Making Mead: the Art and the Science

Making mead is a centuries-old practice that can be enjoyed by the home brewer. As with the preparation of most foods and beverages, the making of a good mead is a blend of science and art. This kit is designed to help you understand the basic principles of mead making and guide you through the process. It is intended as a primer for the beginner and as a resource for the more experienced home brewer.

The History of Mead Brewing

Mead is one of the world's oldest fermented beverages. Ancient myths and writings throughout the world contain references to alcoholic beverages that were drunk by both people and gods alike.

Mead was a part of the rituals of the Celts, Anglo-Saxons and Vikings. It was believed to have magical, healing powers even capable of increasing fertility. The word *honey-moon* is derived from the practice of the newlyweds drinking mead for one month (a moon) after the wedding. If the mead was "proper," a son would be born nine months later.

As civilizations and agricultural resources grew, beverages such as wine made from grapes or other fruits, and ale made from barely and wheat replaced mead in many areas of the world. In Northern Europe, where grapes were difficult to grow, mead remained popular until grape wine was imported from southern regions.

The roots of the variations of mead we have today can be found in the cultures and agriculture of old. The practice of adding bitter herbs (gruit) to mead began in the Middle Ages. Mixing grape and other fruit wines with mead can be traced to Roman times.

Eventually, agricultural crops such as grapes, grains and hops, became the preferred ingredients for alcoholic beverages such as wine, beer and ales.

Varieties of Mead

Mead is an alcoholic beverage made by fermenting a mixture of honey and water. Traditional mead is simply that — honey and water. Variations have existed through the ages and range from the traditional to complex mixes of fruit juices and spices. (See Table 1.)

Mead can be either still or sparkling. Sparkling mead results from a second fermentation that retains dissolved carbon dioxide in the bottled product.

Other alcoholic beverages made from honey include braggot and mead brandy. *Braggot,* made with malted grain and honey, is part beer. *Mead brandy* is mead that has been distilled. A honey liqueur is made by adding extra honey to mead brandy.

Table 1. Varieties of Mead

Traditional Mead	A fermented honey beverage made from approximately two and one-half pounds of honey diluted with one gallon of water only.
Hydromel	Weak, or watered mead
Sack Mead	Mead that is made sweeter by the addition of twenty to twenty-five percent more honey; a sauterne-like beverage.
Metheglin	Spiced mead; originally spiced with a combination of herbs (gruit) but later hops became more popular.
Sack Metheglin	Sweet spiced mead; traditionally similar to vermouth.
Melomel, or Mulsum	Mead made with fruit juice.
Cyser	A melomel made with apple juice or cider; similar to a sherry wine.
Pyment, or Clarre	A melomel made with grape juice; sometimes referred to as honey-sweetened grape wine.
Hyppocras	Spiced pyment.

Basics for Brewing Mead

Getting Started: Ingredients

HONEY

Honey is the first ingredient to consider when making mead. The flavor and color of the final product are dependent on the variety of honey used. In general, a light honey yields lighter colored and flavored mead and a dark honey, darker colored and more robust flavored mead.

The floral source of the honey determines its flavor profile and other sensory attributes. Honey bees gather nectar and convert it to honey. There is some variation in the amount of sugar, minerals and vitamins in the nectars that the bees gather. An enzyme (invertase) secreted by the bees converts the sucrose in the nectar to fructose and glucose and another enzyme (glucose oxidase) changes the glucose to gluconic acid and hydrogen peroxide. The water content in the nectar is also reduced in the process. The result is honey: a fermentable sugar with pH of approximately 3.9, on average, and an 17.1 percent water content.

Choosing which honey to use is a matter of taste and the type of mead desired. Stronger honeys go well with sweeter, heavy or spiced meads and milder honeys with delicate flavors work well for traditional or fruit meads.

The National Honey Board has additional information available on the floral sources of honey. A list of honey suppliers is available on the National Honey Board's Web site, www.nhb.org. A paper describing the sensory attributes of U.S. honey varieties is available both online and as a hard copy.

The United States Department of Agriculture Technical Bulletin number 1261 gives detailed information on the chemical composition, color and granulation of various honey varieties. These resources will be helpful in selecting a honey variety.

YEAST

Yeast is the next ingredient to consider and once again, there are several choices. Yeast is living organism that metabolizes sugars in honey to carbon dioxide and ethyl alcohol. Cultured wine yeast is commonly used to make mead. In general, those that are used for white wines, especially sauterne-yeast work well. The yeast used for wine and mead fermentation is *Saccharomyces cerviseae*.

Matching the appropriate yeast culture to the honey variety is key to developing the desired taste and mouthfeel of mead. Formulation guideline for various types of yeasts and honeys can be found in *Zymurgy: For the Homebrewer and Beer Lover*, May-June 2000 issue.

In addition to sugar, yeast needs nitrogen, phosphorus and potassium for growth. Ingredients such as urea, peptone and potassium phosphate are used to supply these nutrients. It is also possible to buy packaged nutrients specially designed for mead.

WATER

The third basic ingredient used to make mead is water. The quality and chemical composition of the water used to make mead is critical.

For example, water that has a high chlorine content may produce off-flavors. Most mead makers recommend bottled or spring water but not distilled water since it lacks sufficient minerals for the yeast.

OTHER INGREDIENTS
ACIDS: Small amounts of acids, such as malic, tartaric and citric acid, are added to balance the flavor. Their tartness offsets the sweetness of the honey while combining with the alcohol to give a degree of stability against spoilage.

Some experts recommend an acid blend composed of twenty-five percent citric, thirty percent malic and forty-five percent tartaric acids.

SULFITES: Sodium bisulfite or potassium metabisulfite in tablet or powder form are commonly used for sanitation in wine making.

STABALIZERS: When making still mead, potassium sorbate, or wine stabilizer, can be added at the bottling stage to prevent a second fermentation by killing remaining yeast cells.

FRUIT: To create the fruit-containing mead, ten to twenty percent fruit juice or purees are added to the honey-water mixture. Whole, pitted fruit can also be used. Twelve to fifteen pounds of fruit with twelve to fifteen pound of honey in five gallons are recommended.

SPICES AND HERBS: Almost any spice or herb can be added to mead either as an extract or directly at almost any time during the mead making process. Blends of two or more spices and herbs are commonly used. If added directly, they should not remain in the mix for longer than twenty-four hours because bitter components may be extracted.

A strong extract of mixed herbs (gruit), can be added at bottling time. Or, a strong extract of each spice can be prepared and added at any time after fermentation but before fining. To make an extract, boil the spices in a small amount of water for 15 minutes.

HOPS: Adding hops to mead will add a distinctive flavor, but more importantly, its resins, oils, tannins and pectin can help to clarify the mead and preserve its freshness.

Tannin is sometimes used by itself to add astringency and aid in brewing and clarification.

Getting Started: Equipment

Home brewers typically make five-gallon batches of mead. The equipment they need is similar to what is used to make wine and is readily available in home wine and brewing supply stores.

Basic equipment needed to produce five-gallon batch includes:

- 1 (four-gallon) enameled or stainless steel pot
- 2 (five-gallon) glass carboys*
- 1 fermentation lock with rubber cork to fit carboy
- 7 feet clear plastic siphoning hose, 5/16-inch diameter
- 3 feet plastic blow-out hose, 5/16-inch diameter
- Detergent and chlorine bleach
- Large funnel
- Corker or bottle capper
- Corks or bottle caps
- Bottles
- Wine hydrometer
- Thermometer
- Acid-testing kit

**Note: A carboy is a glass container with a narrow neck.*

Processing Guidelines

There are seven basic steps to making mead. (See Table 2.)

SANITIZING
The single most important step in making a good mead is sanitation. Contamination with wild yeast, molds or bacteria will result in mead that is cloudy and off-flavored. Wash all equipment and containers with detergent and water. Scrub well and rinse repeatedly. After rinsing, sanitize all equipment and bottles by immersing them in a bleach solution of one-ounce chlorine bleach to 5 gallons water. Soak for at least 10 minutes; rinse well with water.

Equipment can also be sanitized in a rinseless solution called iodophor sanitizer (available at brewing supply stores).

PREPARING THE MUST
Must is the unfermented mix of honey, water and other ingredients. There are several methods for preparing the must. Several factors should be considered in choosing which method to use.

BOILING: Boiling the honey and water for 10 to 30 minutes will sterilize the must and cause a "cold break" which precipitates the protein and other colloidal materials in the honey. This will help clarify the final mead.

The disadvantage of boiling is that it drives off the delicate flavor components of the honey. Yeast nutrients and acid blends can be added before or after boiling.

PASTEURIZATION: Heating the honey and water to 190 °F for 10 to 20 minutes will destroy any wild yeast in the honey but will preserve more of the volatile flavor components.

When preparing large batches of mead (3 to 5 gallons), it may be impractical to heat the total volume of water. Instead, mix the honey with 1 or 2 gallons of water. Heat-sanitize this mixture (boil or pasteurize) and when cool, transfer to the carboy. Add enough additional water to the mixture in the carboy to equal the total volume needed.

SULFITING: An alternative method of sanitizing the must is "sulfiting." The advantage of this method is that there is no heating. Simply dissolve the honey in water along with the acid blend and yeast nutrients and add the sulfites. The major disadvantage is that some individuals are allergic to sulfites and would not be able to consume mead that is made with sulfiting agents. Also care must be taken not add too much sulfite as levels in the 60-70 ppm range can inhibit yeast growth. Since proper adjustment of levels requires an accurate scale and pH meter, sulfiting is not recommended for the amateur mead maker.

Sanitizing with sulfites is recommended when making Mulsum or Melomel. Since boiling fruit juices will "set" the fruit pectin and prevent the final mead from clarifying.

ADDING THE YEAST
If the must has been sanitized by heating, the yeast can not be added or "pitched" until the must is at room temperature (approximately 70-75 °F).

When using sulfites to sanitize, let the must stand for 24 hours before adding the yeast. If using dry yeast, activate it by stirring the packet of yeast into 4 ounces of warm water (80 °F). Allow the yeast to hydrate for 10 minutes before stirring into the must.

Table 2. Basic Steps For Making Mead

1. Clean and sanitize all equipment and containers.
2. Make the must (i.e., honey-water mixture).
3. Add the yeast or yeast starter.
4. Ferment until all visual signs of air bubbles disappear.
5. Rack (fine first, if desired) two or more times.
6. Age until clear and good flavor develops.
7. Bottle and cap with bottle caps or corks.

FERMENTATION

Fermentation takes from several weeks to several months. During this step, the sugar in honey is converted to alcohol and carbon dioxide gas. Once the must has been sterilized (by boiling, pasteurization or sulfite treatment), transfer it to the fermentation vessel (carboy) and add the activated yeast.

At the onset of fermentation, yeast need an ample supple of dissolved oxygen. Therefore, it is helpful to cascade the cold must into the carboy prior to adding the yeast. Air is excluded during the remainder of the fermentation process by installing an air lock on the neck of the carboy.

RACKING

Racking involves siphoning off the clear mead into a second sanitized fermenter, leaving the sediment behind in the first. This step is repeated as many times as is necessary to achieve the desired level of clarity, usually at three-month intervals.

Strict sanitation practices must be observed to prevent contamination. (If sulfiting agents are used as a disinfectant, they need to be added at each racking to ensure the desired level of 50 ppm sulfur dioxide.)

Care must also be taken to not incorporate oxygen during racking after the onset of fermentation. Excess exposure to oxygen once the process has begun, can cause spoilage. When filling the carboy, headspace should be limited to approximately one inch to minimize the available oxygen.

FINING

Fining is an optional step that clarifies mead, using agents such as bentonite, isinglass, egg white, gelatin, and casein. A commercial product called Sparkolloid is also available. Fining agents combine with charged particles in suspension, such as protein, and precipitate them. The result is clear mead that has a sparkle. The drawbacks to fining are the amount of mead left in the residue and the potential for decolorizing the mead.

Fining is usually done before racking or when mead fails to clear. After racking, attach the air lock. Fermentation will begin in several hours or may take several days. Mead is best fermented at temperatures between 70 °F and 80 °F. Fermenting at lower temperatures will not harm the mead flavor; it will just take longer to complete.

During fermentation, rack the mead into a new container as sediment develops. If the mead sits on the sediment too long, the yeast will begin to feed on the sediment (autolysis) and result in an unpleasant flavor. Fermentation is complete when air bubbles are no longer visible.

AGING

Aging requires the most patience. During this step, the mead clears and develops its flavor. Usually, it moves from a harsh, acidic, unpleasant taste to a smooth, mellow beverage with a nice bouquet and fragrance. As the dead yeast cells continue to settle, it is important to continue racking the mead. A steady temperature below 70 °F (preferably around 60 °F) is recommended through the aging process. The length of aging can take months or years,

depending on a number of factors. In general, lighter meads will be ready sooner while darker, sweet meads and those with higher alcohol content will need more time to fully develop. Ultimately, the taste preference of the mead maker will determine when it has aged enough.

BOTTLING

The last step is bottling and capping. As with all the steps, good sanitation practices are essential and aeration during the transfer should be avoided. Standard caps or corks can be used. Bottles with corks need to be stored on their sides or the corks need to be dipped in melted paraffin to keep them from drying out. Headspace should be approximately one-half to three-quarters of an inch to limit exposure to oxygen.

Making sparkling mead requires a second fermentation using a new yeast culture and priming sugar. The concentration of sugar to mead should be 60 grams or 2 ounces for each gallon of must or three-fourths to one cup per five gallons. The second fermentation occurs in capped bottles, thus trapping the carbon dioxide gas until the bottle is opened. Typically, sparkling mead has higher alcohol content. Additional sediment settles in the bottom of the bottle. The finished sparkling mead should be decanted off the sediment. Overall, careful handling of sparkling mead is required to prevent premature release of the carbon dioxide gas and exploding bottles.

Throughout the mead-making process, it is important to test various parameters. Sugar levels of the honey, fruit juices, and mead are measured in brix or specific gravity, using a hydrometer. Acid levels are determined by measuring pH using acid test kits that are readily available in brewing supply stores. A good thermometer is necessary to monitor room and brew temperatures throughout process.

Common Problems

OFF FLAVORS

Most off flavors are the result of poor sanitation practices. All equipment must be sanitized to prevent contamination and the resulting off flavors. The must needs to be free of any wild yeast of bacterial contamination before fermentation starts (see **"Preparing the Must"**) and good practices must continue throughout the brewing process. Also, any residue of sanitizer (bleach, sulfites, soaps) remaining on the equipment will affect the flavor of the final mead.

"STUCK" FERMENTATION

After adding the yeast to the must, fermentation should begin within several days. If fermentation does not start within 5 days, it is probably because of a poor nutrient balance or a weak strain of yeast. The best remedy is to rack the must into a sterilized fermentation vessel and begin again by adding new viable yeast.

In other cases, yeast activity may stop in the middle of the fermentation period. All activity stops and the specific gravity indicates that there is adequate sugars still available for fermentation.

The most common cause of this behavior is that the alcohol produced by the yeast has reached a level in the mead that is too high to support yeast activity. When the level reaches approximately 12 percent, yeast metabolism is inhibited.

Basic Recipes/Formulas

Recipes for mead abound—with each mead maker having his/her own slant on what and how much to use as well as how to put it altogether to create the right flavor and bouquet. Below are a few basic recipes for mead and variations of mead to get you started. Use the guidelines in the equipment and process sections to produce your mead.

Basic Mead Recipes

Morse
Traditional Mead Recipe

Ingredients	Amount
Honey (preferably goldenrod)	3.5 lb
Water	1 gal
Ammonium phosphate	4 g
Urea	4 g
Cream of tartar	4 g
1:1 mixture of tartaric and citric acid	4 g
Yeast	
Anti-foam agent	Optional

Morse, R. A. 1980. "Making Mead (Honey Wine)." Wicwas Press, Cheshire, Conn.

"Wassail Mead"
Yield: 5 gallons

Ingredients	Amount
Light clover honey	12.5 lb
Acid blend	4 tsp
Yeast nutrient	5 tsp
Water	to make 5 gal
Wine yeast	sufficient for 5 gal
Optional:	1/3 tsp sodium or potassium metabisulfite

Original specific gravity: 1.110

Source: Papazian, C. 1986. Brewing Mead. Wassail! Page 175 in "Mazers of Mead." Brewers Publications, Boulder, Colo.

"St. Elizabeth's Day" Mead
Yield: 5 gallons

Ingredients	Amount
Honey	18 lb
Water	5 gal
Yeast nutrient	2 oz
Stock sodium bisulfite solution (add after fermentation)	5 tsp
Tartaric acid	5 tbsp
Liquid oak essence (optional)	30 mL
Prise de Mousse Yeast	10 g

Original brix: 25 °
Total acid: 6-6.5%

Burch, B. 2000. Making Sense of Making Mead. Zymurgy: For the Homebrewer and Beer Lover. 23(3): 39-40.

Mead Variations

Mulsum or Melomel
Yield: 5 gallons

Ingredients	Amount
Light clover honey	9 lb
Crushed Fruit (such as raspberries, blackberries, marionberries, loganberries, mangoes, currants, peaches, plums or cherries)	10-15 lb
Yeast nutrient	5 tsp
Water	to make 5 gal
Wine yeast	sufficient for 5 gal
Sodium metabisulfite	1/3 tsp
Acid blend	to bring level to 0.4 to 0.5%

Approximate original specific gravity: 1.100 to 1.120

Special Instructions: Boiling grape or any other fruit juice will "set" the fruit pectin and prevent the mead from clarifying. Therefore, sulfating agents should be used to disinfect the must.

Use an open fermenter (i.e., a clean fermentation pail covered with a snug aluminum foil or plastic sheet so gases can escape) for the first to ten days. Then strain out the fruit, and siphon the ferment into a closed glass fermenter. Some fruit will unavoidably be carried into the second fermenter. After two weeks, or when vigorous fermenting has subsided, siphon ferment into another fermenter leaving virtually all the fruit and some of the yeast sediment behind.

Papazian, C. 1986. Brewing Mead. Wassail! Pages 183-184 in "Mazers of Mead." Brewers Publications, Boulder, Colo.

Raspberry Melomel
Yield: 3 gallons

Ingredients	Amount
Light honey	10 lb
Raisins	1/2 cup
Lemons	juice from 3
Crushed raspberries	1 to 2 pt
Champagne yeast	sufficient for 3 gal
Water	to make 3 gal
Sodium metabisulfite	1/3 tsp

Special Instructions: Mix all ingredients except the yeast and let sit overnight. Add the fruit directly to the must or suspend it in a cheesecloth bag.

Spence, P. 1997. "Mad About Mead! Nectar of the Gods." Lluewellyn Publications, St. Paul Minn.

Sack Mead
Yield: 5 gallons

Ingredients	Amount
Light clover honey	15 lb
Acid blend	4 tsp
Yeast nutrient	6 tsp
Water	to make 5 gal
Wine yeast	sufficient for 5 gal
Sodium or potassium metabisulfite (optional)	1/3 tsp

Approximate original specific gravity: 1.120 to 1.130

Note: To make "Sack Metheglin," add gruit as described in the "Metheglin" recipe.

Source: Papazian, C. 1986. Brewing Mead. Wassail! Page 179 in "Mazers of Mead." Brewers Publications, Boulder, Colo.

Pyment or Clarre
Yield: 5 gallons

Ingredients	Amount
Light clover honey	7 lb
Grape juice	2.5 gal
Water	to make 5 gal
Yeast nutrient	5 tsp
Wine yeast	sufficient for 5 gal
Sodium metabisulfite	1/3 tsp
Acid blend	to bring level to 0.4 to 0.5%

Approximate original specific gravity: 1.100 to 1.120

Special Instructions: See "Mulsum" directions.

Caution: Do not add grape skins to closed glass fermenter as they will plug the escape vent and could cause an explosion. Use an open fermenter (i.e., a clean fermentation pail covered with a snug aluminum foil or plastic sheet so gases can escape) for the first to ten days, if adding crushed fruit.

Papazian, C. 1986. Brewing Mead. Wassail! Page 181 in "Mazers of Mead." Brewers Publications, Boulder, Colo.

Metheglin
Yield: 5 gallons

Ingredients	Amount
Light clover honey	12 lb
Acid blend	4 tsp
Yeast nutrient	5 tsp
Water	to make 5 gal
Wine or champagne yeast	sufficient for 5 gal
Sodium or potassium metabisulfite (optional)	1/3 tsp

Gruit

1 oz leaf hops or any of the following:

- 1 to 2 oz freshly grated ginger
- 2 to 4 oz lemongrass
- 1 to 2 oz crushed cinnamon bark
- Crushed fennel, anise, caraway seed or cloves
- Crushed hot chile pepper (with or without seeds)
- Combination of these and any other spice, herb, bark and seeds

Approximate original specific gravity: 1.110

Special Instructions: Make a strong extract of gruit ingredients by boiling spices in small amount of water for 15 minutes. Add at bottling time or after vigorous fermentation has subsided.

Papazian, C. 1986. Brewing Mead. Wassail! Page 180 in "Mazers of Mead." Brewers Publications, Boulder, Colo.

Honey Hop Metheglin
Yield: 1 gallon

Ingredients	Amount
Wildflower honey	3 lb
Leaf hops	1 oz
Lemon and lime	juice and peel from half of each
Yeast energizer	1 tsp
Montrachet Yeast	1 packet
Water	to make 1 gal

Special Instructions: Add half of hops in a mesh bag to honey dissolved in 6 pints water and heat to just below boiling. Hold for one hour. Then add citrus peel and juice, remaining hops and yeast energizer. Boil for 1 hour, remove from heat and let cool overnight.

Source: Spence, P. 1997. "Mad About Mead! Nectar of the Gods." Lluewellyn Publications, St. Paul, Minn.

Cyser
Yield: 5 gallons

Ingredients	Amount
Light clover honey	7 lb
Apple juice	4.5 gal
Water	to make 5 gal
Yeast nutrient	5 tsp
Wine yeast	
Sodium or potassium metabisulfite	1/3 tsp
Acid blend	to bring level to 0.4 to 0.5%

Approximate original specific gravity: 1.100 to 1.115

Special Instructions: See "Mulsum" directions.

Papazian, C.1986. Brewing Mead. Wassail! Page 182 in "Mazers of Mead." Brewers Publications, Boulder, Colo.

"Rockport Still Mead"
Yield: 3 gallons

Ingredients	Amount
Orange blossom honey	9 lb
Fermex yeast nutrient	3 tsp
Yeast hulls	1.5 tsp
Yeast energizer	1/2 tsp
Wyeast No. 3184 mead yeast	sufficient for 3 gal

Approximate original specific gravity: 1.116
Final specific gravity: 1.0212
Boiling time: 5 min.
Primary fermentation: 30 days at 68 ºF (20 ºC) in glass
Secondary fermentation: 90 days at 68 ºF (20 ºC) in glass
Tertiary fermentation: 2 years at 68 ºF (20 ºC) in glass

Turczyn, A. 2000. Winner's Circle. Zymurgy: For the Homebrewer and Beer Lover. 23(3): 47.

Prickly Pear/Mesquite Melomel Sparkling
Yield: 5 gallons

Ingredients	Amount
Prickly Pear Puree	7 lb
Mesquite honey	12 lb
Yeast nutrient	1 tbsp
Acid blend	4 tsp
Dry mead yeast Wyeast #3632	sufficient for 5 gal
Corn sugar for bottling	1 cup

Burch, B. 2000. Winner's Circle. Zymurgy: For the Homebrewer and Beer Lover. 23(3): 41.

Bit O' Honey Cyser
Yield: 5 gallons

Ingredients	Amount
Fresh pressed sweet cider, tested and adjusted for acid	5 gal
Clover honey	2 lb (or enough to bring the specific gravity to approximately 1.065)
Ale or mead yeast starter	sufficient for 5 gal

Special Instructions: Simmer honey with a small amount of cider until honey warms and thins. Then add to 1 gallon of cider in glass carboy. Add the yeast and then top with remaining cider. It takes at least six months for cyser to clear and taste acceptable. After bottling, it should age at least four months.

Correnty, P. "The Art of Cidermaking." Brewers Publications, Boulder, Colo.

Selected Resources and References

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INTERNET SITES

- Mead-Lover's Digest, an online distribution of articles from readers. Subscribe by e-mail sent to mead-request@talisman.com with the word "subscribe" in the subject line.
- www.talisman.com/mead, Web site for *Mead Lover's Digest* and other material.
- www.best.com/~davep/mme, The "Mead Made Easy" book by Dave Polaschek in electronic format.
- www.brewery.org/brewery/Mhall.html, collection of links to mead-related pages.
- www.brewery.org/brewery/library/beeslees.html, collection of mead recipes, formulas and tables.
- www.solorb.com/gfc/mead/mead.html, Mead Maker's Page on mead basics and terminology
- www.gotmead.com, Web site with mead-making basics and links.