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Survival & Prepping

Flint Knapping: an introduction
Tesla Motors partnered with SolarCity to bring a solar powered home battery system to homes across the USA. Utilizing Tesla’s proven battery technology, they have created a residential energy storage system which provides backup power in the event of an emergency.

Powered by the sun, the solar panel system provides power to your home and the lithium-ion battery pack stores the power for later use. It provides enough power to keep your refrigerator running, it allows you to keep the lights on, and charge your cell phone in case you need to make an emergency call while also keeping any necessary security systems powered and fully operational. Over 300 home battery systems have been installed so far.

Here’s an excerpt from SolarCity’s website detailing the residential home battery energy storage system:

**Our Storage Product will be available again in late Summer 2015.**

So far through the program, we’ve installed 300 systems, and plan to finish out 130 more in early 2015. We’ve been getting great feedback from the many excited Bay Area customers who seamlessly switched to their SolarCity backup system during the power outages caused by recent storms. The Storage team is working hard on the next phase of Battery Energy Storage at SolarCity. Check back again in mid-2015 for a new and improved offering!
Be prepared for anything

Your battery system will provide your home with power if the utility grid goes down—such as after an earthquake or other natural disasters. A fully charged battery provides enough energy for your essential needs during an emergency. - SolarCity

First comes the large scale commercialization of solar power, and now we have a battery system which provides power in emergencies and as an alternative to running direct from your solar or wind power system. System specs are not currently available but we'll have them soon. A larger battery system will of course provide you with more power for a longer period of time, so we hope to see some specifications on the battery pack.

This new battery system captures the power of the Sun and allowing you to essentially use it as you need it.

All in all, this is the kind of cutting edge technology we need to advance renewable energy and sustainable living.
You might think it a bit odd to devote an entire article to candles in a series that has, so far, covered whole classes of energy sources in a single article. But I have a bit of a soft spot for candles, and I want to have plenty of space to present their history and science in a way that ties together the first two articles on solid biomass fuels and liquid biofuels with the fourth article on gaseous fuels. Because, really, burning and combustion involve a mixture of states and the candle transitions all four states of matter in order. It really is that cool, as you’re about to see, but first, let’s see how long we’ve been making and burning candles, and what they’ve been made of in the past.
Humans have been making candles for about three millennia, with the first candles being wicks stuck into containers of flammable materials like animal fat. In Rome, as early as 500 BCE, the first candles that you might recognize as such were being made by dipping wicks into tallow which is made from rendered beef or mutton fat. It probably didn't take much inspiration to discover the method. After all, the use of wicks with oil from animal fat or plant seeds for lighting had already been around for a few millennia, and if your lamp with a wick and animal fat got cold you had a solid mass with a wick poking out. Light the wick, the fat melts, the lamp still burns. BINGO: you've got a candle.

In the East, China, during the Qin Dynasty (about 221 BCE), made candles from whale fat with rolled rice paper for the wick. India produced wax from boiled cinnamon for use in candle making and Japan squeezed tree nuts to get the wax for their candles. Indigenous peoples of the American Pacific Northwest and Alaska had the “candlefish” (the Eulachon - Thaleichthys pacificus), of which they harvested the oil for lamps and just stuck the whole fish on a fork and lit it on fire.

The collapse of the Roman Empire caused trading disruptions that shook up the supply of olive oil, which was more popular than candles for burning in many areas, creating an upsurge in the use of candles. By the middle ages, candle making had become a guild craft under the title of “chandlery”. Later, English speakers would get lazy and start calling it candle making, and all but for that fancy word “chandelier”, nobody missed the unnecessary “h”.

Tallow was the primary material for making candles up until about 1850 since it was made from kitchen leftovers and also had other uses such as in the making of soap. Tallow, though, is stinky stuff to burn and just as much to store and process, leading many cities to outright ban the process. Beeswax didn't smell quite so bad but was reserved for fancy times like church ceremonies and was more expensive than tallow. Around the late 18th and early 19th century, spermaceti wax,
made from the oil from a sperm whale, was introduced. It burned without a foul smell, burned brighter, and had a higher melting point than both tallow and beeswax, preventing it from softening during the hot summer months. Spermaceti had also become very plentiful thanks to the glorious age of slaying warm blooded sea critters into extinction. Herman Melville wrote a book all about it.

Then came the 19th century and all its wonderful industrial revolution. Chemistry was a big thing and new compounds were being created or refined using the power of science! A couple of French chemists named Michel Eugène Chevreul and Joseph-Louis Gay-Lussac created stearin. While still derived from animal fat, stearin didn’t contain glycerine, which was the source of the stinky smell given off by tallow, and which also had a higher melting temperature and so could be used as a hardening agent. This leads us to paraffin wax, a petroleum byproduct. With the addition of stearin, paraffin wax soon became the leading material used for making candles into the 20th century. It wasn’t until people got into those nauseating smelly candles in the jars during the 1990’s that other waxes were developed. Paraffin wax has many other uses, such as protecting cheese, coating candy, augmenting chewing gum, insulating electricity, and as an addition to drywall for thermal energy storage. The 19th century also introduced the braided wick, which caused the wick to curl in on itself when burning so that you wouldn’t need to trim it as it burned, leading to the term “self-trimming wick”.
Kerosene lamps and the electric light bulb virtually did in the candle as a primary light source, and today candles are mainly used for decoration, mood lighting for sexy-time, and as a bathroom courtesy for the morning after chili night. However, in a pinch, candles are a great source of light and heat. They store well, don’t spontaneously combust, are water-proof, and burn for hours at a time. Keeping a bundle of candles handy for an emergency is always a good idea. So let’s look at how candles work and how you can integrate them into your off grid lifestyle.

**The Chemical History of a Candle**

In 1848, [Michael Faraday](https://en.wikipedia.org/wiki/Michael_Faraday) gave a series of lectures titled *The Chemical History of a Candle* (later published in 1861 as a book by the same name). With these lectures, Michael Faraday launched a tradition in London at the Royal Institution called the *Royal Institution Christmas Lectures* that have gone on every year (except for 1939 to 1942 because, you know, Hitler) to this day. This was an early popularization of science, and if you read the lectures in print ([public domain](https://archive.org/details/chemicalhistoryofacandle)) you can almost feel Faraday’s excitement and energy in taking something as simple and easily overlooked as a candle and turning it into a portal to the wonderful chemical reactions that make life work. It is from these lectures where I draw most of the following information, and that we knew even this much in the middle of the nineteenth century, before the Origin of Species had even been discovered, is astonishing.

Chemists Michel Eugène Chevreul and Joseph-Louis Gay-Lussac created stearin, which was used in paraffin wax, the leading candle making material in the 20th century.
Candles are devices. They are self-contained lamps that, by accepting heat as an input, transform solid hydrocarbons into a liquid, evaporate them into a gas, break apart their molecules into individual elements, and combust those elements into other molecules in a ball of plasma. That's not just one, not two, but a whopping three state changes between four states of matter all while performing numerous chemical reactions that give off heat. Can your iPhone do that?

The solid part of a candle, wax generally, or tallow, is melted when you light the wick. The liquid wax then travels up the wick using a nifty trick called capillary action and more specifically “wicking”. The heat then evaporates the liquid into a gas and ultimately breaks down the long chain of hydrocarbons into their constituent elements of hydrogen and carbon. Once freed from their bonds, the hydrogen and carbon combine to form water, carbon dioxide, and carbon monoxide. This reaction causes more heat, and the whole thing appears to us as a measly little flame atop a wax stick.

Hold the phone! Burning candles makes water? Yeah, the common hydrocarbon molecule in paraffin wax (Hentriacontane) contains 64 atoms of hydrogen and 31 atoms of Carbon, and that's where part of the combustion comes from. Each molecule burned releases 32 molecules of water and 31 molecules of either carbon dioxide or carbon monoxide. (Candles produce very little carbon monoxide. Carbon monoxide is the result of poor combustion, and can occur in low-oxygen environments. Proper ventilation not only reduces the production of carbon monoxide, but also reduces exposure to carbon monoxide.) To put that into every-day weights, burning a pound of wax will take 3.44 lbs of oxygen out of the air, and put out 1.32 lbs of water and 2.25 lbs of carbon dioxide (we’ll just ignore CO for now to make things easy). Now, your average candlestick is about 4oz and burns for several hours, which would only put out about a third of a pound of water or about 5 fluid ounces. It would take about 25 candlesticks to put a gallon of water into the air over the hours it takes to burn them.

But what if you could trap the moisture somehow and...
put the exhaust of your candle to good use? Faraday
did this in order to measure the water produced by
a candle to help intuit the chemical compounds in-
volved, and that was over 165 years ago! Could you
light candles in a greenhouse to increase the humidity,
allow the cool nights to collect the moisture as dew for
your thirsty plants and let the carbon dioxide warm
your greenhouse and provide the carbon that plants
need for proper growth? Since plants then respire oxy-
gen back into the air, you could keep your greenhouse
sealed for most of the night while providing a warm
glow to your growing room. You could also create a
system of vents that collect the exhaust from your in-
door candles and funnel it into your greenhouse. This
might seem a little Rube-Goldberg-y but innovation is
rarely sleek at first. You would be, in effect, re-creating
the carbon/oxygen dependence cycle that animals and
plants have shared for hundreds of millions of years.

What Else Can You Do With a Candle?

Other than simply lighting up a room, or possibly
powering a greenhouse, candles are sources of heat,
though not very efficient ones on their own. Hot air
rises and the area above a candle's thin flame is not
very large for decent convection, but there are sim-
ple ways of trapping the heat produced by candlelight
and radiating it throughout a larger area. Terra cotta
pots are cheap: you can get them at the dollar store,
and sometimes you can find them for even cheaper in
bulk. You also probably have some nuts and
bolts laying around. Stack several pots to-
gether, smaller pots inside larger pots and
loosely connect them with a metal bolt us-
ing nuts and washers as spacers to allow for
air pockets, and then rest this assembly on a
pair of bricks or some other suitable stand.
Put a candle underneath and light it. The
heat from the flame will warm the metal
components and that heat will be absorbed
by the clay pots. Clay has excellent thermal
energy storage properties and will retain
the heat of the candle longer, and radiate
that heat into the air. The hot focal heat of
the candle will be spread across the larger
surface area of the pots, allowing contact
with more air. This simple little trick won’t
replace your 30,000BTU heating unit, since
candles only put out about 250BTU, but it
will warm a small enclosed area enough for
comfort. Duplicate the device, and expand
your heating profile. These DIY space heat-
ers are cheap and low-tech, and can be used
with cheap tea lights. There are many dif-
ferent designs for these on the internet, and
even a commercial version.

Though the true effectiveness of these heat-
ers is controversial, you need to take into
consideration that you are not going to be
sweating to the oldies in your 500 square
foot living room with vaulted ceilings in
the dead of winter warmed only by four tea
lights and an old flower pot. “Warm” is a
subjective measure of how comfortable you
Four tea-lights placed inside a metal tray heat a flowerpot that has been placed over the candles. A larger flowerpot is then placed over the top. The air between the two flowerpots is heated and escapes through the holes at the top and bottom.

Inner workings of a flower pot heater
are at a given temperature. As a size XXX-large hairy male, 65 degrees Fahrenheit is a comfortable day for flip-flops and board shorts. If you’re in an area with sub-zero temperatures, sitting around the living room in a sweater and long pants and the thermostat at 50 degrees might be considered “comfortably warm”. A 30,000BTU heater could turn your living room into Satan’s waiting room but that’s just overkill. There’s also the safety issue with burning things indoors. Ventilation is key to reducing the dangers of toxic inhalation and, as with any flame, there’s always the issue of things catching fire. While these devices won’t “heat your home for only 4 cents a day” as many like to claim, they can serve as a small piece of a much larger energy efficient strategy for living off-grid, and that strategy may include a snuggy and a warm cup of tea when your room isn’t quite as toasty as you would like.

So that’s all I have room to say about the candle. It’s a wonderful little gadget with a lot of potential for your off-grid project. It’s a part of the overall carbon and water cycle that makes up the wonderful dance of entropy in which we have found ourselves ensnared. The same general principle of combustion, the same chemical processes that convert a candle into water and carbon dioxide, are those that convert the sugar in your body into heat and energy. You intake oxygen, and exhale carbon dioxide, plants intake carbon dioxide, and respire oxygen into the air. You are much like a candle in your chemical activities though with much messier effluence, and in that regard, much like the burning of all other hydrocarbon based energy sources. I’ll let Faraday finish us off with his inspirational final words to the six lectures on the Chemical History of a Candle:

Thus you see the analogy between respiration and combustion is rendered still more beautiful and striking. Indeed, all I can say to you at the end of these lectures (for we must come to an end at one time or other) is to express a wish that you may, in your generation, be fit to compare to a candle; that your may like it, shine as lights to those about you; that, in all your actions, you may justify the beauty of the taper by making your deeds honorable and effectual in the discharge of your duty to your fellow-men.

* * * * * * *

Above - a rolled beeswax candle
Below - 6th/7th century A.D. beeswax candles from a German graveyard
Photo Journal

Solar arrays & solar powered homes
SeedStarting101
the basics of starting garden plants
by Shannon Oyler, sustainablesimplicity.com
Has the long winter season left you craving sunshine, warm temperatures, and the lush green of trees and gardens? It definitely has for me, but the good news is that the cold is just about at an end for another year. I don’t know about you, but I’m totally ready for a respite from dark days, wind and snow, driving on icy roads, shoveling walkways, and having to bundle in layers upon layers to keep warm. Blah.

I know that spring is (finally) right around the corner when the yellow and purple crocus and hyacinth blooms stand defiantly out of the cold bare earth in my flower beds and the leaves of my tulips and daffodils peek out of the dirt as if testing the air to see if it’s okay to make a full appearance. Green buds are appearing on the trees and birds are singing - more signs of sunny days ahead!

If you’re a gardener, this time of year probably has you itching to get your hands back in the dirt for another season of growing. I know by the end of winter I find myself looking for any excuse to get some use out of my green thumb, even if it means just giving my houseplants some extra TLC. While it’s a little too early to start digging in outdoors in most zones, now is Nights are still frosty here in South Dakota, but my hyacinths are toughing it out. Now is the perfect time to start garden seeds indoors.
the ideal time to get a jump on the growing season by starting some garden plants from seed indoors. Many types of flowers, herbs, and vegetables do very well when given a head start inside while it’s still too cold to plant directly outside. This is a great excuse to get your garden gloves out early, but there are many other advantages to starting seeds indoors:

- Starting plants from seeds saves lots of money! The expense of buying plants from garden centers can add up fast, especially if you have a large garden. Growing your own plants from seeds is much cheaper, and with those seeds and a few inexpensive supplies you can have your own assortment of plants ready to be transplanted outdoors in just a few weeks.

- Plants started indoors weeks before the kick-off of the outdoor growing season have a head start advantage over seeds sowed directly in the soil and should produce earlier and longer. This is especially beneficial in colder climates where the growing season is short. There’s nothing more frustrating than having a plant ready to produce ripe fruits and vegetables just as the first fall frost hits. I have learned this the hard way more than a few times.

- When it comes to picking which plants you want in your garden, you have a much larger variety to choose from when you plant from seeds than you would if you bought plants from a store or greenhouse. While those places might have a nice selection of started plants, they simply can’t provide all the varieties you can find when choosing seeds.

**Supplies**

You don't need fancy or expensive equipment to get your seeds started indoors. All you need are containers, planting medium, and, of course, seeds.

- Pots or other containers - you can buy seed starting trays or pots at the store or use containers you have sitting around your house. Seedlings aren't picky about what they’re grown in, as long as they have adequate light
and moisture. See the list at the end of the article for some unconventional but creative seed starting containers. I have a big box of plastic containers that I have accumulated over the years from buying garden plants and small houseplants at the store, so I reuse these over and over each year to start my seeds. You can also buy peat pots that can be planted right in the ground along with your plants. These are biodegradable and inexpensive, so they are a good option if you want to reduce the plastic clutter around your property and in the landfill.

- Growing medium - this can be anything from bagged potting soil or seed starting mixture from the store to your own mix of soil and compost. An easy way to start seeds without having to deal with soil or filling your containers with growth medium to buy the expandable peat pellets made just for starting seeds. You just soak the pellets in water and they expand in a few minutes, leaving you with ready-made little seed starting pots encased in biodegradable netting that can be planted right in the ground once the seedlings are ready. Many seasoned gardeners choose to make their own potting mix and have learned what combinations of materials work best for their seedlings.

You don’t have to buy expensive supplies to start your own seeds. I reuse these same plastic containers every year.
Choosing seeds

And now the fun part - seeds! Isn’t it amazing what can be produced from one little seed? Have you ever really thought about that? One tiny seed, when given water, light, and nutrients, can grow into a beautiful plant that will produce an abundance of food all summer long in the right conditions. It really doesn’t take many seeds to feed a whole family for a good part of the year. Pretty awesome, right?

What seeds you choose to plant will depend on your personal preferences and what you want from your garden. One of the coolest things about growing your own food is that you can customize your crop pretty much however you like it. Do you love salsa? Grow a few tomato plants, peppers, onions, and cilantro, (and whatever else you might like in your salsa) and by the end of the summer you’ll have enough veggies for several big batches of salsa - enough to eat fresh with plenty leftover to preserve for later. If you love cooking with fresh herbs, grow an herb garden with your favorite choices. You can fit a lot of herbs into a small space, and many are perennial so you only have to plant once and they’ll come back year after year. Personally, I like variety and I like to grow enough food to preserve for winter, so I fill my back yard with all kinds of plants, almost always started from seed. Flowers and other decorative plants can be started from seed, too, so you can spice up your landscaping or grow a bee or butterfly garden with little expense.

When selecting your seeds, be careful to choose varieties that are appropriate for the zone you live in. Some plants are very hardy and tolerant to colder climates, while others are not as adaptable, so pay attention to those zones to give your plants the best possible chance to succeed. Most seed packets come with a zone map right on the package.

So where do you get seeds? Fortunately, there are lots of options, no matter where you live! You can likely find suppliers in your area, which is a good way to ensure you are getting plants that will thrive in your zone. Most big box stores sell seeds in the spring, as do garden centers and greenhouses. Seeds catalogs are another great resource, and they’re fun to look through (and maybe a little addicting). Catalogs have a huge variety of plant seeds, some of which you have probably never seen. You can find many of these large...
seed suppliers online and browse through their inventory on their websites or request a print catalog. Seed exchanges are another fun way to get new varieties of seeds. You can find exchanges online and often in your local community, where seeds usually won’t cost you a dime, just a trade of some of your seeds. Even Etsy and Ebay have sellers with unique assortments of seeds for sale. Many seed sellers, even those in big stores, are offering many varieties of heirloom and organic seeds - a big plus!

**Planting**

The best way to ensure you are giving your plants the start they need is to read the package or directions that came with your seeds and follow those care recommendations. Some seeds do better when planted directly outdoors once the soil warms, while others flourish when started indoors from 6 to 10 weeks before the growing season starts. Most seeds do not need any preparation before planting, but some should be soaked in water or refrigerated for a time. Different seeds have different light and water requirements for germination, so pay attention to those factors as well when preparing to plant.

Timing is important when starting your seeds indoors. Some of your plants might need to be started 8-10 weeks before the last frost, while others might need only 4-6 weeks. Every plant is different, so here again read the seed packet or directions to ensure they are getting the optimal amount of indoor growing time. Of course, the timing thing means you may not be planting all your seeds at the same time. If you plant them too early and don’t have a bright window or grow lights to give the seeds adequate lighting, they will get too tall and spindly trying to reach light and will be too weak to transplant outdoors. I have also learned this the hard way in the past when I’ve gotten too anxious about getting my seeds going without sufficient

Hardiness zone maps like [this one from the USDA](https://www.usda.gov) can be used to determine your growing zone. Most seed packets will say when to plant outdoors depending on your zone.
lighting in my house. These days I have an insulated shed with large south-facing windows that I use for starting my seeds and they do very well in there.

Once you fill your pots with your chosen growth medium or have your soaked peat pellets ready, you can begin planting your seeds. How many you put in each container will depend on how big your containers are. Some people like to plant several seeds in each cell or container in case some don’t germinate, then thin them out later, while others prefer to skip the thinning and just start with one seed per cell. I usually plant 3 seeds per cell, and they almost always germinate so I have to thin them out once they get a little bigger. The seed packet should give the approximate planting depth for each type of seed, but a good rule of thumb is that the size of the seed is usually indicative of how deep it needs to be planted. Larger seeds typically need to be planted deeper than smaller seeds, which can go as little as 1/8” deep or even sit on the surface of the soil. Be sure to label your containers as you plant so you remember what you have as you go. You can label plastic containers with a sharpie or use plant labels - either the plastic ones you buy in the store or something more creative. I like to use popsicle sticks that I buy in bulk from the craft store.

Caring for seedlings

Seeds need light and water to germinate and to continue growing. Some of your seedlings may sprout in as little as a day or two and others could take as long as ten to fourteen days. As I mentioned above, lighting can be provided with grow lights or a bright window for a period of time (or a nice, bright greenhouse, if you’re lucky enough to have one!). If using grow lights, keep them an inch or two above the plants and move them up as the plants grow. If your seeds are in a window, rotate your trays every day or so to ensure even growth. The soil or growth medium should be kept consistently moist - not allowed to completely dry out, but definitely not overly soggy. Also provide seeds with adequate air circulation. In my shed, I usually leave the door cracked on nice days to keep a slight breeze going through since the sun exposure from the windows can make it pretty toasty in there, even on cool days. In muggy rooms you can open a window or use a fan on the low setting to circulate air. Seeds actually grow stronger when exposed to a gentle flow of air and transition to the outdoors easier.
Hardening off

If you take new seedlings and plant them directly outdoors with no acclimation period, they will most likely die. Seeds cared for indoors in a controlled environment need to be toughened up a little before they can withstand outdoor conditions with temperature fluctuations and wind. Gradually exposing them to the outdoors will strengthen their stems and prepare them for an easy transition into the garden.

You can begin the hardening off process by placing your seedlings outside for short periods of time a week or two before you plan to transplant them into the garden. Gradually increase their time outside until outdoor conditions are right for them to be transplanted after the last frost and once the soil warms. Always provide some protection on a covered porch or other area safe from harsh winds and hot sun exposure until the seedlings are strong enough to withstand full exposure. Also be sure to keep the soil moist as being outside can dry them out faster than when they are inside. I set my seedlings on my partially-covered front porch for a couple hours a day to start and increase that time each day over a couple of weeks. They never seem to have trouble adjusting after transplantation into the garden.

While this all might sound somewhat complicated, it’s really not, so don’t let it deter you from trying your hand at growing your plants from seeds. It’s very rewarding watching them grow and a great way to start spring!

Upcycled seed starting containers

If you want to save money on planting containers or just like the idea of recycling, here are links to some interesting DIY seedling containers:

- Egg cartons
- Egg shells
- Newspaper
- Keurig K-cups
- Yogurt containers
- Toilet paper rolls
- Plastic bottles

Seed Resources

A few organic & heirloom seed suppliers:

- Seeds of Change
- Burpee
- Annie’s Heirloom Seeds
- Raresseeds
- High Mowing Seeds
Flint Knapping

an introduction to making stone points

by Michael Tomlinson

I have been fascinated with stone points since I was a small child. The first ones I ever held were 25 cent knockoffs from a bowl in a souvenir shop. They were awkward, and not knowing any better, I thought they were real. I saw better ones in museums and private collections. When I was in grade school I was taken camping and found my first real artifact. It was a three inch broken knife with the tip missing. Over the years my collection started to get larger and larger and I wanted to learn how to make them myself. I tried using broken glass and a nail. They were really awkward and no better than the tourist ones I saw as a child. I was told that aborigines would heat a stone in a fire and drip cold water onto it to pop off flakes. This was completely ridiculous, but I still had a lot of learning to do.

From a Ben Hunt How-To Scouts book my grandmother gave me I learned that stone points were made by using deer antler tines to chip the edges of stones into points and to add notches in the corners. I used a leather pad to protect my palm and learned to chip glass to triangles and add the notches. These were better than the tourist ones, but still nowhere near the ones that we found on the ground. When I got out of the Marines I found a large cobble of obsidian for sale at an outdoor flea market. I brought it home and did some more research. I got ahold of McPherson’s books and really started to improve my skills. My work was starting to look more like the artifacts I was finding. Then I got into the “bad habit” of using copper tools. I was using obsidian blanks that were cut using lapidary equipment and chipping them using copper pressure flakers I made by drilling a hole in the end of my antler tines and inserting copper points. I was producing decent points, but my work didn’t improve and I had sort of peaked in my skill. I had a doz-
en other hobbies and didn't ever really focus on learning the proper methods or making advanced points. The only raw material I ever seemed to get my hands on was obsidian, and like most knappers I learned the art backwards. I learned to pressure flake first and never really grasped how to spall large cobbles of stone into blanks and finish them out the old way.

In this article I hope I interest you enough in flint knapping to give it a try. It is absolutely impossible to teach the skill in a magazine article and with a few photos, but I will introduce you to the concepts, show you some easy to make tools, both traditional and modern, and teach some of the vocabulary and concepts of basic knapping.

Flint knapping is one of our oldest skills. It is perhaps THE skill that shaped our minds, and allowed us to make tools that furthered our understanding and mastering of our environments. It allowed us to rise to the top of the food chain. It allowed us to take and process game, shape wood tools, and enabled us to drill, scrape, and cut materials to shape them to suit our needs. Our first attempts were, like most discoveries, by accident. Sharp natural flake tools were found and utilized, then we discovered we could break stones on each other to produce sharp edges. Over the centuries these skills were refined and we learned how to predict how stones with certain properties would fracture. We learned that other stones didn't have these properties and would crush and shatter with no predictable results. Granite,
sandstone, shale, and grainy stones were worthless to a knapper, while glassy type stones that would produce a sharp edge when flakes were knocked off were prized.

Centuries ago we discovered that when two glassy stones were slammed together, a Hertzian cone was produced in the one impacted. We have all seen this phenomenon in windows when a small stone or BB hits the glass and it punches out a cone approximately 136 degrees. This was predictable and could be controlled. The angle at which the stone was struck following the angle of this cone would produce a predictable flake.

Our earliest tools were hand axes, then they were refined into thinner and thinner blades producing spear points, knives and later, MUCH later, dart points and finally arrow heads. In North America the skills were mastered early on, producing fine Clovis points and Folsom points which had channel flutes thinning the blades in final blows that allowed them to be slid into a groove on spear, and dart points that could easily penetrate even the thickest mastodon hides. Over the centuries the skills didn't improve, but seemed to be forgotten, or were at least simplified as darts points and arrowheads replaced the finer points of old. Near the end they were simple, small triangle points without attachment grooves. Metal trade points replaced the stone points altogether.

Knapping skills went extinct in North America, only surviving in stone age cultures such as Australian aborigines, who have been known to scale telegraph and power lines for the porcelain and glass insulators that they could chip into points. The techniques were forgotten among the Native Americans. Even recently I have heard Natives say that stone points were never made by their ancestors, but were found, and credited to Iktomi the trickster, whom they believed made and hid them. There is evidence that Natives found and recycled points, as I have seen a Folsom point with corner notches added so it could be used as an arrowhead.

One Native I encountered had beautiful points and blades he was chipping, and told another man that they used to heat the stone and drip cold water on it to shape them, further preserving the old myth. As a child, a friend of mine tried this by heating a stone in an old cast iron oven then dripping cold water on it. Much to her horror it exploded with no control whatsoever.

**Beginning flint knapping**

You can take the skill of flint knapping as far as you want, but it is not a skill easily mastered. It takes decades to become good, and can take even longer to master. I will help start you on your first project, the absolutely wrong, backwards way like everyone else learns these days. Then after you learn how to chip small, you can go big, instead of learning big and going small.

Since it's easier to learn flint knapping by seeing the process rather than reading about it, be sure to check out the many awesome videos on YouTube that will
walk you through each level from novice to advanced. Even better, get your hands on the tools and decent stone and learn the hard way: experience.

The best way to get a basic feel for the art and see if you are interested enough to pursue more advanced projects is to make a simple arrowhead from the bottom of a glass bottle. I still make these as they are really pretty and make nice jewelry points or throw away points you can tip field arrows with. It is also good material to warm up on after going several months without practice. Materials are easy to come by and you can practice as much as you want with little to no investment.

To make this type of point, you will need a glass bottle with as thick a bottom as you can find. Convex is preferable to concave. If you have antlers you don’t mind cutting up you can use the tips to chip with, or you can make some copper tools. To make copper tools, purchase some 1/8” and ¼” wire, cut it into two inch lengths, and grind and file the ends to rounded points and set them into a wooden handle.

Before starting, you’ll need a leather glove or a piece of leather thick enough to protect your support hand. You will also need a small grind stone - some people use angle grinder blades, sandstone, or even knife sharpening stones - just course enough to grind the sharp edge and set up a platform to chip off of. Be sure to have safety glasses and a comfortable place to sit that will allow flakes to fall onto a drop cloth and not end up on your lap or in your shoes. Also, have some Band-Aids on hand. You WILL bleed, not bad, but you will be dealing with broken glass and no matter how well you master the art, a stray flake will find you on occasion.

First a bit about safety. I do not wear and do not recommend gloves as they dull your senses and actually tend to trap and hold sharp micro flakes and are more dangerous than a flat piece of thick leather that you can shake off between flakes. Keep the flakes out of your eyes; I don’t have to explain how glass shards in your eyes are a bad way to spend your day. If you use proper techniques and decent leather pads your bloodshed will be minimal. One other caution that shouldn’t scare you off, but needs to be taken seriously, is the dust. With each impact on the glass a tiny puff of microscopic blades will be released into the air you breathe. Always practice outdoors and with a small fan or breeze. Indoors the micro dust will end up on floors, carpets, and in vacuum cleaners and will be a constant health hazard. Silicosis can produce scar tissue and cannot be coughed up, and this can be fatal.

Ok, getting down to business. I’ll try to coach you through making an arrowhead the best I can with words alone, but after reading this, if you are still interested, go to YouTube and watch some of the videos as they will help you to better understand general flaking techniques. To produce a functional arrow head you don’t need to know all that much. This can be a survival skill or a really cool, even profitable, hobby.

Start here: https://www.youtube.com/watch?v=wyzN1a-U5Nc
One technique for making a bottle arrow head is to take a 4” nail and drop it into the bottle head first, then shake the bottle until the bottom fractures out. Next, use the side of the copper flaker tool or antler tine to grind chips off of the sides to eliminate the square edge. Try to get a flat, round disk free from the sides of the bottle. When you have the sides removed and have beveled the edge down so that there are no square edges left, draw a triangle on the disk with a sharpie or pick one out in your mind. Rough out the triangle, making sure all square edges are gone. Use your grind stone to dull the edge to produce decent flaking platforms. Platforms are the place you put the tip of the antler, pressing down towards your padded support hand, producing a flake off the bottom of the glass disk. If the edge is too sharp you will simply crush the edge and no flake will pop off. When you grind it down and dull it, a white dust will highlight the platforms and show you where to place the tip. After the initial run a flake pattern will emerge on the bottom side with a groove and ridges alternating across the edge. You should flip the disk over, again dull the edge, making an initial pass over the opposite side. Flip again, grind and follow the ridges on the bottom side to build up enough pressure to cross half way across the glass if possible. You must support the glass in the leather pad with your support hand fingers. It is easy to apply too much pressure and snap the entire disk in half. Good thing bottles are easy to come by and cheap. If you snap your preform in half, you can often make a smaller arrowhead from the tip and base. This is a problem that goes all the way back and in my best guess, the origin of the first bad words. I often find preforms that were broken in half and discarded with no pressure flakes.

As you get the feel for how glass chips and are able to start to predict how they will come off, you will be able to produce a decent edge and triangles in the glass
where the flakes cross in the middle and no original surface is left. When you have the basic triangle shape as thin and sharp as you want it, you can add corner notches or side notches. Notches are made by taking a shallow flake in one spot, then flipping the blade over and taking another flake at the same point on the blade, getting deeper with each flip. It is easy to snap the blade in half at this point as the blade is thin. Use support from your padded hand and fingers, and be careful not to press too hard. Murphy’s Law will guarantee that the point will snap in half on your last notch just when you have the most time and effort invested in the point. This was the origin of the first advanced bad words.

Without detailed visual diagrams and hands-on practice it is impossible to describe the exact pressures, supports, grinding, and other techniques you will need to get the feel for this skill. You will need lots of practice and materials to practice on. Try looking at local rock shops. I have even purchased spalls from magazines and e-bay. I have been spotted ripping off stones from fast food restaurant landscapes, public parks, hotels and other places I stumbled across a rock that called out to me.

When you move on to actual rocks and natural materials, be sure not to contaminate archaeological sites with your waste materials. Always collect your flakes on a tarp and dispose of them properly.

Good luck, and good chipping! With a little practice you will start to develop your own techniques. No two knappers seem to be the same.
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