed they had many of them — so many that they cut off and placed at our disposal no less than one hundred pounds of ears, with an affidavit that they were, as represented, the ears of departed sows.

Being thus abundantly provided with the raw material for our silk purse, we prevailed

upon Messrs. Wilson & Company to undertake the extraction of glue from these identical ears. This was done in their Research Laboratory under the personal and scientific

WILSON & CO.

LABORATORIES
L. M. TOLMAN
CHIEF CHEMIST

PACKERS AND PROVISIONERS
CHICAGO, U.S.A.

March 18th, 1921.

STATE of ILLINOIS)
COUNTY of COOK) SS

Frank R. Johnson being duly sworn deposes and says that he is employed by WILSON & COMPANY, Inc., Chicago, Illinois as Research Chemist and that he supervised the manufacture and packing of ten pounds of gelatine shipped to Arthur D. Little, Inc., Cambridge, Mass., on the 16th day of March, by parcel post (Insurance No. C 441434) and that said gelatine was manufactured wholly from sows' ears.

And further deponeth and sayeth not.

Signed Frank R. Johnson

Subscribed and sworn to
before me this 17th day
of March, 1921
Cynthia B. Kelly
Notary Public

control of their chemist, Mr. Frank R. Johnson, to whom we here take pleasure in making our acknowledgments. The glue, with Mr. Johnson's identifying affidavit, was forwarded to us under seal, and we thereupon proceeded with our work of transformation.

Undoubtedly sows' ears lose somewhat of their individuality when handled in one-hundred pound lots,—more so, for in-

stance, than persons, — but we like to think that the particular portion of glue which constitutes the silk from which we made the purse was derived from the ear of a particu-

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CHIEF CHEMIST

PACKERS AND PROVISIONERS
CHICAGO, U.S.A.

March 18th, 1921.

STATE of ILLINOIS) SS
COUNTY of COOK)

James M Beaty being duly sworn deposes and says that he is employed By WILSON & COMPANY Inc., at Chicago, Illinois as Foreman and that he supervised the accumulation of one hundred pounds (100 lbs.) of ears taken entirely from sows.

And further deponeth and sayeth not.

Signed James M Beaty

Subscribed and sworn to
before me this 17th day
of March - 1 9 2 1.
Cynthia R Kelly
Notary Public

larly estimable sow called "Sukie" back on the farm. To call her "Sukie" has been our only flight of fancy in this entire transaction. The rest was straight laboratory work. Sukie's picture is on the frontispiece. And now, although Sukie has passed away after the approved manner of porcine flesh, and has been resolved into hams and bacon and sausage and lard and soap, and what is generally known as provisions and chemicals, Sukie's ear — Sukie's right ear, let us hope — abides with us, translated and glorified into a beautiful blue purse, a challenge to tradition and a contradiction of the wisdom of the ages.

While we cannot trace Sukie's history back of her arrival in Chicago, we know how she lost her life and her ears, and of the development of her ears into glue. Now let us tell what we did with the glue from the sows' ears until it became a silk purse.

First, it was dispersed in water, then a small amount of acetone was added to bring it almost to a jelly, and a little chrome alum helped to expedite its subsequent setting.

The next step was to filter it very carefully under pressure, after which it was placed in the spinning apparatus. This was an enclosed copper container with one (long) pipe reaching nearly to the bottom and a second pipe just reaching through the cover. The container was immersed in warm water and the short pipe connected with a pressure cylinder containing carbon dioxide, — i.e., carbonic acid gas. The outside end of the long pipe was bent over like an inverted U and connected with the spinneret, which was of metal, about the size and shape of a large thimble, and perforated at the end with sixteen very fine holes about 1/1000 of an inch in diameter. The end of the spinneret dipped under the surface of a coagulating and hardening mixture of acetone and formaldehyde contained in a large V-shaped glass tube two inches in diameter with arms about three feet long. The arm of the tube below the spinneret was vertical, the other arm extending at a slant.

Then the valve in the carbon dioxide pressure tank was turned on. That forced

the solution in the copper container up through the long tube, down through the spinneret, and into the formaldehyde and acetone mixture in the V tube. It came out as sixteen very fine, colorless streams, so fine as to be hardly visible, but these filaments on the way down through the V tube joined into one composite fibre which was hardened by the formaldehyde. When it reached the bottom it was fished up with a wire hook, drawn out of the slanting arm, and from this pulled over a rotating drum into a pan containing more of the formaldehyde and acetone mixture. At this point the fibre was very swollen, and had hardly any strength at all. It had to be removed quickly and wound on a reel to dry, else it would have become too brittle for any use.

After the first drying it was brittle and without lustre — indeed, it was a very unpromising thread. But by soaking for a short period in a bath of forty per cent glycerine, in which it was also dyed, and after drying again, the bright lustre appeared, and it developed the desired soft, silky feel. It was then ready for weaving, which we did on a small hand loom, and the fabric was finally sewed up into the form and substance of a silk purse. The tassels are a continuation of the warp threads, each thread being a composite of the sixteen original filaments.

The purse is of the sort which ladies of great estate carried in medieval days — their gold coin in one end and their silver coin in the other. It is one of which both Her Serene and Royal Highness the Queen

of the Burgundians in her palace, and the lowly Sukie in her sty, might well have been proud. When it is not on show at the Exposition, its place will be in our chemical museum in Cambridge.

We admit frankly that it is not very strong or very good silk, and that there is no present industrial value in making it from glue. The artificial silk that is made in great quantity is made from cellulose, either cotton or wood fibre. There is more cotton and wood fibre available than there are hoofs and horns and ears of animals, and consequently of glue, and the threads are stronger.

We have no intention of producing sow's ear silk for the market. We made this silk purse from a sow's ear because we wanted to, because it might serve as an example to clients who come to us with their ambitions or their troubles, and also as a contribution to philosophy.

The most discouraging thing to hear, if you are interested in real progress and in the forward march of events, or more particularly if you have set your heart on doing something that you believe should be done, is some old saw that is repeated merely because the words that tell it have been learned, parrot-wise.

For thirty-five years we have been fighting such expressions as "What's the use?" "It isn't done," "It isn't practical," "We've got no time for theories," and all the other wretched substitutes for hard, earnest, straight thinking.

Things that everybody thinks he knows only because he has learned the words that say it, are poisons to progress. The only way to get ahead is to dig in, to study, to find out, to reason out theories, to test them — and then to hold fast to that which is good.

* * * * *

This making of silk purses of sows' ears was merely a diversion of chemistry at play. When chemistry puts on overalls and gets down to business, things begin to happen that are of importance to industry and to commerce. New values appear. New and better paths are opened to reach the goals desired.

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