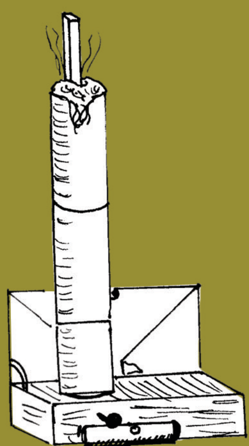
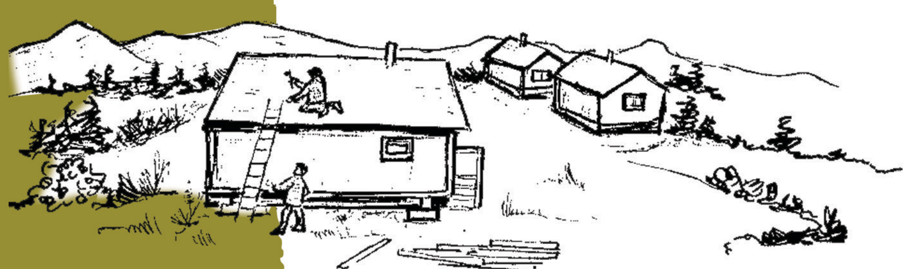
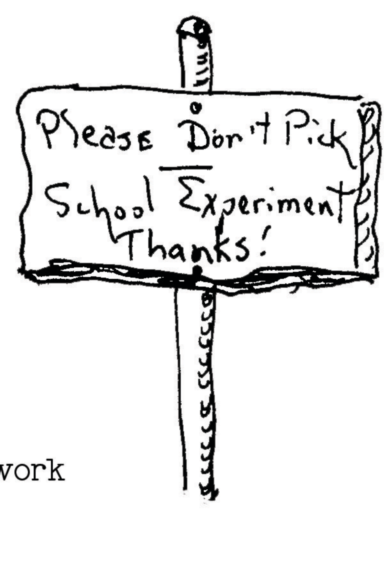
Alaska Science

Camps, Fairs & Experiments



by Alan Dick





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Camps, Fairs & Experiments

by Alan Dick

Alaska Native Knowledge Network

A partner with the Alaska Rural Systemic Initiative

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Camps as an Environment for Science and Culture

As educators seek more effective ways to teach students, camps have emerged as successful means of sharing information and experiences that are not possible in the regular classroom setting. Camps provide young people with the opportunity to interact with Elders and instructors in an environment that naturally promotes learning.

Educators often talk about using the local environment and doing more hands-on activities. Until students and teachers break out of the classroom for extended periods of time, this will be an unfulfilled vision. At camp, there is endless opportunity for hands-on, culturally relevant activities.

The information presented here was primarily gleaned from presentations at an AKRSI meeting. The meeting participants were like-minded people who have, through trial and error, planning and revising, conducted camps in almost every possible setting in Alaska.

Among those describing their efforts were representatives from the following:

- Academy of Elders Camp
- Camp Water Juneau
- Alakanuk School
- ANSWER Camp
- AISES Camp Fairbanks (Gaalee'ya Spirit Camp)
- AISES Camp Afognak

As we pioneer camps as a means of educating our children in significant knowledge, new insights will be gleaned and added to the following information. Please join in this effort.

TYPES OF CAMPS

There are three possible types of camps:

- Immersion camps where only the Native language is spoken.
- Language camps where the Native language is taught.
- English-speaking camps

Immersion camps are much more comfortable for Elders. Thoughts and activities are naturally directed to the land and the living that springs from it. Students who are proficient or growing in the language do exceptionally well. Students who are weak in the language make major leaps in their abilities.

Language camps are appropriate in a region where the language is recovering. Language instructors are often pleased and surprised at the interest of non-Native students.

English speaking camps are necessary in regions where too many different languages or dialects are represented.

Different Orientations

Staff

When the camp staff plans the experience, objectives and correct behaviors can be identified and met. A camp with a common theme like "language," "tools" or "travel" feels more cohesive than one with fragmented parts. Camps with this approach tend to be well organized but exhausting for instructors.

Students

When students bring a project to develop, instructors are facilitators. This requires a higher level of maturity on the part of the students and greater versatility on the part of the instructors.

Elders

If there are enough Elders present, there is a dynamic that unfolds as the generations interact with each other. Elders have information for which we haven't yet learned the questions. It is important to anticipate tools and materials they might need. An Elder-coordinator paces the Elders over the schedule, creating a setting where they can be most effective.

Synthesis

The above three orientations can exist in any combination. A camp that is staff driven might be more like school than a summer camp. A camp that consists of only student projects is too loose. A camp that is totally Elder driven might necessitate putting away calendars as well as watches. A healthy synthesis is best.

SETTING GOALS

Starting with clearly defined goals helps maintain the camp focus as well as later evaluating the success of the camp and guide modifications that should be made. Without clear goals, consistency in following years is impossible.

What are the goals?

- ✓ To inform/interest students in science?
- ✓ To culturally enrich students?
- ✓ To bring students and Elders together?
- ✓ To strengthen or rekindle the Native language?

Clearly define your goals and stick with them.

Evaluation

Record suggestions right after camp while they are fresh in people's minds. File them carefully for the planning meetings in following years. Evaluate the camp in light of the stated goals.

SUGGESTIONS FOR PLANNING

Overall

Dates/location

- Study the weather patterns. Schedule camp dates according to the findings. Have contingency plans for inclement weather.
- Set camp dates to coincide with subsistence activities.
- How long will the camp be? Shorter, smaller camps are better in the first years.
- Where will the camp be held? What location(s)? Is this location best considering the camp goals?

Student Applications

First ask yourself:

- What **age group** will be served? Is the camp for a **specific type of student**? Is the camp for all students?
  Teaching styles differ greatly for different types of students. Students with behavior problems need more rules and structure. Motivated students function better with instructors as facilitators.
  Welcome handicap students, but ask about handicaps and medical needs ahead of time. Don't embarrass handicapped students by putting them in uncomfortable situations.
  Ask if students have **medication needs** that staff must supervise.
  Ask students about their personal interests.
- **How will students be screened?** The application process should be specific enough to determine whether a student meets the criteria or not. Sending students home is expensive. Screen out trouble before it arrives unless you are prepared to handle all situations.
- Should **pairs** of students be accepted **from each village** to minimize homesickness and reduce travel costs? Note: Trouble can arrive in pairs.

Logistics

- How will you prepare for **medical emergencies**? What transportation do you have available if something happens?
- What means of **communication** are on-site? Telephone, CB radio, etc.?

- How **long** will the camp last? Will it be an overnight camp or day camp?
- Will you cook your own meals or hire someone? Food is an important link to contentment.
- If a **bear event** occurs, repercussions come from many sources. An experienced local person should be present whose judgement is respected.
- What will be the **student/instructor ratio**? How many counselors will be needed?
  When the student/instructor ratio is low, there is less need for rules and structure. At one camp, younger students were accompanied by mothers and grandparents. It worked wonderfully, giving a real sense of family.
- **How many** students will be invited? It is much easier to start with select students in small numbers and increase over the years as experience grows. Ten to twenty percent of the students who make a commitment to attend will not do so because of last minute concerns.
- How much **structure** will there be? One camp scheduled every minute from getting up to bedding down. Another camp brought people together, scheduled three meals, and let it all happen.
- What **region** will the students come from? How much will travel cost? If one camp follows another, can money be saved by filling chartered planes in both directions?
- What **insurance policy** will cover the camp? Does it restrict water sports and activities?
- What **awards** will be given at the end of camp, and on the basis of what criteria? Students need to know at the beginning what the standards are.
- Will you take many **pictures**? Photos not only help students reflect on the good times, they also help document activities to funding sources.

Students

- If the goal of the camp is to develop science projects, students should have several ideas in mind before coming to camp.
- Students need a checklist of clothing and supplies to bring to camp.
- Students should have a very clear understanding of what the camp is about and how it will be conducted. **Failed expectations are the greatest source of discontent**.

Staff

- If instructors do what they are most interested in, but do not coordinate with each other, the students get a fragmented experience. If one instructor is teaching about northern lights, another is enthusiastic about nematodes and the Elder is trying to get the students to make a canoe, the cohesion necessary for a meaningful experience is missing.
- It is better to have too much scheduled than not enough. Students often surprise themselves when they discover an interest in something they've never done before. Having a diversity of experiences available is always beneficial.
  It is easy to edit activities. It is difficult to improvise in a remote location. It is easier to start with structure with the option of relaxing schedule and rules than imposing structure on a situation that has lost its continuity.
- When the student/instructor ratio is high, good counselors are more valuable than gold. Good female counselors are more plentiful than good male counselors. All counselors should be treated with respect, not like 24-hour-a-day babysitters. They are part of the team, and should be represented at all staff meetings.

- Planning meetings that are held at the camp location provide an important connection.

Tools/Materials/Equipment

- Each instructor should create a materials list for each planned activity. Every camp should have standard tools and materials. The list should develop each year. Certainly it includes tents, rope, axes, tarps, hammers, saws, and science equipment like thermometers, balances, magnifying glasses, tape measures etc.
- Several instructors have stated that a laptop computer with a CD-ROM encyclopedia would greatly benefit the students who are doing research. However, the presence of a laptop computer can spoil the "flavor" of a traditional camp. At a remote camp, a computer requires a small generator and perhaps 12v batteries and inverter.

Rules

Using the local Native values as the basis for camp rules serves quite well (see values on page 6.) There is a greater sense of cooperation when camp authorities support the values that are the basis for the local lifestyle. Send them to students before camp, include them in the student agreement, and post them at the camp.

Before camp, students should sign a commitment to abstain from verbal, physical, substance, or sexual abuse, including improper touching. Curtail verbal abuse as soon as it surfaces.

QUESTIONS TO ASK BEFORE A CAMP

- ✓ What are the rules? What behaviors are acceptable and which ones are not? What will the consequences be for negative behaviors? Who makes the rules? Are students involved?
- ✓ How much technology will be involved? Computers? TV? Walkmans?
- ✓ What activities will be available? If it is a science camp, will there be Native dancing, beading and storytelling? Will accommodations be made for church services?
- ✓ Will there be a Native language component in the camp? Immersion? Incidental?
- ✓ How will you reconcile the difference between contemporary views of girls participating equally in all events with boys, and the traditional views of separation of certain tasks by gender? Involve the Elders in this discussion.
- ✓ Will junk food be allowed? If so, to what extent? Camps that forbid junk food have far fewer discipline and bedtime problems.
- ✓ Will any kind of music be allowed? A blaring local radio station detracts from the camp experience, particularly if it is a remote camp. Do you want rap music around the campfire of a culture camp? Sometimes the offenders are adults, like the cook. This is hard to deal with after the fact.

Alaska Native Values

Kodiak Alutiiq

We are the descendants of the Sugpiak, the Real People. Understanding our environment and events that have shaped our lives and created the culture of our ancestors is vital for our children's cultural survival. The history of our people and our place in the world is a part of who we are today. Kodiak Alutiit must learn and pass on to younger generations our understanding of our natural world: the sky, land, water, and the animals. As we meet the challenge of living in the 21st century, we must continue to live in honor of those things we value:

- Our Elders
- Our heritage language
- Family and the kinship of our ancestors and living relatives
- Ties to our homeland
- A subsistence lifestyle, respectful of, and sustained by the natural world
- Traditional arts, skills, and ingenuity
- Faith and a spiritual life, from ancestral beliefs to the diverse faiths of today
- Sharing: we welcome everyone
- Sense of humor
- Learning by doing, observing, and listening
- Stewardship of the animals, land, sky, and waters
- Trust
- Our people: we are responsible for each other and ourselves.
- Respect for self, others, and our environment is inherent in all of these values.

Yup'ik

Every Yup'ik is responsible to all other Yup'iks for survival of our cultural spirit and the values and traditions through which it survives. Through our extended family, we retain, teach, and live our Yup'ik way.
With guidance and support from Elders we must teach our children Yup'ik values:

- Love for children
- Respect for others
- Sharing
- Humility
- Hard work
- Spirituality
- Cooperation
- Family roles
- Knowledge of family tree
- Knowledge of language
- Hunter success
- Domestic skills
- Avoid conflict
- Humor
- Respect For nature
- Respect For land

By the design of our Creator we were created Yup'ik in space and time; proud, for generations to come, of the values given to us by our Creator.

Athabascan

- Self-sufficiency and hard work
- Care and provision for the family
- Family relations and unity
- Love for children
- Village cooperation and responsibility to village
- Humor
- Honesty and fairness
- Sharing and caring
- Respect for Elders and others
- Respect for knowledge & wisdom from life experiences
- Respect for the land and nature
- Practice of Native traditions
- Honoring ancestors
- Spirituality

Tlingit

(from Walter Sobeloff sharing his thoughts on Native values)

- Respect for self, and others, including Elders.
- Remember our Native traditions, our families, sharing, loyalty, pride, and loving children
- Responsibility
- Truth and wise use of words
- Care of subsistence areas, care of property
- Reverence: "We have one great word in our culture: *haa shageinyaa*. This was a Great Spirit above us, and today we have translated that reverence to God."
- Sense of humility
- Care of human body
- Dignity; the Tlingit word for dignity is *yan gaa duuneek*.
- Peace; peace with the family, peace with the neighbors, peace with the others, and peace with the world of Nature

Iñupiat Ilitquasiat

Every Iñupiaq is responsible to all other Iñupiat for the survival of our cultural spirit, and the values and traditions through which it survives. Through our extended family, we retain, teach, and live our Iñupiat way. With guidance and support from Elders, we must teach our children Iñupiaq values:

- Knowledge of Language
- Sharing
- Respect for Others
- Cooperation
- Respect for Elders
- Love for Children
- Hard Work
- Knowledge of Family Tree
- Avoidance of Conflict
- Respect for Nature
- Spirituality
- Humor
- Family Roles
- Hunter Success
- Domestic Skills
- Humility
- Responsibility to Tribe

Our understanding of our universe and our place in it is a belief in God and respect for all his creations.

COMMUNICATION

- Online registration makes the process painless. Postal problems are eliminated.
- Staff meetings before, during, and after camp are vital. The director should meet with the Elders, other instructors, and counselors separately and jointly.
- Good communication is the lifeblood of camp. Before camp begins, communication with the staff, students, parents, and schools must be very clear so that responsibilities are understood. "Who, where, what, when, and how" are the key words. Reminders by mail or phone call are appropriate. Once school is over for the year, a major communication link is severed.
- Students are disappointed if their expectations of camp and their experiences are very different. Communicate clearly before the camp begins. Describe what will happen, how, and why.
- On travel days thorough communication is an absolute must. Radios, cell phones, or whatever it takes to have good clear communication will reduce stress tremendously. Responsible helpers are desperately needed on arrival day. Getting home is always easier.
- Talking circles and student "family groups" are most helpful in breaking down walls between people. Journals give insights to staff that help respond to student needs.
- Phones available in camp lessen the possibility of homesickness and gives recourse if there is an emergency. An unattended phone presents the possibility of phone abuse.

CAMP ORGANIZATION

One person must oversee the whole camp. It is folly to expect that person to also be an instructor.

Camp staff is made of the director, Elders, instructors, counselors, cooks, and transportation people. Coordination among the staff is vital to the flow of the camp. Do not assume everyone will understand their roles or pitch in to help when there is a need. Simple job descriptions make life much easier. One person in charge of transportation is usually a great help as well.

SUCCESS FACTORS

While each camp has its own objectives and priorities; there are certain factors that contribute to positive results.

- With the presence of Elders, camps have stability, depth, content, and focus. Elders are a precious resource that cannot be programmed. They don't always enjoy good health. Often the schedule calls for five Elders and only one or two are able to attend.
- If the camp is community based, with opportunity for everyone to interact, there is great support. Some camps with road access have enjoyed the flow of community members in and out as personal schedules allowed.
- Camps that are based in traditional activities have strong support from the

communities. Camps scheduled simultaneous with subsistence activities are very successful.

- Day camps draw from a broad base of talent in the community. Many instructors are able come for a few hours. Overnight camps have greater continuity. Both have advantages. A remote camp develops a pleasant rhythm after two or three days. If one of the leaders continually goes back and forth between camp and town, the rhythm is broken. He/she brings the pace of town to camp. It takes a few hours to recover.
- Early planning allows schools, teachers, and students enough time to respond to all camp requirements before school is over in the spring. January and February are not too early to get information to teachers and school districts.
- Weather has a tremendous effect on outdoor camps. Study local weather patterns, and plan accordingly.
- Camp location is very important. There are some activities that are natural in the woods, and others that are natural in a laboratory. The camp location should be consistent with camp goals. If it is a wilderness camp, it should be located in the wilderness. Elders are spontaneous. They need to be in their environment. Making a boat trip to get poles or basic materials hinders traditional activities.
- If the students can roam away from the camp location, there is a greater need for chaperones.
- Some form of "show & tell" at the end of camp enhances the experience for everyone.
- Students like to take home a collection, a craft or something tangible. Memories and pictures are important, but a physical reminder of the events is significant: a basket, ulu, drum, headband etc.
- One camp required students to earn one award after returning to the village. Under the supervision of a mentor, the camper had to present to a community group what he/she learned at the camp. This made an excellent connection between the camp, the student, and the village.
- If one of the purposes of the camp is to develop science projects, boards should be available to organize and show student efforts and thought. Have a mini-science fair at the end of camp.
- There is always a giant gap between camp and the classroom. Poster boards, photos, and videos help close that gap. If one person has the responsibility of informing classroom teachers about each project, there is much greater continuity.

Past or potential problems

- Poor or late planning always leads to rounding up the camp quota from a village a couple of days before the camp. This brings a group of participants who haven't filed applications, met requirements and don't know what to expect. They arrive with boom boxes and junk food saying they weren't informed. Once school is out, screening students and applications is most difficult.
- When students expect one type of experience and encounter another at camp, they quickly resort to grumbling. They need to know ahead of time how much time will be spent on camp chores and compulsory activities each day.
- Bears are a constant concern in some camp locations. Expertise and strict supervision of students are necessary to prevent incidents.
- Occasionally, camps attract "campfire Romeos," a young man around

18–21 who initially helps in transportation, firewood or other tasks—a good volunteer. Once he settles in, he gathers a bevy of young admirers around the campfire, and serves as a constant distraction until asked to leave. Sometimes the Romeo is a male counselor in a co-ed camp. Prevention is far more expedient than the cure.

- The worst-case scenario would be to have an injured student and no way to access medical services. This hasn't happened yet, but the possibility always exists in remote camps. Safety dominates all other concerns.

Future

The learning curve would be flattened considerably if leaders of one camp attended camps in other locations to get ideas and a better perspective.

Teacher participation during the summer is difficult, as many teachers need the few summer months to regenerate their energies. Offering college credit for recertification is an incentive. Teacher contact with Elders and their methods of instruction is always positive.

At the time of this printing, we have yet to hold winter camps.

CONCLUSIONS

Alaska is a huge state with a diversity of people, resources, and needs. However, there is a common theme that permeates Alaska camps. We want a healthy educational experience for our young people. This includes the integration of traditional activities with modern education. It includes professional teachers and Elders working together in camps for the benefit of the students. It includes a commitment that goes beyond funding and job descriptions. It touches the essence of why we live in this great land.

Culturally-Relevant Science Fairs

Culturally Relevant Science Fairs

The Alaska Rural Systemic Initiative (AKRSI) has been funded by the National Science Foundation for many years now. Our commitment is to promoting locally and culturally relevant curricula, particularly science and math. AISES is the American Indian Science and Engineering Society, a very active national organization dedicated to promoting collegial support and mentoring for Native Americans involved in science and engineering. ANSES is the Alaska Native Science and Engineering Society, the Alaska adaptation of AISES. ANSES is funded and supported by AKRSI. Our goal is that locally culturally relevant science projects and fairs will continue long after our funding has expired.

Why We Have Locally Relevant Science Fairs

Science fairs based on contemporary Western science have served well to establish a precedent in Alaska. However, the need has long been expressed, and is now fulfilled to have a science fair with projects based on locally and culturally relevant events. Elders are now recognized as the experts along with Western scientists. Students are encouraged to find projects from their village, from subsistence activities, and from their heritage. The richness of this effort has released enthusiasm like an artesian well. Many of the strict rules of state and national fairs have been replaced by village Elders' wisdom. What is safe? What is respectful? What is the appropriate way of approaching the subject? Elders answer these questions.

Respect for people and animals runs deep in the inquiry process. Students have little trouble conforming to the values established by their regional Elders.

What is a Culturally or Locally Relevant Project?

Any project based on activities in the community, whether past or present is locally or culturally relevant. This is opposed to a project on lunar landings, dolphins, or alligators.

Cultural Standards Met by Science Fairs

Many cultural standards adopted by the State of Alaska Department of Education are being met when students are actively involved in developing a locally or culturally relevant science project.

A Brief History and a Look Ahead

Since 1996, AKRSI has sponsored local and regional fairs in five cultural regions of Alaska: Iñupiat, Athabascan, Aleut, Tlingit/Haida, and Yupik. After each of the regional fairs, the best projects went to our state fair, and the best of those went on to AISES Nationals in the Lower 48. The goal was to jumpstart each region so the events could continue on their own after AKRSI phased out.

In February, 1999 AKRSI sponsored the first ANSES State Fair in Birchwood, outside of Anchorage, gathering the best projects throughout the state. The next ANSES State Fair was held in Camp Carlquist on Mirror Lake by the town of Peter's Creek north of Anchorage in February 2000.

AKRSI is very grateful for the precedent AISES National has established, but feels that Alaskan differences are great enough that Alaska guidelines were needed. Therefore, students who go from the Alaska fairs to AISES National need to be prepared for different requirements.

Unlike AISES National, Alaska fairs had no lower age limit, nor are they limited to Native American students. Our Alaska projects are not sterile, but students are encouraged to display natural materials, make noise, smoke, smell, pop, and fizz (as long as they are safe and approved by a teacher and a village Elder.)

On the other hand, Alaska projects must reflect the guidelines of a culturally relevant school and curriculum. They should be rooted in the local lifestyle, traditional activities and cultural views.

AKRSI'S ROLE

Because of greatly reduced funding, AKRSI's future role in regional and the state fair are uncertain. Check with the AKRSI website, www.ankn.uaf.edu for current information.

AISES National Science Fair

This event has been a great experience for students and is high on the student "benefit-per-buck" ratio. A student does not have to be a winner in our ANSES State Science Fair to attend AISES National. All school districts should budget to send top projects. AKRSI may or may not be able to help fund this travel.

Information about the AISES National Science Fair can best be obtained on the web, http://www.aises.org or through the AKRSI website, http://www ankn.uaf.edu/anses/science fairs. This contains a link to the AISES National website.

Timing of Fairs

In the past, regional fairs were between October and January. The State fair was the end of January during the Native Educator Conference. AISES Nationals is in March, with a early February deadline for registration.

The Western science-based Alaska State Science Fair is usually held in April.

WHO IS INVOLVED?

The Student

Any student enrolled in an Alaska school or distance education program is eligible.

Every effort should be made to accommodate handicapped individuals.

The Project Review Group

This group includes:

- ✓ An adult sponsor, teacher, or local expert
- ✓ An Elder or Elders

The project review group must insure that the student's plan and efforts meet the cultural values of the region, is safe and educationally sound.

The Adult Sponsor

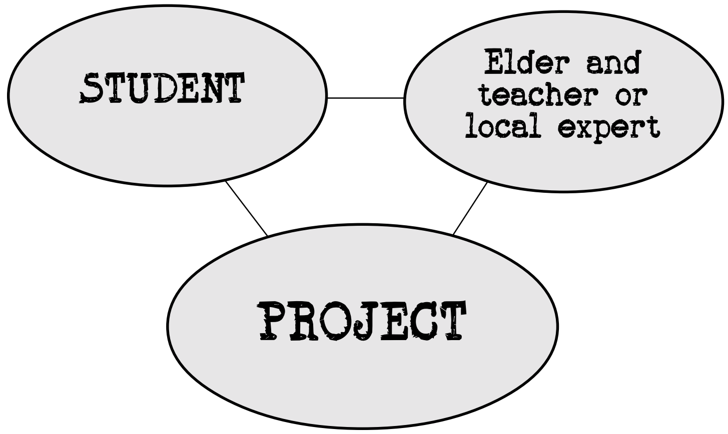
An adult sponsor may be a community member, teacher, parent, university professor, or scientist with whom the student is working. This individual should have close contact with the student during the course of the whole project.

The adult sponsor is ultimately responsible, not only for the health and safety of the student doing the project, but also for the humans or animals used as subjects.

The adult sponsor must be familiar with the regulations that govern potentially dangerous projects. This may include: thin ice, hypothermia, firemaking materials, boating and firearm safety as well as handling of chemicals, experimental techniques, research involving human or nonhuman animals, and animal tissues. The issues must be discussed with the student during planning. Some experiments involve procedures or materials that are regulated by state and federal laws. If not thoroughly familiar with the regulations, the adult sponsor should ask for help from AKRSI staff.

The adult sponsor is responsible for making sure the project is eligible for entry in the science fair. If the project is to go to AISES Nationals, the sponsor will have to scramble to meet their standards as well.

At the same time, the adult sponsor should be certain the student does the major portion of the work. Enthusiastic parents often contribute more than their share of effort, putting other students' projects at a disadvantage. Help the student over humps. If necessary, do the dangerous parts, but the general rule for adults should be "Words, no hands."



The teacher is concerned with student safety and the expertise necessary to link the project to modern science. This individual fills in the gaps the adult sponsor and Elder might leave, whether in preparing the project for the fair, providing specific technical knowledge on the subject or suggesting new ideas that would broaden or deepen the project.

Elder

The Elder is the resource, the guide, the one who guarantees that the project aligns with local values and beliefs. The Elder provides stability.

The student should spend as much time as possible listening to the Elder or Elders. This link with the previous generations gives the student insight into where he/she has come from and where he/she is going. The Elder tells how the question or issue was handled in the past.

RULES, REGULATIONS & REQUIREMENTS

Reasons for Rules

Students need to compete fairly in a safe environment.

No compromise for safety should be made. At the same time, the fair should not be a line-up of sterile posters and notebooks. If the village Elders, local experts, and teachers think a project is safe, it probably is.

Compliance with the local Native values (see Appendix) eliminates the need for most extraneous restrictions. If students clearly explain the project to the review people, and they agree that it is acceptable, then it is.

With large numbers of people as well as scientific displays and contraptions in the same closed space, there is opportunity for mishap during the fair. There should be enough rules to insure safety, yet enough freedom to show the essence of the project. If a student needs to go outside to demonstrate spear throwing to the judges, that should be part of his/her interview.

The main concern is that students have an enjoyable, safe science learning experience. Everything else is secondary.

I often say, “We are the temporary stewards of other people’s greatest treasures . . . their childr en.”

ANSES Social Rules

ANSES agrees with AISES National’s strict behavior guidelines against the use of alcohol and controlled substances, and against verbal, physical or sexual abuse or improper touching. Violations of these standards should not be tolerated at any ANSES sponsored event. Immediate dismissal of a student violating these ANSES guidelines is most appropriate. These rules should be clearly stated and rigidly enforced in all ANSES activities.

Display and Safety Regulations

Unacceptable for Display:

- ✓ Highly flammable or hazardous chemicals or materials.
- ✓ Poisons, drugs, controlled substances, HASMAT. Project materials should meet FAA requirements for transport. Don’t assume! Inquire.

- ✓ Tanks that have contained combustible liquids or gases.

Display items requiring permission previous to the fair:

- ✓ Strong smelling items: fermented fish heads, beaver castor, mink glands, caribou skins soured to slip the hair, etc.
- ✓ Pressurized tanks that contain non-combustibles.
- ✓ Any apparatus producing temperatures that will cause physical burns or freezing.
- ✓ High-voltage. Wiring, switches, and metal parts must have adequate insulation and must be inaccessible to others.
- ✓ Electrical connections. 110-volt AC circuits must be soldered or made with approved connectors. Connecting wires must use wire nuts and electrical tape. Cords must be UL approved.
- ✓ Bare wire and exposed knife switches may be used only in circuits of 12 volts or less; otherwise, standard enclosed switches are required.
- ✓ Any liquid that is acid or base, i.e., above or below ph 6.5–7.5
- ✓ Lasers.
- ✓ Projects that involve live animals or people.

Any display involving the above issues should get an okay from fair organizers.

Acceptable for Display . . . Cannot be Operated

- ✓ Projects with unshielded moving belts, pulleys, chains, and parts with tension or pinch points
- ✓ Any device requiring over 120 volts

Teachers and local Elders should set necessary further stipulations for display for the above projects in a local or regional fair.

Size of Project Space

A project may take up to half a table. Projects requiring more space than this should get permission previous to the fair. (Permission should be granted if there is any way to do so.)

Overall Requirements

Every student must complete the registration forms that simply ask: name, school, grade, name of project, category of project, name of chaperone contact number and email address of student and chaperone.

Each student or team in grades 9–12 should prepare a one page summary of the project for judges to review.

Each student or team should display all data taken during the project that validates the conclusion of the project. Weather-beaten field notes are fine.

Each student must have the Elders fill out the Local Values Checklist, and sign it (see Appendix).

If the student is using human subjects under 18, the student researchers must obtain written informed consent from all subjects and their parent or guardian. The consent form should clearly state all activities. Devise your own form based on your circumstances.

A student may improve on a project from a previous year, but the report from that year should accompany the second year's project so judges can see how much *new* work the student has done.

Team Projects

When there are too many students working on a project, some do not participate. Two is ideal. Three is maximum.

Each member of the team should be able to serve as spokesperson, be fully involved with the project, and be familiar with all aspects of the project.

The judges will assess if all presenters were actively participating in all aspects of the project.

Categories

There are eight categories identified by ANSES:

In a small local fair, all categories might not be represented. In some fairs with fewer projects, we disregard the grade distinction in experiments. Judges take age into consideration when scoring.

A GOOD SCIENCE PROJECT SHOULD INCLUDE:

Elder Guidance

The distinguishing feature of a project in an AKRSI fair is that the student has spent considerable time consulting with Elders in the community. This accomplishes many objectives. It identifies the Elders as valuable resources. It validates local knowledge. It links the student with his/her past. It teaches the application of local knowledge to modern science concepts. It creates bonds between the students and the Elders so other information can flow between the generations. It allows the teaching of local values along with local activities. It brings the school, community, and students together in a healthy fashion.

Project Summary

Projects submitted by students grades 9-12 should include a one page project summary so judges can get a quick overview of the intent and scope of the effort.

Consent forms

All consent forms that haven't been previously collected.

A Good Visual Display

A good visual display attracts and informs.

Interested spectators and judges easily assess the project and results obtained. The display should use clear and concise expressions. Headings should stand out, graphs, and diagrams should be clearly and correctly labeled.

A display board stands alone with three panels. It may be two-stories tall, but make sure it doesn't topple over onto other projects.

The poster usually includes:

Identification

Name, grade, school, and type of project.

Title and Original Question

What question lurks in the student's mind to motivate the project?

Hypothesis

What is the student's "best guess" how this will turn out?

Materials Used

What materials were used? This gives judges an idea how the project was performed.

Data

What facts did the student find out? Include measurements, dates, and notes. The original data book with "field stains" should accompany the project.

Procedure

What steps did the student take to do the project?

Results and Conclusion

The conclusion might easily contradict the original hypothesis. This is perfectly good science.

Models, photographs, or drawings are often appropriate. The display board should be logically presented, easy to read, and eye-catching.

Handwritten materials don't compete well with computer-generated poster board materials.

Display as much of the project as possible. Clearly mark what can and cannot be touched, but if possible, allow people to feel the fur, touch fish skin boots, try the bow & drill firemaker, etc. Make the project as interactive as possible.

Judging Criteria

The criteria by which Elders and Western science judges evaluate each project are different. Top winners satisfy *both* groups of judges.

Rubrics that have served well for years can be found in the Appendix.

Warning! Science Project vs. Library Project

Many students go the library or internet and do exhaustive hours of work, draw good poster boards, including graphs and visuals, and don't do well in the fairs. Those students don't realize the difference between a library project and a science project.

A science project gets the student involved *doing* something. The student tries several ways of accomplishing a task, or tries different weights, lengths, sizes, colors etc. in pursuit of an answer. The results should be measurable.

A student should go to the library or internet to broaden his/her understanding, get definitions, clarify concepts or find more examples. But the project should be based on *the student's experience,* not a vicarious description of someone else's efforts.

For that reason, models of "life on the moon," "save the dolphins," or "northern lights" generally don't score well, as there is little the student can interact with. The project review group needs to work with the student to turn this type of interest into a "do-able" project that will score well with both groups of judges. Example: One student was interested in forensics. Lacking a dead body to work on, we helped her develop a related project on ballistics and the rate of burn of different types of gunpowders.

ORGANIZING A LOCAL OR REGIONAL FAIR

Location

Choose a town or village site that is economical and easy/safe to travel to/from. Be careful that no site feels left out, but take weather, safety, and amount of volunteer help into careful consideration.

Typically, the gym of a local school or National Guard Armory are used. Gyms are loud, large and impersonal. Students are used to horsing around in the gym. The gym or armory might be used for displaying projects, and another smaller room for awards and more intimate exchanges. It is hard to hear Elders speak in a gym, even with a sound system.

Season/Date

This is a much-discussed topic:

Decide if you want the local or regional fair to lead up to other fairs. Obviously, your local fair should precede these fairs if you want to send winners.

Early Fair

Some people feel that an early winter fair is better because it draws from three seasons: the previous summer, fall and current winter. Camp experiences are fresh in students' minds. A later fair is usually limited to winter activities.

The quiet period from the end of November to the second week of December has become a favorite time for many local or regional fairs.

Many school districts are shifting to project-based curricula, and find that an early fair sets the stage for all projects throughout the school year.

Later Fair

Traditionally in Alaska, science fairs have been in April. Many teachers have this timing built into their schedules.

Sports

Science fairs don't compete well with sporting events. Find the basketball schedule and work around it!

Weather

Choose months when weather isn't too bad in your region. You don't want students weathered in or weathered out for long.

Preparing for the Event

To organize a local or regional fair, ask yourselves the following questions:

- What rules guide the preparation and performance of a project?
- What rules guide the display of a project?
- What categories will the projects register under?
- What are the criteria for judging?

You determine the rules for your own fair. Borrow from others, but create your own.

School principals need to know the financial expectations placed on their budgets. Get information out *early* in the school year before travel funds are committed to other activities.

Far in advance, teachers and principles need:

- ✓ Clearly stated rules, requirements and regulations.
- ✓ Dates, times, and location.
- ✓ Judges scoring guides.

Speakers and Elders need time to prepare. The public, including parents need to know in advance the hours the fair will be open to the public.

All judges need to know the dates, times, location, and what is expected of them. Give them the scoring guide far ahead of the fair so they can think about it. Spend time with Elder judges over a cup of coffee, casually informing them of the intent of the fair and what is expected of them. Give them time to think of questions. Western science judges are very familiar with such fairs. It is foreign territory for Elders.

Also consider:

- Where will people sleep?
- How many people are expected for meals?
- Who will take care of transportation?

- Do you have all contact numbers?
- What will you do if weather is bad: cancel or postpone?

Typical Schedule

Morning

- Students set up projects.
- Students practice presentations among themselves. 30 minutes.
- Students leave projects for 30–45 minutes. Judges look at all projects, getting an overview. This is very important for judges to get an idea "How good is good?" and for judging teams to agree among themselves.
- Judging starts.

Afternoon

- Judging continues.
- Students leave, and judges confer, deciding on awards. This is a good time for team/peer building activities among students. See "Judging by Tables" on page 15.
- Judges deliberate, choosing First, Second, Third, "Best of Show", and grand prizes.

Evening

There are two options in the typical schedule:

Option #1: (This makes a shorter evening)

- After judges' deliberation, while all participants and the public are out of the room, blue, red and white ribbons are hung on all projects. Elders ribbons are on one side of the project, western science judges' ribbons on the other. Each project then gets two ribbons. Students and the public are excluded until the doors open after supper.

After supper:

- Doors burst open.
- Students and the public enter the fair site, looking at projects and associated ribbons hanging on projects.
- Awards ceremony and Elder speeches. Ribbons are given for "Best of Show" and "Grand Prize."
- "Grand Prize" and "Best of Show" ribbons are hung on projects, and all students stand by projects for pictures and questions from public for 20–30 minutes.

Option #2: (This makes a longer evening)

After supper:

- Fair site is open to the public. At this time, there are no ribbons on projects.
- During the awards ceremony, all blue, red, and white ribbons including "Best of Show" and "Grand Prize" are awarded.
- Elders give speeches.

This method gives more public recognition to every student, but can be quite long if an effort is not made to move quickly through the program.

With both options, it is very important to have students display ribbons and stand beside projects after wards so everyone can make the connection between projects and awards. It is a good "photo moment." People tend to think the fair is over when awards are over, so announce that projects must be on display for another 20-30 minutes.

Alternate Schedule

One alternative is having judging on one day and awards at a noon luncheon the next day. This gives judges time to deliberate into the evening. Confusion and hurt feelings have arisen from mistakes made while rushing judges. Perhaps small local fairs are best held on one day and larger fairs are more manageable if held on two days.

This alternate schedule allows all evening for tallying the scores and deciding on best of show among the judges. The typical schedule gets a bit frantic if there is debate between the Elders and western science judges. As the synthesis of both views is the crux of the whole effort, it should not be rushed, yet often is.

On the other hand, the alternate schedule keeps many parents from the noon awards ceremony, unless activities are planned for all day, and the awards are that night.

Organizing the event

The days of travel, particularly arrival, are often hectic. People arriving from other towns need contact numbers, location of lodging, schedules, and event locations all in a packet.

A designated driver on the day of arrival for the fair is a must. A cell phone for the driver is a *tremendous* help. Travelers should have the cell number. Getting people to planes to go home is much easier than gathering them on the first day.

Know where the extra tables, extension cords, and mops are kept. Know where the electrical breaker boxes are. Who has the keys on the weekend? What do you do in a physical emergency? How can parents call students if the school office is closed?

Administrators and janitors in the building must know what is going on and how their job will be impacted.

Designate one person to take memorable pictures or video.

If students and teachers do not know each other, it is good to have an ice-breaking activity that gets people acquainted right away.

Projects

Assign a number to each project.

All projects should be clearly labeled as to category and assigned a project number. Put a line for project number on the upper *left* of the scoring sheet. (Reasons for this will follow.)

Identifying

Each project should have a one-word identifier like “nets”, “lamps”, or “medicine.” Put this on the top of the scoring sheet.

What categories will be established? If there are few projects, they might be grouped differently. In regional fairs we use the following categories:

- Individual collection
- Individual demonstration
- Individual experiment
- Group collection
- Team demonstration
- Team experiment

The group collection could be a whole lower elementary class.

Individual	*Group*
Collection	Collection
Demonstration	Demonstration
Experiment K-8	Experiment K-8
Experiment 9-12	Experiment 9-12

We limit team projects to three participants. Sometimes we divide experiments by grade, 5–8 and 9–12 if there are enough projects, but the young folks often do quite well against the upper grades.

Online registration works wonderfully! Weather and poor postal service don’t interfere with deadlines. Put your fair on the school district website, with rules, regulations, and all information only a click away. Contact the AKRSI webmaster, fyankn@uaf.edu for help in this regard.

CRITICAL SCIENCE FAIR DATES PEOPLE NEED TO KNOW

Dates before the Fair

- ✓ Permission for projects that require approval for performance of display.
- ✓ Participant registration needs to be received or postmarked by: ______________ .

Dates and times at the Fair

- ✓ Check-in/setup
- ✓ Opening ceremony
- ✓ Judging schedule. All students must be present at their own exhibit for questioning by the judges.
- ✓ All group activities.
- ✓ Exhibits open to the public. This is important to get public support in the future.
- ✓ Dinner and awards ceremony
- ✓ Dismiss, take-down/cleanup

JUDGING

Finding Judges

Quality judging is critically important so the students feel that their efforts have been fairly evaluated.

Western science judges can be found in government agencies and local industry. Some don't relate well to students. Casually interview them before inviting them to judge. The ability to understand students and respond with compassion are more important than scientific expertise. We aren't delving into subatomic particles. Try to get a balance among judges. Biologists far outnumber earth and physical science people in Alaska.

Have several home visits with Elders before the fair to insure that they understand what is expected of them. It is best to have Elders from the community and cultural region, as the values and details of the lifestyle are unique from region to region. Elders don't always enjoy good health. Schedule a few backups in case some cannot attend.

Consider a stipend for both sets of judges, or at least a gift of appreciation.

Working with Elders

Elder judges contribute a priceless dimension to the fair. Their presence gives honor and value to all that we do.

However, since Elders have little or no experience with science fairs, there are a few precautions that go a long way towards a successful fair. Asking them to judge a fair without instruction is like dropping a teacher blindfolded on the tundra.

Avoiding problems

Try not to pick an Elder with a grandchild in the fair. Rumblings may follow.

Helper

Appoint someone who is familiar with science fairs to work with the Elders. Give them an idea of what to expect ahead of time. Tell them what the fair is for, how it will be run, why they are there and what is expected of them.

Teams

Put the Elders in teams of two to three. Each group should include someone who speaks English and is more literate. If there are many projects, there might be two or three teams of Elders. Split husbands and wives into different teams.

Scoring

The Elder scoring guide (see Appendix) identifies the judging criteria. Practice and demonstrate on a simulated project before they go out and evaluate all the projects. Put a copy of the local values on the back of your Elder scoring rubric. (See Appendix for all values.)

During the interview, Elders score each criteria on a scale of 1–5 (or 1–10 as you wish.)

Elders review the projects for their alignment with traditional Native values of that region and for their contribution to the students' village/community.

- How well did the student maintain Native values?
- Is the project important to Native/local culture, village, and community?
- Is the project of high quality, showing hard work?
- Has the student drawn upon Elders and local experts, involving the community in the research?

Elders need to understand which end of the scale signifies "best" and which end signifies "not-so-good" and what a 5 or an 8 might mean. This is best done on a relaxed day before the fair.

Timing

Elders need a sense of how much time to spend on each project. One uninformed Elder spent 45 minutes teaching one student how to set snares. No one told him what a science fair was or what was expected of him.

Idea vs. work done

Elders need to understand the difference between a good idea and a project well done. Uninformed Elders have overvalued a project with an important subject although the student's work was of lower quality.

Chairs

Have chairs for Elders to use during the interview. The person working with the Elders can move the chairs from project to project. Be certain all Elders can see and hear.

Elders' hearing must be adequate to understand the students in a large room with many noises.

Ribbons

Scoring is always hard because Elders want to encourage everyone and discourage no one. They must understand that students put different amounts of effort and thought into projects, and their job as elders is to evaluate that effort.

Blue, red and white ribbons seldom have meaning to them. They relate to "good," "better," "best."

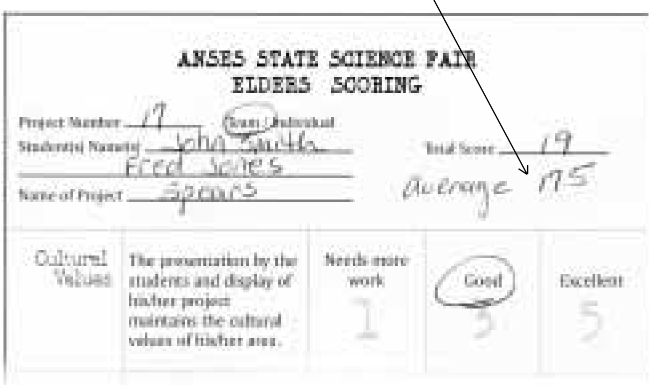
After Visiting All Projects

Give Elders a break when the score sheets are handed in.

While they are on break, on each Elder score sheet, add the scores for each of the criteria and put the total on the top *right* of that scoring sheet. Don't confuse this number with project numbers! (Which should be on the top left.)

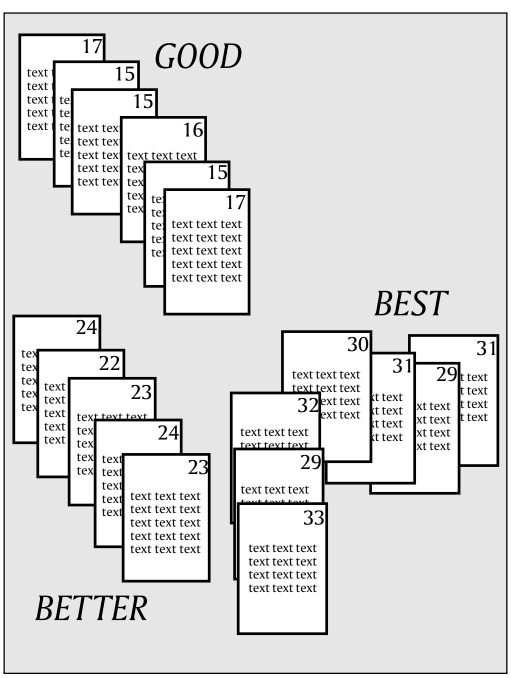
There should be a score sheet for each Elder that evaluated each project. Staple them together, project #23 with #23, #16 with #16, etc. *This is where you discover whether all projects were judged or not.* Make sure there are scoring sheets for every project! We have dismissed students before and found that all projects weren't judged.

Average the Elders' scores for each project. You can use the totals for each project, but if one judging team had three members and another two, scores will be off. Averaging overcomes that problem. Write the average on the top sheet.


ANSES STATE SCIENCE FAIR
ELDERS SCORING

Project Number 17 Team / Individual
Student(s) Name(s) John Smith
Fred Jones
Name of Project Spears
Total Score 19
Average 175

Cultural Values	The presentation by the students and display of his/her project maintains the cultural values of his/her area.	Needs more work 1	Good 3	Excellent 5



Arrange the papers in ascending or descending order.

Elders return.

Talk about the way the totals have come out. Does everyone think this is a fair rating for each project? At this point, a one word descriptor of each project is most helpful- nets, fur, moss, knives etc.

Take time on this part. Experience says elders get done before the Western science judges anyway.

Go look at projects again. Discuss the merits of each. The averaged number scores are a guide. Dialogue and consensus can overturn numbers. Do the Elders want to reevaluate a project now that the big picture is clearer? Refer to projects by name, "nets," "lamps," "deadfalls." Project numbers at this point are confusing.

Don't rush this part. Give Elders time. You might even have a meal at this point, giving them time for thought and personal conversation.

Once there is consensus that the projects are in ascending/descending order, find the breaks in the scores. There is usually a large gap between the totals, like:

18, 18, 19, 20 . . .

27, 27, 27, 28, 29, 29, 30 . . .

36, 36, 40

These are obvious natural breaks between the blue, red, and white ribbons and the levels of performance. There is no given percentage of projects that must be given each color. Let the breaks and quality of projects determine the ribbons.

Confer with Elders. Do they want to change their minds about any projects now that they have talked with each other?

WESTERN SCIENCE JUDGES' SCORING

Western science judges are acutely aware of how to judge a science fair, as they have personally participated in so many. Western science judges and Elders tally their scores separately. In the past, judges have stapled all score sheets for a given project together, averaged the scores and placed that number in the upper right corner of the top score sheet in a bright color. When that is done, they grouped the projects in three ranges: high, middle, and low. The break between the three groups is usually obvious.

The high range gets a blue ribbon, middle range a red ribbon, and low range gets a white ribbon.

Important! Because the number of ribbons required for each group is not known ahead of time, it is good to have an abundant *surplus* of ribbons of all colors. They are cheap and reusable. Remember, there are two sets of judges, so double your supply.

Two Ribbons

Each project gets two ribbons, one from the Western science judges, and one from the Elders. It is possible for a project to get one blue and one white ribbon.

Western scientist Scoring Criteria

Teacher/scientists evaluate in a demonstration or experiment:

- How well a student explained and understand the scientific principles involved (demonstration) or
  How well the student followed the scientific method? (experiment)
- Detail and accuracy of data
- Creativity and originality
- Presentation
- Conclusions
- Appearance
- Use of materials

The collection shows

- Quality and variety
- Creativity
- Good presentation
- Good data. Where and when items were discovered.

Overall Scoring

Judges look for well-planned work. They look at how significant the project is in its field and to the village community. They look for thoroughness.

Judges respond favorably to students who can speak freely and confidently about their research. They are not interested in memorized speeches. They simply want to talk with students to see if there is a good grasp of the project from start to finish. Besides asking the obvious questions, judges often ask questions outside the normal scope to test insight into research such as "Why did you pick this project?" and "What would be your next step?"

Do not be locked into numbers. Numbers are only a guide. Talk and interact when deciding on a final ribbon.

Best of show

For the ribbons that identify "Best of Show" and "Grand Prize" Western science judges and Elders should be in agreement. Sometimes this takes strong negotiating and other times it is quickly unanimous. The discussion is always healthy, as Elders get to hear what the scientists value, and the scientists better understand the Elders' viewpoint. There is no fixed number of projects in this upper category. Have extra awards on hand, but don't feel compelled to give them if the quality isn't there. Awards should be meaningful.

When the Western science and Elder judges have a hard time coming to agreement there are two ways to help work out the differences.

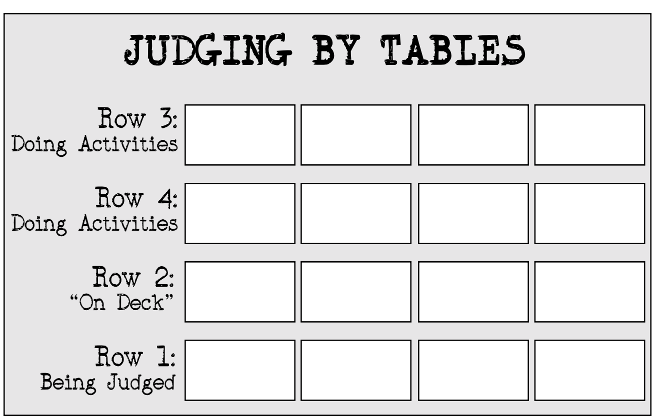
1. Revisit the projects. The judges defend their choices to the others, giving the strong points of the projects. Do this for all the contenders.
2. Usually the two teams of judges can agree on one or two projects. If there is ultimate impasse, then the Elders can pick one "Grand Prize" and the Western science judges another. This solution should be a last resort as it doesn't involve consensus.

Helpful Hints

Judge by Tables

The judging time can get quite long for students as they wait for judges to come to their project.

Have the judges interview one row of tables at a time, and tell the students in the next row of tables they are "on deck" (not in the fair room, but "no wandering.") Students from rows 3 & 4 might do activities. As soon as the first row of tables has been judged, those students are dismissed and the second row of students come into the fair site to be judged. The students whose projects are on the third row are now "on deck." All other students can be occupied with board games, or other organized activities. This keeps students from having to stand by their projects for three hours until the last projects are judged.



It while it might help to organize tables by category: experiments, demonstrations, and collections, students like to set up next to their school or friends.

Practice

After the students have setup their projects, but before the judges come to interview them, allow the students to practice on each other. This helps kill "butterflies."

Divide the students into two groups, the presenters and the interviewers. Give each a piece of paper with 1 or 2 on it. Counting off 1-2-1-2 doesn't work!

Presenters stand by their projects and interviewers position themselves in front of individual projects.

At a signal, the presenters share their project with the interviewers for 3–5 minutes, when the time is up, the interviewers rotate to another project. After this is done several times, presenters and interviewers switch positions.

The rotating begins again. This gives each student the opportunity to share his/her project to peers several times before talking to the judges.

Forms

Even if students have registered through the web, they should sign and have signed behavior, media, cultural values, and liability forms similar to those in the appendix.

Student Absent

Upon occasion, schools have sent projects without the students. Those projects seldom win high honors, but their presence contributes to the fair.

We have yet to explore the possibility of sending a project from a remote village with a video of the student being interviewed by local judges. This doesn't allow the student the opportunity to learn from other projects in the fair, nor does it allow the student the opportunity to present the project under the pressure of unfamiliar judges, but it would be better than not participating at all. It would at least allow the science fair judges the opportunity to watch and listen as the student responds to questions by other adults.

Interaction

If the fair is in a larger city, groups tend to split off to go to movies or malls. Teachers and school districts have expressed the desire that fairs be more educational, so we have tried to hold them in more remote locations. Peer building and science are more important than shopping. Those who want to shop can come earlier or leave later than the others.

Teachers and chaperones have felt the need for more meaningful interaction among the students, developing long-term, region-wide or statewide, peer relationships. The relationships will serve as a support system in college and later endeavors. Field trips , other large group activities, as well as sharing the same housing and transportation enhance this. During the State Fair, we have hired professionals to do team/peer building activities.

Group ice breakers are the quickest way to initiate interaction among people. Native Elders like students to know how to introduce themselves in a group, giving their name, Native name, name of their parents and village.

CONCLUSION

Locally relevant science fairs depart from those of the past in several ways. They are based on local knowledge using local Elders as authorities. The Western science model is followed, but traditional knowledge and values are acknowledged.

Many projects evolve from summer science/culture camps, linking camps to the classroom.

Community involvement has been extremely high. Years of experience across the state of Alaska have laid a solid foundation. The enthusiasm of the students, strength of the Elders, and support of the communities assure that culturally/locally relevant projects will long outlive AKRSI.

Science Fairs Appendix

LIABILITY FOR EXHIBITS

Every effort will be made to protect your exhibit. However, since the Science Fair Exhibition will be open to the public, the ____________________ ANSES Science Fair cannot and will not accept any liability or responsibility of any nature for any theft of, or loss or damage to, any exhibit or any other property of any exhibitor. Accordingly, it is recommended that each exhibitor take product precautions to prevent any theft, loss or damage to his/her exhibit and/or other property. Each exhibitor should secure and guard his/her exhibit and/or other property at all times during the exhibition, and remove all valuable components, especially those which are easily portable, when the exhibit and/or other property is left unguarded by the exhibitor.

I have read the above paragraph, and understand and accept that the ____________________ ANSES Science Fair cannot and will not accept any liability or responsibility for theft or damage to any exhibit.

____
Single entry participant/Team member #1 Date

____
Parent/legal guardian signature Date

____
Team member #2 Date

____
Parent/Legal guardian signature Date

____
Team member #3 Date

____
Parent/Legal guardian signature Date

____
Adult sponsor Date

MEDIA PERMISSION

The ____________________ ANSES Science Fair is a significant event and your presence there is newsworthy. The organization or businesses sponsoring awards at the fair may want to publicize their involvement in such an important science competition by using photographs or information about you. Your cooperation may make it possible for other promising young students to get involved in science.

You have my permission to use appropriate information about me for publicity purposes. This includes any photographs, videos, or likeness(es) that may be used by AISES, the First Interior Alaska AISES Science Fair, Alaska Native Knowledge Network, and/or Alaska Rural Systemic Initiative, or the sponsors for the purposes of illustrations, advertising or publication in any manner. I also consent to the use of my name in connection therewith.

Single entry participant/Team member #1 Date

Parent/legal guardian signature Date

Team member #2 Date

Parent/Legal guardian signature Date

Team member #3 Date

Parent/Legal guardian signature Date

Adult sponsor Date

CONDUCT CODE

Whenever there is a meeting or gathering under the name of AISES or ANSES the following conduct code is maintained. Having a safe environment for students and adults to learn and develop into productive community members is highly cherished by ANSES leadership and membership. Therefore we request that you read over carefully the following and sign a personal commitment to this code.

During the entire time of the Science Fair, as well as during my travel to and from the fair:

1. *I will not use or abuse any alcoholic beverages, nor drugs;*
2. *I will not engage in any verbal or physical abuse of any human being.*
3. *I will not engage in any sexual harassment nor inappropriate touching. These values are important to me and I am proud to sign this document, to confirm my commitment to them.*

____
Participant Date

____
Parent/legal guardian signature Date

! If your project is a team project, make one copy of this conduct code for each team participant. Each participant along with his/her parent or legal guardian must carefully read this conduct code and sign the code, and send or bring the hard copy to fair organizers. No student will be admitted to the fair who has not signed a copy of the conduct code.

SAMPLE FAIR INFORMATION

Date of Fair

Location of Fair
City State
Host Hotel

For more information contact:

Name of contact
Email
Phone:
Fax
Business/School
Address
City / State / Zip

SAMPLE: LETTER OF INVITATION TO PARTICIPATE

Dear Teachers and Students:

We would like to invite you and your students to the Annual Interior Alaska AISES Science Fair. The fair will be held in the gymnasium at the Howard Luke Academy, Fairbanks, Alaska. The opening ceremony is at 6:00 PM. Thursday, November 20, 1997.

Preregistration deadline is Friday, November 14. Students will set up their projects anytime between 8 AM and 5 PM., November 20, 1997

Any student of the eleven rural Interior school districts in grades 5–12 is eligible to participate in the First Annual Alaska Interior AISES Science Fair (none of whom has reached age 21 on or before November 1 preceding the fair.) All students K–4 are invited to send in their project for display on November 20.

Students are invited to wear traditional dress at the fair and at the awards dinner.

All Grades:	Projects must adhere to display and safety regulations
Grades 9–12	Every student in grades 9–12 must submit a copy of their research plan with their registration form.
All grades	Fill out and sign the registration form.

Students can select a project in any one of the categories listed. There will be 1st, 2nd, and 3rd place awards in each of these categories. Elders will select 1st, 2nd, and 3rd place winners. All students will receive a participation certificate. In addition, the overall top X projects will win an expense paid trip to XXX on April XXX where they will enter their project in the AISES National Annual Science Fair.

All registration forms and research plans will be reviewed by a committee with teacher, scientists, and Elders associated with the Alaska Native Knowledge Network. We will contact you if there is any problems or questions about your project.

Participants and chaperones are responsible for their own travel, room, and meals while at the science fair. ________________ can assist you with hotel and air travel arrangements. Please contact her at (907) XXX-XXXX.

Please read the enclosed information and guidelines carefully. If you have any questions, please contact me (907) XXX-XXXX for assistance. We look forward to seeing you in Fairbanks.

Sincerely,

____

AISES Science Fair Coordinator

SAMPLE AGENDA

Tentative Agenda, November 20-22, 1997

Location: All activities Will take place at the Howard Luke Academy Gym.

Thursday, November 20

Noon–6 PM	Judges' registration/check-in
Noon–8:30 PM	Participant check-in
Noon–8:30 PM	Project setup
6 PM	All check-in tables closed
6 :30–7:30 PM	Opening ceremony
7:30–8:30 PM	Athabascan dance and reception
7: 30–8:30 PM	Science fair committee walk through of exhibits

Friday, November 21

6:45–9 AM	Judges' registration/check-in/briefing
9:30 AM–1 PM	Grades 9–12 judging with student participants only
9:30 AM–1 PM	Grades 5–8 van tours
1 PM–2 PM	Lunch break on your own.
2 PM–5 PM	K–8 judging with students participants only.
2 PM–5 PM	9–12 van tours
6 PM–8 PM	Projects open to the public
8 PM–9 PM	Participants take down projects

Saturday, November 22,1997

1 PM–4 PM	Dinner and awards ceremony Dinner ticket for non-project participants $10.00 per person (over 18)

SAMPLE PROJECT REGISTRATION FORM, page 1

DEADLINE: Entries must be postmarked no later than November 13, 1997

To participate you must:

1. Submit this registration form by November 13, 1997 (entries must be postmarked no later than November 13, 1997).
2. Include a copy of your research plan and abstract.
3. Submit three copies of the checklist for adult sponsor, a teacher/expert in the field, and an Elder with their signatures~
4. Complete all information on this registration form.
5. Let organizers know if the student has a handicap and what accommodations are necessary to include the student.

Project Information

Type of Project:

❒ Collection ❒ Demonstration

Experiment Category Code__________ Grade Level__________

❒ Individual Project ❒ Team Project

Title of Project: (limit to ten words or fewer)

____

____

Do you require an electrical outlet? ❒ YES ❒ NO

School Information

School name______________________________

Phone________________ Fax________________

Address______________________________

City/Village______________________________

State________________ Zip________________

Email (if possible)______________________________

Chaperone________________ Phone________________

Address______________________________

City/Village______________________________

State________________ Zip________________

SAMPLE PROJECT REGISTRATION FORM, page 2

Single Entry Participant or #1 Team Member

Name____ Age______________
Nickname_____________________________________ Grade____________
Birthdate_____________________________________ Gender___________
Social Security #____
Tribal affiliation____
Address____
City/Village____
State__________ Zip________________ Home Phone_________________

#2 Team Member

Name____ Age______________
Nickname_____________________________________ Grade____________
Birthdate_____________________________________ Gender___________
Social Security #____
Tribal affiliation____
Address____
City/Village____
State__________ Zip________________ Home Phone_________________

#3 Team Member

Name____ Age______________
Nickname_____________________________________ Grade____________
Birthdate_____________________________________ Gender___________
Social Security #____
Tribal affiliation____
Address____
City/Village____
State__________ Zip________________ Home Phone_________________

Committee Schedule:

1. Before (date) the science review committee will review and approve experimental procedures of projects that require prior permission to make sure they comply with the Athabascan values and scientific method.
2. On November 20 the science review committee will review the project displays of the same projects to make sure the students followed their research plan and the Athabascan values.

CHECKLIST FOR ADULT SPONSOR,

Science Teacher/Expert in the Field and Elder

Student Name ______________________________ **Grade**__________

I have reviewed and signed the research plan. ❐ Yes ❐ No

The student and parent/guardian have signed the research plan. ❐ Yes ❐ No

SA = Strongly Agree
A = Agree
N = Neither agree nor disagree (or does not apply)
D = Disagree
SD = Strongly Disagree

In your opinion this project reflects or maintains the following values:
(circle the letters that most closely fits your opinion)

Self-Sufficiency	SA	A	N	D	SD
Hard Work	SA	A	N	D	SD
Caring	SA	A	N	D	SD
Respect For Others	SA	A	N	D	SD
Village Cooperation	SA	A	N	D	SD
Responsibility to Village	SA	A	N	D	SD
Family Relations	SA	A	N	D	SD
Respect for Elders	SA	A	N	D	SD
Respect for Knowledge and Wisdom From Life Experiences	SA	A	N	D	SD
Respect for the Land and nature	SA	A	N	D	SD
Practicing Native Traditions	SA	A	N	D	SD

____

Signature Role Date

The Alaska AISES Science Fair will support and endorse the local Native values during the fair. *The Elder judges will evaluate projects on their ability to maintain local Native values.*

SCORING RUBRIC: DEMONSTRATION
ANSES SCIENCE FAIR

Project Number__________ Team / Individual (circle)

Student(s) Name(s)____________________________ Total Score ______________

____

Name of Project ______________________________

Demonstration	2 The student has done a demonstration, but has not connected the process to science. There isn't a good understanding of the "how and why" of the subject.	4 The student understands the project and has made some connection to the scientific principles involved.	6 The student has identified the science principles involved in the demonstration. He/she has shown clear and thorough knowledge of how and why the demonstration operates.
Data	1 Data is somewhat disorganized. Difficult for reader to understand the results. Data was collected, but not enough for conclusive results.	2 The data is organized and tells the reader what happened. Enough data was collected to make adequate conclusions.	3 The data is overtly organized and displayed in several ways including graphs and charts. There was enough data for conclusive results.
Creativity & Originality	1 This project has been done before, and shows no deviation from the past.	2 This project might have been done before, but shows insightful adaptations with original approaches.	3 The project combines western and traditional science in a fresh way. The questions asked, methods used and conclusions drawn are freshly insightful.
Presentation	1 Speech is too soft. Presenter lacks confidence, knowledge of subject, and enthusiasm.	2 Speech, confidence, knowledge, and enthusiasm are adequate.	3 Speech, confidence, knowledge, and enthusiasm are inspirational.
Conclusions	1 No connection is made between the question, hypothesis & data collection. A vague reference is made as to how this project could be improved.	2 Conclusions are clearly stated. An adequate description is made as to how this project could be improved.	3 The student has made insightful connections between the question, hypothesis, and data collection.
Appearance	1 More work is needed to make the display neat.	2 The information is displayed clearly and neatly.	3 The project commands attention, is extremely neat and easy to read.
Use of Materials	1 Materials used were not appropriate and/or safe.	2 Materials were used appropriately.	3 Materials were used appropriately and creatively.

SCORING RUBRIC: EXPERIMENT
ANSES SCIENCE FAIR

Project Number__________ Team / Individual (circle)

Student(s) Name(s)____________________________ Total Score ______________

____

Name of Project ______________________________

Scientific Process	A question was asked, but not well pursued. This is more of a library project than a hands-on science project. 2	Clear hypothesis, data gathering, and performance of experiment or observation. The project requires hands-on activity, organized thinking, and good observation skills. 4	Exceptionally well done with insightful performance and conclusions. The student was immersed in the project, trying several methods, even unsuccessful ones. The student thoroughly explored the original question. 6
Data	Data is somewhat disorganized. Difficult for reader to understand the results. Data was collected, but not enough for conclusive results. 1	The data is organized and tells the reader what happened. Enough data was collected to make adequate conclusions. 2	The data is overtly organized and displayed in several ways including graphs and charts. There was enough data for conclusive results. 3
Creativity & Originality	This project has been done before, and shows no deviation from the past. 1	This project might have been done before, but shows insightful adaptations with original approaches. 2	The project combines western and traditional science in a fresh way. The questions asked, methods used and conclusions drawn are freshly insightful. 3
Presentation	Speech is too soft. Presenter lacks confidence, knowledge of subject, and enthusiasm. 1	Speech, confidence, knowledge, and enthusiasm are adequate. 2	Speech, confidence, knowledge, and enthusiasm are inspirational. 3
Conclusions	No connection is made between the question, hypothesis & data collection. A vague reference is made as to how this project could be improved. 1	Conclusions are clearly stated. An adequate description is made as to how this project could be improved. 2	The student has made insightful connections between the question, hypothesis, and data collection. 3
Appearance	More work is needed to make the display neat. 1	The information is displayed clearly and neatly. 2	The project commands attention, is extremely neat and easy to read. 3
Use of Materials	Materials used were not appropriate and/or safe. 1	Materials were used appropriately. 2	Materials were used appropriately and creatively. 3

SCORING RUBRIC: COLLECTION
ANSES SCIENCE FAIR

Project Number__________ Team / Individual (circle)

Student(s) Name(s)____________________________ Total Score ______________

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Name of Project ______________________________

Quality/ Variety	**1** The collection shows interest but there could have been many more samples. Some samples are of poor quality.	**3** Most local samples have been collected. The samples are of good quality.	**5** The collection is thorough. The local possibilities have been ehausted. The samples are of high quality with all sizes, colors, types and shapes possible.
Creativity & Originality	**1** The collection shows little original thought.	**3** There is evidence of creative thought in the gathering and presentation of hte collection.	**5** There is clear evidence of creative thought and ingenuity.
Presentation	**1** Speech is too soft. There is little enthusiasm or interest. The display is not organized.	**3** Speech is loud, clear and thoughts are orderly. The display is organized and understandable.	**5** The presentation is loud, clear and orderly, given wtih enthusiasm. The display is clear, attractive and easy to understand.
Data	**1** There is no data about where and when the samples were taken.	**3** There is some ata indicating where an when the samples were collected.	**5** The data of where and when the collection was made is very understandable.

ANSES STATE SCIENCE FAIR
ELDERS SCORING RUBRIC

Project Number__________ Team / Individual (circle)

Student(s) Name(s)____________________________ Total Score ______________

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Name of Project ______________________________

Cultural Values	The presentation by the students and display of his/her project maintains the cultural values of his/her area.	Needs more work 1	Good 3	Excellent 5
Quality Project	The student's work is well done. The project is organized and attractive. It shows good thought. The presentation is clear and confident. The discovery process is evident as used in village life.	Needs more work 1	Good 3	Excellent 5
Importance	The project is a study of something that is important to the land, village and community.	Needs more work 1	Good 3	Excellent 5
Community Resources	There is clear evidence that the student consulted with one or more community Elders, local experts and other cultural resources.	Needs more work 1	Good 3	Excellent 5

ALASKA NATIVE VALUES

Kodiak Alutiiq Values

- Our Elders
- Our heritage language
- Family and the kinship of our ancestors and living relatives
- Ties to our homeland
- A subsistence lifestyle, respectful of and sustained by the natural world
- Traditional arts, skills and ingenuity
- Faith and a spiritual life, from ancestral beliefs to the diverse faiths of today
- Sharing: we welcome everyone
- Sense of humor
- Learning by doing, observing and listening
- Stewardship of the animals, land, sky, and waters
- Trust
- Our people: we are responsible for each other and ourselves.
- Respect for self, others, and our environment is inherent in all of these values

Yup'ik Values

- Love for children
- Respect for others
- Sharing
- Humility
- Hard work
- Spirituality
- Cooperation
- Family roles
- Knowledge of family tree
- Knowledge of language
- Hunter success
- Domestic skills
- Avoid conflict
- Humor
- Respect for nature
- Respect For land

Athabascan Values

- Self-sufficiency and hard work
- Care and provision for the family
- Family relations and unity
- Love for children
- Village cooperation and responsibility to village
- Humor
- Honesty and fairness
- Sharing and caring
- Respect for Elders and others
- Respect for knowledge & wisdom from life experiences
- Respect for the land and nature
- Practice of Native traditions
- Honoring ancestors
- Spirituality

Tlingit Values

- Respect for self and others, including Elders
- Remember our Native traditions, our families, sharing, loyalty, pride, and loving children
- Responsibility
- Truth and wise use of words
- Care of subsistence areas, care of property
- Reverence for the Creator
- Sense of humility
- Care of human body
- Dignity
- Peace with the family, neighbors, others, and the world of Nature

Iñupiat Ilitquasiat Values

- Knowledge of language
- Sharing
- Respect for others
- Cooperation
- Respect for Elders
- Love for children
- Hard work
- Knowledge of family tree
- Avoidance of conflict
- Respect for nature
- Spirituality
- Humor
- Family roles
- Hunter success
- Domestic Skills
- Humility
- Responsibility to tribe

Experiments

Introduction

Ideas for science projects are endless. Science inquiry involves exploring and adventure. There is no better place for science exploration than villages as there are so many questions that have not been asked or answered by scientists. A village project could be the first of its kind.

This book shows students how to pick and develop an exciting project.

THE QUESTION

Science projects start with questions.

- Why does this happen?
- Why did my grandpa do it that way?
- What is the reason for shaping it like that?
- What material is the most durable for this purpose?
- Etc.

The question should come from your personal life, from a problem, from something you have wondered about for a while.

A science project is exploring the world of how and why.

THREE TYPES OF PROJECTS

There are three types of projects:

- Collections
- Demonstrations
- Experiments

Collections

Lower grades do collections. Students learn about shapes, sizes, how something feels, what is different, what is similar. They learn how to accurately observe, compare and record data. Collections might be of leaves, rocks, shells, types of nails, pictures, etc. Organize the collection in the way people can easily understand. Record when and where samples were collected. See the list on page 13 for suggested collections.

Demonstrations

Demonstrations show how an activity is done, how something is made or operated. Middle grades often do demonstrations. A demonstration might be of how to make a deadfall trap, throw a spear with an atlatl, reload bullets, render seal oil, sharpen tools to work with wood, store berries, etc.

A student should identify the science principles involved in a demonstration. A deadfall trap involves understanding friction and gravity, kinetic and potential energy, as well as animals eating habits. Throwing a spear with an atlatl involves understanding levers, wind resistance, balance, and inertia. Rendering seal oil involves understanding heat and chemical reactions as well as facts about seals.

Experiment

A good experiment is doing a comparison using a fair test. We could compare which size shot is most effective in hunting geese, #2 or #4. We could compare seal oil with vegetable oil in a lamp. We could compare one fishing lure against another when hooking through the ice.

A good experiment is simply a fair test. If I test my shotgun with #2 shot on a windy day and #4 shot on a calm day, that isn't a fair test. If I use a big wick in the seal oil lamp and a small one in the vegetable oil lamp, that isn't a fair test. If I use one fishing lure in shallow water and the other lure in deep water, that also isn't a fair test.

Observe and Think Experiments

While we would like to control the experiment, often the variables are far out of our control, like the amount of snowfall in a winter, the activity of the northern lights, or the conditions for a good berry year. We must observe, identify what is influencing the outcome, record, compare, and think about our data in order to come to a good scientific conclusion.

Is there a connection between the height of the fireweed in September and the amount of snow the following winter? We control none of the variables. We must observe and measure accurately for several years and then think about the data before coming to a conclusion.

Will the river flood this year? What are the conditions? We control none of them. We must measure, record, compare, and think about the facts. We need the data from several years before we can come to a conclusion to the question. Knowing the answer could save much trouble for a village.

Developing a Science Fair Project

FIND A TOPIC / DEVELOP A "BIG QUESTION"

Find a topic of personal interest. See the connection between the subject and your life. Once that connection is made, you will have the energy to carry you through the tough places.

You will be the expert when you are done.

All year long you should be looking and thinking about a science project. When you run into a problem, store it in your memory until the time to develop science projects.

A science project is the opportunity to get school credit and use school resources to find out something you have been wondering for a long time. If you do well, you could even take a trip to the state or national science fairs.

DECIDE WHICH KIND OF PROJECT YOU WILL DO

Decide if you are going to do a collection, a demonstration, or an experiment. Grades K–5 can do any of the three. Grades 6–12 should do a demonstrate or an experiment. Grades 9–12 should do an experiment.

PICK A PROJECT

Pick a project that is interesting and one you can do. "How can I save the dolphins?" is not a do-able project in an Interior Athabascan village. Pick something that you can observe or test in your home village. "Do the trees on the hills always turn black just before the weather warms up in the winter?" That is do-able. Why did our ancestors have fringes on their buckskin clothing. That is do-able.

Studying and experimenting with the material in snowmachine tracks is an easy one in the village. It is do-able.

Test which tastes better: campfire coffee, percolated coffee, or filtered coffee. That is do-able.

"Lunar landings" is not do-able. Pick something you can get your hands on, observe, test, and prove.

A student said, "I want to do thunder." I said, "How do you do thunder?'" You might study thunder in a library, but that is a library project, not a science project. How would you make thunder and test it?

There are many suggested projects in this part of the book, some of which have never been done before. The results will surprise everyone.

CHANGING PROJECTS

As you start on your project, a new question might arise that seems more interesting than the one you started with. It's okay to change your project once, but students who change twice or change too late are not ready on the day of the science fair. If you think of a new topic late in your current project, save it for next year. You'll need a project then too.

SOURCES AND RESOURCES

There are many sources for science project ideas.

Your Own Imagination.

Your own imagination and curiosity are the best source of projects and ideas. If you work on a question that has arisen in your life, your interest and energy level will be high. Why does the water spray your back when you have no rear tire guard on your bicycle? Why do unripe blueberries give you a stomach ache?

Classmates

Brainstorm (bubble) with your classmates about things people your age are interested in. Write everything down. From one of these bubbling sessions someone got the idea to experiment on the signals given by a TV remote control. Do the signals go through pillows? Do they bounce off or go through walls? How far do they travel?

Village People

Ask questions of people in your village. Do outboard motors really go faster after dark or is that a trick our eyes play on us? There are many things the Elders know that are worthy of testing. Their knowledge has come from generations of scientific observation. Most villages have someone who is an "expert" in what we are interested in. Go to that person and ask questions. Someone knows guns better than others. Someone knows tanning better than others. Someone knows winter travel better than others. Local Elders are the best resource.

Teachers and Books

Books have suggestions. Teachers do too. However, the ideas must perk your interest. This book is full of Alaska science ideas and projects. Perhaps a few will excite you. Libraries, magazines, and internet have many answers, but are usually lacking in traditional Alaska information.

There is a big difference between a library report and a science project. *Science pr ojects involve doing.* Do library research about your project, but find a project you can get your hands on and do some discovery.

PROCEDURE FOR A COLLECTION

Find something you would like to collect. Often collections are more fun when they are done by teams. See the suggestions for collections on page 13 for ideas, but you should pick something you are interested in. It takes time to make a good collection. Don't wait until the last minute. Plan ahead so you don't rush.

Start your collection. Keep your samples in a safe place. Do they need to be dry? Damp? Frozen?

Record where you got each one from and when you got it.

Organize your collection. How does the collection make sense to you? You might organize the samples by type, by color, in the order that you found them, by location that you found them, etc. There are many ways to organize a collection. Can you later add to your collection without disorganizing it?

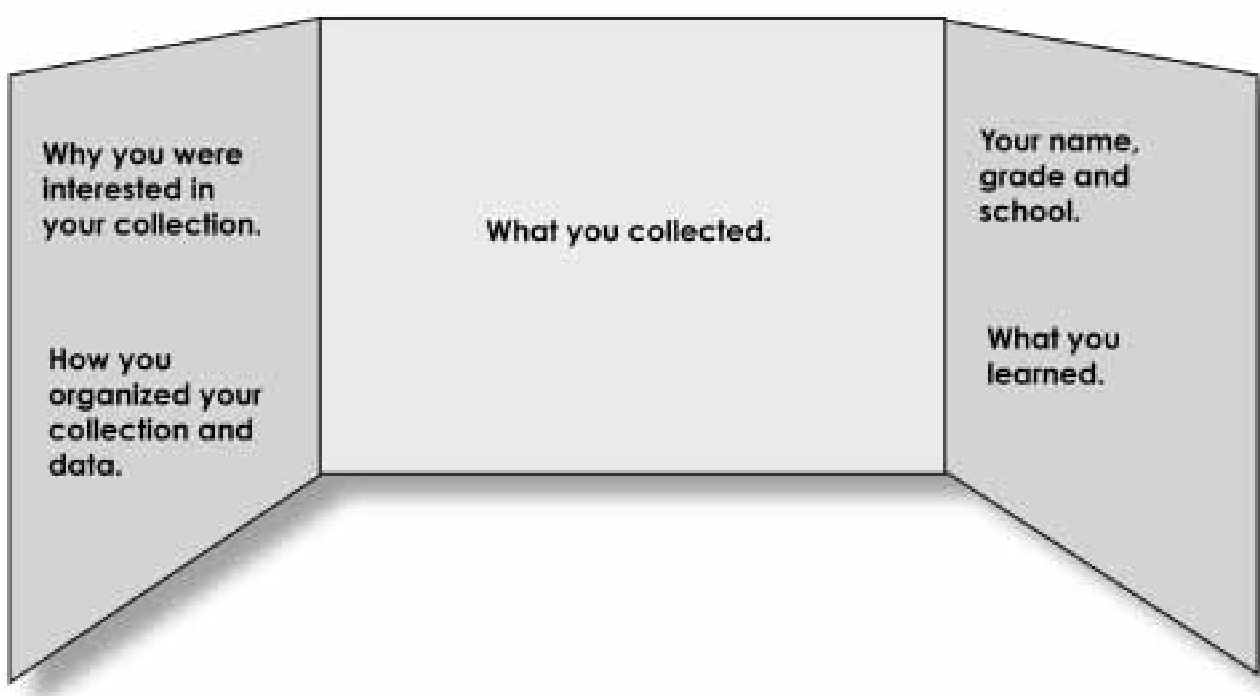
Look closely at your samples. Look at them under a magnifying glass. Look at them from all angles. Do you want to weigh them? Measure them?

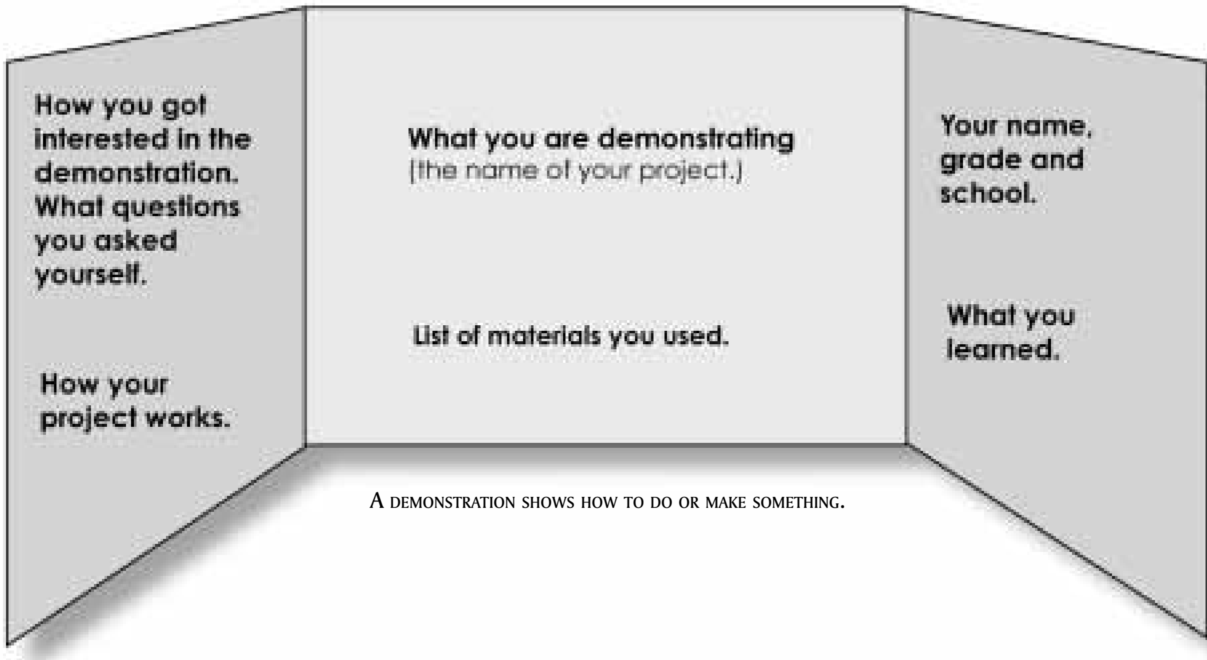
How will you display the collection? How will you store it again after showing it to others?

Decide how to present your collection. If you are going to enter your collection in a science fair, see the judges scoring rubric in the appendix following the section on "Culturally Relevant Science Fairs". The judges will use a scoring sheet something like this one. Can you change your collection in any way to score higher?

If you are entering a science fair, you might want to organize your poster to look something like the one below.

If you can't keep your samples for long, be sure to take pictures.





A DEMONSTRATION SHOWS HOW TO DO OR MAKE SOMETHING.

PROCEDURE FOR A DEMONSTRATION

Choose a demonstration of something you are interested in. Demonstrations can be done by teams. If you will be part of a team, pick team members who will work as hard as you do.

Once you have chosen something to demonstrate, **find out** as much about it as you can. Talk to Elders and local experts who know about it. Don't wait until the last minute. Start early. Good information doesn't come quickly. Think about your demonstration.

Try many ways of doing the demonstration. Try different materials. Try different methods. Try different sizes at different times. Is there a traditional way and a modern way to do the same thing? Explore what you are doing in every way you can think of.

Be sure a teacher says the demonstration is safe and a local Elder says the project is okay for your village.

With teacher help, **find** the science principles involved in your project.

Study those principles. Do you see them working in other places in your community?

Look at the judges scoring rubric in the appendix. Is there anything you can do to your project to make it score higher with the judges?

Make a poster board. Your poster might follow the form above. Make it attractive.

If your demonstration is safe enough to show in the science fair, **decide** how you will show it to people. Will you allow them to try it? Will you let the judges try it? Will you do the demonstration, show only the results, make a model, make a video, or have pictures?

PROCEDURE FOR AN EXPERIMENT

Pick an experiment that you are interested in and that is do-able.

Ask a question about your project. This is the main focus of your experiment. What are you trying to find out? What are you curious about? Start with one big question, not two or three. "What kind of set is best for marten: pole or cubby?" "Which local natural plant is most effective for curing infections?" "Why do air holes form on certain lakes even during cold weather?"

Make a guess what you think is right. How do you think the experiment will turn out? This is your *hypothesis* .

"I think the smoke goes up the stovepipe because warm air is lighter than cold air, and the smoke is warm." "I think the green net catches more fish because the fish can't see it in the water of the lake."

Plan a fair test to see if your hypothesis is right. Do the test one way then another. Perhaps you will test which shape of canoe paddle is the quietest for hunting. Get two paddles of different shapes and paddle in identical ways with the only variable being the type of paddle. Perhaps you will test which type of skin is more durable for mukluk bottoms: moose or seal. Make mukluks with one bottom of moose and the other one of seal. Wear them for two or three months. Compare the wear.

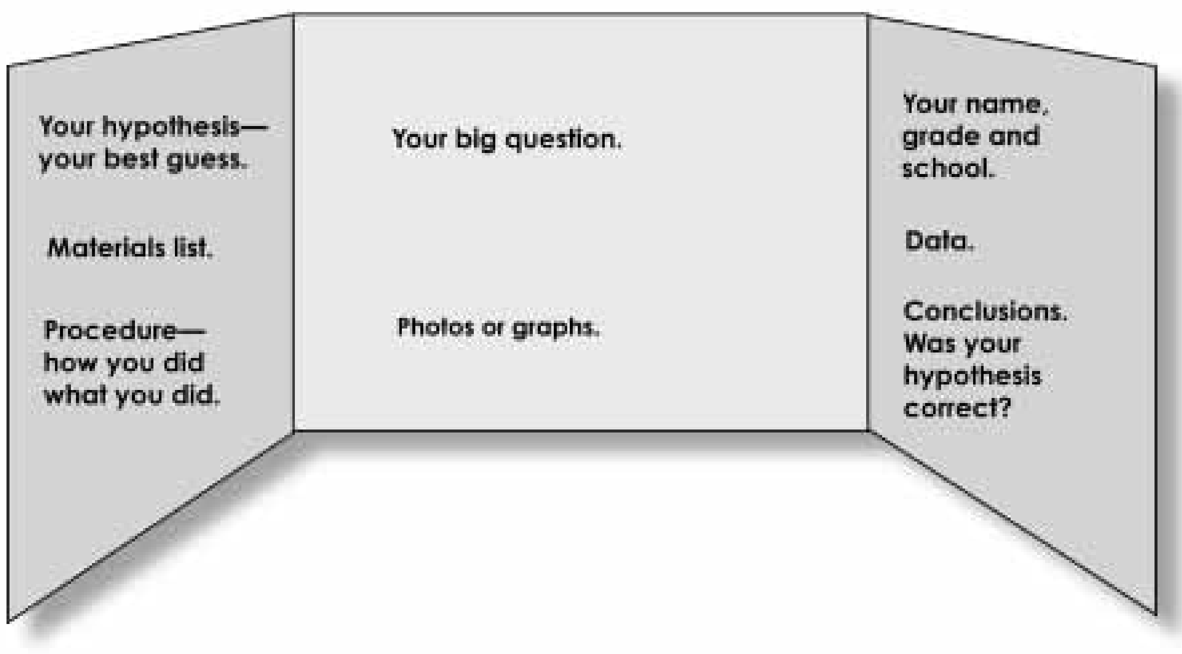
Record on paper what the results are. Observe, measure, weigh, time, etc. This is your data sheet. You might want to show your data in a graph so people can get a picture of your results.

Make a materials list. What materials did you use in this experiment?

Come to a conclusion. Was your hypothesis right or wrong? Why? How could you perform the experiment again to get a more accurate result. What did you learn? Do you want to take the experiment farther? Have new questions risen? What are the village applications of your findings?

Remember, many science projects have won science fairs with a failed hypothesis.

There are many suggestions for experiments included in this book.



Finding and Developing a Science Fair Project

1. Decide which **kind** of project you will do
2. Get ideas for a project
3. Go to your local sources

COLLECTION

- ✓ Find a project that is interesting
- ✓ Find out about your project from local Elders and experts
- ✓ Start your collection
- ✓ Organize your collection
- ✓ Look closely at your samples
- ✓ Decide how to present your collection, including an attractive poster

DEMONSTRATION

- ✓ Choose a skill or activity you are interested in
- ✓ Find out as much as you can about your project. Go to local Elders and experts
- ✓ Be sure the project is safe and culturally appropriate
- ✓ Try many ways of doing the demonstration
- ✓ Find the scientific principles involved in your demonstration
- ✓ Study those principles
- ✓ Look at judges scoring rubric. Improve your project
- ✓ Decide how you will present the demonstration to the judges and public
- ✓ Make an attractive poster and display

EXPERIMENT

- ✓ Pick an experiment that is interesting and do-able
- ✓ Ask a clear question about your topic. Go to Elders and local experts
- ✓ Make a good guess what the answer is. This is your hypothesis
- ✓ Plan a fair test to see if your hypothesis is correct
- ✓ Record the results. This is your data
- ✓ Make a materials list that shows what you used to do the experiment
- ✓ Come to a conclusion. Was your hypothesis correct or not?
- ✓ Plan your presentation including an attractive poster

Examples of "Observe and Think" Projects

There are times when we cannot control all the forces working in a situation, yet we want to learn what is happening and why.

Scientists want to know why some years there are many salmon returning to Alaska and other years there are few. There are many factors, or variables involved in the life cycle of the salmon. Any number of them could increase or decrease the number of salmon returning.

We wonder if the river is going to flood during breakup. Again there are many factors involved, yet we control none of them.

We wonder why some years there are lots of blueberries and other years there are only a few.

We want to know if, when the loon calls, there will be a strong wind within a day.

How can we study situations like that? We cannot do an experiment. We can only observe and think.

When we do an experiment, we control all the variables. We set up the project and greatly influence its outcome. When we do a project based on observe and think, we try to influence the outcome as little as possible. If we try to observe the nesting habits of ducks and geese by paddling up to the nest every day, we will be observing how they respond to us, not how they nest.

BREAKUP

Will our village flood when the river breaks up this spring? The first step in finding out whether it will flood or not is to go to the Elders and ask them what things influence breakup the most. They will probably identify:

- The amount of snow in the mountains.
- The thickness of the ice.
- The rate the snow melts and runs off before breakup.

If there is lots of snow in the mountains and it runs off quickly, and the river ice is thick from a cold winter, the ice will probably jam and the village will flood.

If there isn't much snow or if the snow melts gradually, and if the ice is thin, the river probably will not flood.

However, some years there might be little snow in the mountain, but the rate of runoff is fast. Many combinations are possible.

While we cannot control the amount of snow, we can measure its depth. We can weigh it or melt it to see how much water is in each foot of packed snow.

While we cannot control the thickness of the ice, we can measure it daily.

While we cannot control the rate the snow melts, we can record the number of days the temperature is over 32 degrees, and the number of hours each day the snow is melting.

As a long term project, do this.

- Measure the thickness of the river ice in several locations. Do this every two weeks for two months before the expected breakup. You might have to auger a hole in a slightly new place each time, as the edge of the previous hole will round off in the current, making measuring difficult.
- Measure the depth of the snow every day or every other day from March 15 until breakup. Do this in several locations: in the shade, in the sun, in a snowdrift, etc.
- On a calendar, record the days that the temperature is over 32 degrees and the number of hours each day that the temperature is over 32.

Record that information for several years, and record how high the water and ice come up (or over) the river bank. You should be able to predict in a future year whether the river is likely to flood the village or not.

This is a good science project, but it will take many years before a good conclusion is possible.

BERRIES

We would like to predict whether or not there will be lots of berries in a given location. There are several things that influence this.

- Is there a late frost that kills the spring buds?
- Is there enough rain at the right times to nourish the plants during the summer?
- Is there enough sunshine during the summer?

We do not control the sunshine, the temperature or the rainfall. We can, however, faithfully record them. We can also record the amount of berries in a measured location.

- Record the weather in the spring. Note any frosts after the blueberry blossoms have started to form.
- Record the number of sunny days and rainy days on a calendar. Note the stage of development of the berries, bloom, bud, green, turning blue, and blue.
- Stake out an area in your favorite berry patch. Record how many berries you get from that area.

When you compare the information from one year to the next, you should be able to determine what makes a bumper crop of berries in one year and lean times the next.

ANIMAL BEHAVIOR

Science projects that involve animal behavior often are observe and think type projects.

Camprobbers (Grey Jays)

We can do an experiment to test which food a camprobber prefers by putting out several types of food on a piece of plywood and protecting it from the squirrels. However, we cannot do an experiment to determine where the camprobber will store the food. For that we need binoculars and lots of patience. Do an "observe and think" project similar to this with birds or animals in your area.

QUESTIONS WE DON'T UNDERST AND

Often we run into a problem we do not understand. We cannot do an experiment because we don't know what is happening.

Campfire Smoke

For years I wondered why smoke followed me around the campfire. I couldn't think of a good experiment because I didn't have a clue. Once I observed and thought about it for several years, I finally had enough information to do a few simple experiments.

Backfiring

My son-in-law observed that his snowmachine would backfire after the weather turned from warm to cold. He couldn't do an experiment. By observing for a long time, he figured it out. The problem was frost forming in his tank when warm weather turned to cold.

With that information, he did an experiment. He kept his tank full during the time the weather was warm. There was no air in the tank to release moisture when the temperature dropped. His snowmachine never backfired again.

Mosquitoes

I would like to find out what causes the changes in the mosquito population from one year to the next. To be honest, I don't know all the factors that are involved. In order to find out why there are many or few mosquitoes, I must first find the factors that influence their growth and development. Perhaps the larvae have predators that are more active one year than another. Perhaps the temperature isn't right for them. I know that there must be puddles when the larvae can hatch. Perhaps the swallows and other birds that eat mosquitoes are more plentiful one year or another. Perhaps the female mosquitoes couldn't find enough blood in the previous year to nurture the eggs.

Observe and think

A good experiment will give a clear answer to a question. However, many situations—particularly those with weather and living things—cannot be done by experiment. Observing and thinking over a long period of time is the only way to come to a good conclusion.

200+ Ideas for Science Fairs!

IDEAS FOR COLLECTIONS

Rocks
Shells
Berries
Pressed flowers
Beads
Pictures
Books
Calendars
Fur samples
String games
Buttons
Knives
Musical instruments
Bottle caps
Keys, Key chains and rings
Types of yarn
Bullet cartridges
Animal teeth or claws
Bones
Net samples
Driftwood
Animal tracks (impressions)
Baskets
Traditional music
Empty birds' nests
Tools
Nails, screws, fasteners
Types of string, rope, or cloth
Knots
Spark plugs
Outboard props
Cards of all kinds
Sparkplugs

IDEAS FOR DEMONSTRATIONS

Net hanging
Setting a net: under the ice & in the summer
Drifting with a net
Spear throwing
Accurate rifle shooting
Reloading bullets
Engine trouble shooting
Piloting a boat
Gold panning
Skin sewing
Caribou tufting
Basket making, birch bark, roots, grass, etc.
Skinning animals
Traditional drumming & singing
Boatbuilding
Sled construction
Fish cutting
Knife sharpening
Animal butchering
Setting traps
Skinning & stretching fur
Carving
Fly tying
Fly fishing
Preserving berries
Cutting fish
Navigating
Drum making
Traditional knots & lashings

WINTER

- Why do I feel cold when I walk away from a campfire? Haven't I been warmed? How can I test this?
- In the winter, why is the temperature lower at sunrise than in the middle of the night?
- Why does a trail get hard in the winter several **hours** after the person or animal makes the tracks? How do people use this to determine the direction an animal is traveling in deep snow?
- What is the weight/surface-area-of-foot ratio of different land animals? Is there a relationship between predators and prey?
- Why do birds like to sit on power lines? Warmth? Vibrations? See predators?
- What kind of birdseed do the birds in your area prefer? What is the best location, height, and situation for a birdfeeder? Experiment with ways to keep the squirrels out.
- What is snow blindness? Why is snow blindness more of a problem on a cloudy day and what did oldtimers do to prevent it? Explore this in terms of reflection and wavelengths of light energy.
- Being undetected is very important during winter hunting. Test the difference in the conductivity of sound in warm or cold air. Would you rather hunt in warm or cold weather as a result of your findings? What effect does wind have on the transmission of sound? What effect does snow on the tree branches have?
- What did people use before plastic sled runners and what were the implications? Compare traditional runners and modern technology for the coefficient of friction.
- Why do some sled runners run better on drifted snow and others on powder snow? What is the existing color code for plastic dog sled runners? What does the difference have to do with the effectiveness of the sled runners under different snow conditions?
- Some people laminate sled runners. Other people bend a solid piece of wood. Which is stronger or better? Why?
- Steam different kinds of wood. Does this make bending sled runners and handlebars easier? Which is better: The inside of the tree on the outside of the bend, or the outside of the tree on the inside of the bend?
- Steaming makes bending easier. Does it effect the strength of the wood later? How can you test this?
- Observe the different types of snow under a microscope. What are the differences in their appearance, density, and texture?
- Some dogs' feet "snowball" easily and others don't. Why? This has always been critical when mushers select sled dogs.
- Which is warmer, grass liners or felt insoles? What are the advantages of each?
- What is the effect of (straw) bedding on sled dogs. Estimate how much dogfeed is saved by using grass or straw bedding for dogs.
- Why is it hard to breathe in a strong wind? What effect does Bernoulli's principle have to do with emergency snow shelters in survival situations?
- Mukluks vs. bunny (vapor barrier) boots. They are so different, yet both are exceedingly effective in cold weather. Compare and contrast their effectiveness. How do these differences parallel traditional sod houses and modern houses with insulation and a vapor barrier?

- Collect some of the liquid that is present in the knee and ankle joints of a caribou or moose. What is the freezing point of that fluid? Test the friction of the joint with and without this fluid. Is the fluid soluble in water or oil? Why doesn't it freeze in severe cold temperatures?

WEATHER

- How can you tell the weather by the behavior of willow grouse in the winter?
- Eagles and other birds soar in front of cliffs. Cranes circle in thermals on the tundra in the fall. What air currents are they taking advantage of? What is a thermal?
- Why do caribou often head into the wind? Why do dogs turn around before laying down outside?
- Winds and temperatures aloft are often different from the winds on the ground. Why is this? Explore inversion. What is mechanical turbulence? What is wind shear?
- What is the cause of fog on the ocean or rivers? Can this be simulated?
- How did the oldtimers tell direction in the tundra wintertime? Is this accurate compared with a compass?
- What are the weather signs in your area?
- What do the different types of clouds mean in terms of coming weather? What direction do your storms come from? What direction do your high pressure areas come from?
- Do the hills appear black just before the weather warms in the winter? If so, why?
- What phenomenon causes the tops of the hills and mountains to appear upside down during a winter cold spell?
- People say that a red sky at night means good weather the next day. Red sky in the morning means bad weather during the day. Is this so and why?
- Oldtimers said if the fog goes up on a summer morning it will be cloudy all day. If the fog goes down, the sky will be clear all day. Is this so? Why?
- Is there a correlation between the loon calling and a wind following? In other words, is the loon predicting or calling for wind?
- What do "sun dogs" tell you about the weather in the winter? Does it matter which side of the sun they are on?
- Oldtimers say that if the moon's crescent is up like a bowl, there will be more snow than if it is sideways. Does science prove this out?
- What do twinkling stars mean regarding the weather in the winter?
- What does a ring around the moon mean and why is this so?
- Why do the river or open leads in ocean ice produce fog? Under what conditions is this so?
- Is there a correlation between the size of the beavers' feedpile and the severity of the coming winter? Can the beavers foretell an early freezeup by completing their feedpile early?
- Is there a correlation between the height of fireweed in the fall and the depth of snowfall the coming winter?

FUR

- Why don't wolf and wolverine ruffs frost like other furs? (Or do they frost but don't hold the frost?) Why do men's beards frost easily and remain frozen? Compare with microscopic inspection and other tests.
- What are the insulating values of different furs?
- What clothing materials act as the best windbreak? How do modern materials compare with traditional furs?
- Tanning. What percentage of traditional tanning softness comes from chemical breakdown of the fibers and what percentage comes from physical breakdown of the fibers?
- Collect some caribou and moose hair. What is the difference between these hairs and beaver or otter hair? People say that caribou hair is hollow. Is it? What is the difference between caribou hairs in different seasons? What is the difference between the guard hairs and the under hairs on a beaver? Which part of a moose or caribou have the toughest fur? The thickest fur? Why?
- During cold days in winter our noses are often runny. When we wipe them on store-bought mittens or gloves they quickly freeze up. When we use beaver mitts, they don't freeze at all. They remain clean all day. Why is this? Is this also true of other furs like seal, otter, mountain squirrel, etc.?
- What is the pH of traditional tanning solutions? How does this compare with modern tanning techniques? In traditional tanning, the urine of men was used, but not the urine of women. Is there a difference in the pH of men's urine and women's? Why? Can this also be a factor of diet?

FOOD

- Traditional ways of storing berries: What are they and why is each effective? Before most villages had freezers, we packed blueberries in sugar and they didn't spoil. Why is this? You would think sugar would make them ferment more quickly.
- Why are berries bright colors? What is accomplished by this? What happens to the seeds of the berries we eat? What is the difference between the seeds of the berry and the surrounding sweet berry material? How resistant to acid are the seeds? What would happen if this were not so?
- Why do fish spoil at 35° and meat is able to keep for a long time at that temperature?
- What is "freezer burn" on foods in a freezer and how can it be avoided? Experiment
- How does salt preserve salmon bellies in a barrel? What chemical and biological phenomena are happening? How much salt is used? Are wooden barrels better than plastic containers? How are salted salmon bellies prepared for eating?
- How does drying fish preserve it? Test different brine solutions for salmon strips. Which do people prefer?
- Most people say campfire coffee is the best. Run a taste test on campfire coffee, percolated coffee, and filtered coffee. Can people taste the difference? Why is there a difference? If so, why?
- Does homemade bread mold faster than store-bought bread? What does this tell you about store bought bread?

HUNTING/FISHING/ANIMALS

- What are the best materials for casting animal tracks? What are the best conditions for casting tracks?
- How can you tell the age of animal tracks? How can you tell the difference between a bull and cow of a given species by the tracks?
- Make a traditional halibut hook. Set it and a modern halibut hook close together. Does one work better than the other? Is there an optimum distance from the bottom of the ocean for the hooks to be set? What is the best halibut bait?
- What color net is least visible in the waters in your area?
- What are the favorite lures used by local trollers for different species of salmon?
- Measure around the gills of a species of fish in your area. Divide this measurement by two. This will give you the optimum stretched mesh for that fish. Measure many fish of that species, average your findings, and compare that measurement with the nets used in your area.
- What factors most influence the distance a fishing rod can cast? (Weight of lure, length of line off the end of the rod, wind, etc.) Do different rods cast differently? Do different lines cast differently?
- Are fishing lines that are advertised as 8 lb test, 12 lb test, 20 lb test weaker or stronger than advertised? Does this vary with different brands? Tie them to a fish scale and pull until they break. Read the scale at the point where they break.
- What is the science of getting a very light flyhook to cast a long distance? Why is flyfishing line tapered? What are the differences between flyfishing and spincasting.
- What is the science involved in a spinning reel? The drag, the gear ratio, the leverage of the handle, etc.?
- There are several types of spincasting reels. What are the advantages of each?
- What are the methods used to call local animals? How are they made? How do they work? What are the different calls that the animals respond to and why?
- What is *refraction* and how does it effect spearing fish and animals under the surface of the water?
- The weight and balance of a harpoon is critical. What happens if the weight is increased or decreased? Test on people of different sizes. How critical is the weight/length ratio?
- What is the difference between the softness/hardness and shape of bullets? Why is one preferable over the other in different applications?
- Shotguns: What is the increase or decrease of effectiveness of steel shot compared with lead shot?
- What are the different methods of calling moose? What are they imitating? Under what conditions is each effective? Record and imitate the different calls.
- What is the difference between rifle powder, pistol powder, and shotgun powder? (**Do not** do this without trained adult supervision.) Why is there a difference?
- When we butcher a caribou or moose, it is much easier to remove the stomach and intestines if the animal is laying on its right side. Why is this? Is this also true of other big animals like walrus and seals?
- What parts of the body do local hunters try to hit when hunting different animals? What systems are effected? What other systems are available for disabling an animal? Identify the animal's system. Observe and document the damage

done by the bullets. What physiological systems did the hunters try to disable in the past with traditional weapons?

- Caribou and moose are both ruminants. Find their four stomachs. Study the contents of each, and compare the findings with research on other ruminants like cows and sheep.
- Horses have nerve endings in their feet that allow them, as they stand up, to detect approaching footsteps. Do moose have the same ability? Why do you think so?
- What is the difference between caribou tracks and moose tracks? What is the difference between a cow and bull of each kind? How can you tell how long ago the animal passed by, given different weather conditions?
- Why do spruce chicken and grouse eat gravel in the fall? Where does the gravel go in their body? What do they use it for? How are they similar to domesticated fowl?
- What are the best baits for trapping each kind of animal in your area? Does this vary with the seasons?
- How do trappers keep steel traps from freezing?
- Some fishnets are said to be "fishier" than others. (Fishier means they catch more fish.) Why is this? What is the difference in the twine, and the way the net is hung?
- To what extent does hanging a nylon net in the sun reduce its strength and useful life? How does this compare with the traditional methods of caring for cotton nets?
- What parasites afflict caribou and moose? Is there any danger for people who eat these animals? Which body parts are more apt to have those parasites? How are the parasites destroyed to make the body part edible?
- What is "beaver fever"? Where did it come from? When? Is it impacting our animals? If so, is there a natural cure? What will the long term effects be on the animal population? What effect does beaver fever have on humans? What is the human antidote?

OTHER OUTDOOR

- What muscle groups are used in each Native Youth Olympics (NYO) competition?
- Which type of wood smoke gives the best taste for eating fish: alder, birch, cottonwood, or willow? Compare these with hickory if possible.
- What is the relationship of the tension/diameter of the Native drum to pitch? How are they tuned, if at all? What effect does the thickness of skin/membrane have on pitch? What effect does changing the length of the stick have on the response in the beat? How do the newer materials like Ceconite and Stitz (airplane fabric) compare with traditional materials for sound and durability?
- Compare traditional snowshoe bindings with modern bindings made out of modern materials. What are the advantages and disadvantages of each under all conditions?
- What are the simple physics of the blanket toss? What are the do's and don'ts of the activity? Why doesn't the individual come down head first? Do heavier or lighter people go higher? Is there an optimum number of people holding the blanket? What happens if they toss the individual too high or too fast? What importance does the blanket material have? Is firm or soft material better? What effect does the wind have on the individual being tossed? What happens

if he/she doesn't come down in the middle? (Do we have a "Funniest Home Videos" of the blanket toss?)

- Traditional methods of firemaking: How did they work? What materials were used for drill and tinder?
- What modern methods of firemaking are used in your area? What kindling is used? How are fires made in wet weather?
- Spruce trees peel more easily in some months than others. What are these months, and why are they easier peeling? How can you prevent mildew on the logs once they are peeled?
- Poles with the complete grain of the tree are stronger than wood cut from a section of a tree. Test the strength of a pole compared with a piece of lumber of similar size. Which is stronger under stress?
- What are the advantages and disadvantages of traditional sinew used for thread compared with commercial threads and dental floss? Is it easier to work the sinew if it is held together by beeswax? What was traditionally used before beeswax?
- Oldtimers used to hunt birds with a sling (a bolo). Some had two weights, some three. Make one of these slings. What is the optimum weight and string length for:
  - Distance throwing
  - Accuracy
  - Manageability
- Oldtimers in the Interior also hunted birds with an atlatl, a long stick with a notch cut in the end. A smooth flat stone was placed in the notch, and, with practice, was thrown with great accuracy. How much farther can a rock be thrown with one of these compared to a rock thrown by hand?

  To this day coastal people use an atlatl for throwing a spear at seals so they won't sink. Experiment with different lengths of atlatl, different lengths, weights and balance of spears. Experiment with different tips and feathers. Which is better for distance? Which is more accurate?
- Oldtimers used to make a "roarer" to drive off wolves. What was the traditional implement in your area? How did it make sound?
- What type of stitches did the oldtimers use for water boots and skin boats that they didn't leak? How does sinew compare in strength with modern sewing materials?
- Long ago, Interior people boiled water by putting hot rocks into a birch bark basket until the contents boiled. Being very careful (as some rocks explode when heated) experiment with this. Which works best, a few big rocks or many small rocks? You will have to remove the cooled rocks and replace them with hot rocks.

HOUSEHOLD

- What oils work best in traditional lamps? Try traditional oils such as bear, moose, seal, or walrus and modern oils such as kerosene, stove oil, cooking oil, shortening and motor oil, but **do not** try highly volatile liquids like gasoline or Blazo. What traditional wicks were used? Which is most effective and durable?
- What is the best way to store potatoes? Why do they give off heat after they are dug up?
- What processes of rendering did oldtimers used to extract fat from bears, whitefish entrails, seals, etc.? What are the qualities of these oils? At what temperatures are they solid or liquid? Are they high or low in good and bad

cholesterol?

- Which roots are better/stronger for lashing baskets/fish traps? Willow, spruce, cottonwood? Is there a difference among the roots of each species? Might one root be good for the first year, but decompose before the second year of use? Are there any modern materials that might be as good for lashing fishtraps?
- Why does a wood stove **feel** warmer than an oil stove, even at the same room temperature?
- Where does the most residue collect in the stove pipe of a wood stove? What can be done to prevent this fire hazard?
- Why do peoples' glasses frost when they come in wintertime? Is there a way to prevent that from happening?
- What are the physiological effects of a steambath? Are they all good? How do modern soaps cleanse?
- Some people breathe through a piece of wood, or small bundle of grass while in the steambath. Why do they do this? What science principles are involved? Why do people use brush to slap their skin in the bath?
- Different kinds of wood produce different kinds of heat in a steambath. Experiment with driftwood, dry spruce, wood from crates and palates and others. Which produces the best heat and why? What is the average temperature of the steambath? (**Do not** use green, pressure-treated wood. It contains arsenic that has killed people in steam baths.) People who steambath often use the terms "sharp heat" and a "strong heat". What do they mean? What different kinds of wood cause these different types of heat? What happens to the temperature when water is poured on the rocks? Why is this so?
- Some rocks are acceptable for steambath and some are not? What are the qualities of each? What is their geological origin. Where do people in your village get the desirable rocks?
- Different kinds of batteries last longer than others. Cheaper batteries aren't always the least costly. Perform a test with a small light bulb. With different batteries, compute the cost of operating a small light in cents per hour. Which batteries are the most efficient, i.e., cheapest use per hour?
- Experiment with different kinds of matches—paper and wooden—both of different brands. Which strike better under damp conditions or cold conditions? Which are better for the home? Which are better for out in the woods? Look at the strikers under a magnifying glass. What are they made of? Which are more durable? Are there other household materials that will produce enough friction to ignite the matches?
- There are four variables in producing a sharp knife or tool:
  - The material you are cutting: wood or flesh.
  - The hardness, or type of steel.
  - The tool or instrument you are using to sharpen the blade.
  - The angle at which the blade is sharpened.

  Experiment with the above variables. Which types of sharpening instruments are better for wood or flesh: file, stone (there are different kinds of stones), or steels (including those impregnated with diamonds).

MECHANICAL

- Snowmachine suspension. What are the advantages of soft/stiff suspension?
- What is the viscosity of different oils and greases at different temperatures. Polar vs. nonpolar grease: What effect do these have on the life of equipment operated in severe cold temperatures?
- Some 2-cycle oils are made for fuel-injected snowmachine engines and some are not. Test all kinds of two-cycle oils for their ability to pour in very cold weather. Is there a danger of using some oils that are not made for fuel injected engines?
- What is the miscability (ability to mix) of 2-cycle engine oils at different temperatures? How much agitation is necessary to **thoroughly** mix gas and 2-cycle oil at different temperatures?
- Test lower unit grease in water. How is this grease different from other greases, such as wheel bearing grease?
- What is the best method/material to repair a hole or crack in an aluminum boat?
- Some gasoline additives that remove water from gasoline destroy the seals on 2-cycle engines. Put identical seals in gasoline solutions containing Heet, Ban Ice, and other additives. After a period of time, test the seals for flexibility and durability. Are the seals damaged by the additives?
- Explore all the uses of 12-volt systems and batteries in your area, particularly in fishing boats. How do lead acid batteries work (be careful—acid is *dangerous!)* What is the average battery size used in boats, 90-amp hour? 115? 200?
- Survey the types of diesel engines used in local fishing boats. What is the science involved in diesel engines? Why are there no spark plugs?
- What is the difference in operation between the newer 4-stroke outboards and the typical 2-stroke? Get beyond gas consumption.
- Compare the patterns and paddles on snowmachine tracks in your area. Are there similarities? Does one pattern give better traction than another? What materials are the tracks made of? Are they the same material as the drive belts?
- Why is one snowmachine better at breaking trail than another?
- 30% of a snowmachine's power comes from muffler design. What is going on?

BOATS & RIVERS

- Why do waves form on the ocean? What is the relationship between waves, wind, and current?
- Why do waves form on some bends of the river and not on others? Is there a relationship between the direction of the wind and the direction of the current? Why are the waves smaller next to the bank?
- How much more efficient is a new prop on an outboard? With a worn prop but the same driver, boat and load, time a trip from point A to point B. Put a new prop on the motor, and time the same trip. Does the new prop make a difference? If so, how much?
- Every sandbar in a river has material that is classified according to its specific gravity. Identify the specific gravity on all locations on a sandbar and explain flood gold.
- Can floods be predicted? What are the variables involved in flooding during spring breakup? How can they be mea-

sured? Are there ways to avoid the floods by engineering or planning?

- Boats seem to travel faster after the sun goes down. This might be a trick of our eyes, but it might have something to do with other factors. Experiment to see if our eyes are playing tricks or whether there are other variables working to make the motor go faster. Use a GPS.
- There is a difference between a substance dissolving in a liquid (solution), like sugar in coffee, and a substance being held in suspension, like silt in a river. Explore this difference. Where on the river does the silt tend to settle out and where is it picked up? Pour the solution and suspension through a coffee filter. Which is changed?
- Scientists say the length of a river never changes. If it cuts short one place, it will get longer somewhere else? Is this so?
- Why are some side streams orange in color? Is that the result of organic growth, or the result of iron deposits that were laid down geologically?

OTHER

- It is much harder and slower to walk on the tundra than it is on a boardwalk. Why is this so? The same effect seems to be occurring when we walk on a soft winter trail. Is this so?
- Why does pressure cooking and jarring preserve food? Are there optimum conditions and materials to use in preserving foods for winter storage?
- Lacking candy, oldtimers used to make cooked sugar. How did they do this? What happens to the sugar that it changes form?
- Which boils at the highest temperatures: seal oil, vegetable oil, shortening, moose, or caribou tallow, olive oil, or other cooking oils? In making fry bread, which oils make the best bread: less greasy, good texture, color, and flavor? (Seal oil seems to be the only animal fat that is liquid at room temperature. Is this true?)
- What is the best way to ferment seal oil?
- How much good/bad cholesterol does seal oil have? How could you test this?

TRADITIONAL

- How was sinew made traditionally? How was it woven? How was it preserved? From what part of the animal did it come? What was used before bees wax?
- What animal parts were traditionally used for containers? Why were they good for those purposes?
- Traditional clothing often had fringes on the sleeves, shoulders and bottom. Was this for appearance or functional?
- Across Alaska, Native people used a tea that goes by many names: Labrador tea, Hudson Bay tea, Eskimo tea, etc. Prepare this tea. Do a taste test comparing this tea with commercial teas. Blend this tea with commercial tea. Which do people prefer? Elders? Middle age? Young people?
- How was cedar bark harvested, prepared and utilized in traditional culture? How does cedar bark compare with modern materials for this same purpose?

- What are the best natural dyes in your area? What are the traditional dyes? (Some might have been trade items.) Can these dyes withstand modern detergents in washing?
- What are the different methods of preparing grass for weaving baskets?
- What are the different traditional uses for grass?
- What is the difference between a decoction and a tincture in preparing local plants for medicinal use?
- How were medicinal plants stored for use?
- How were drums made in traditional culture? How were the frames made? How were the skins prepared? How were the skins attached to the frames? How are these processes different among the Alaska Native cultures? How are these processes different from the ones we use today?
- What are the traditional methods in your area used for steaming such items as drum frames or bentwood hats?
- What are the rhythms used in traditional songs? Can you write the percussion music for them? Were there different rhythms for different songs, informational songs, spiritual songs, love songs, etc.?
- What are some traditional knots? What were they used for? Why were the knots good for those materials?
- There are three parts to traditional tanning: (1) softening by breaking down the fibers, (2) Scraping off different layers of skin, and (3) removing some of the skin material by soaking in an acid. Explore all three parts. Can you find a more modern way to do each now that we have electricity and different materials available?
- What ocean currents bring driftwood to local beaches? How are these ocean currents formed? Are they the same all year long, or just seasonally?
- What were the traditional insect repellents?
- What plants in your area are poison and need to be avoided?
- Oldtimers knew how to work metals. Compare an ulu made of copper with one made of steel. Cut many fish with each. Sharpen each. Can you learn how to temper or soften steel? How did oldtimers cut steel without electric tools?
- How are different knives and tools sharpened for different applications?
- What are the traditional uses for knots? What materials were typically used for lashing? What are the advantages and disadvantages of those traditional materials?
- Apart from food, animal parts were traditionally used for many applications. Pick an animal in your area and find all the uses for the different parts. Make some of these traditional items. (Bones, hoofs, flippers, sacks, clothing, etc.)
- What is the difference between modern shoe packs and vapor barrier boots vs. traditional footwear? Consider different seasons.
- How were deadfall traps made in your area? What seasons were they set? Why?
- Does the tide rise and fall at a steady rate, or does it follow cycles? Measure the height of the tide for one complete tide cycle to find out. Try this at extreme tides and mild tides. Call the distance the tide rises or falls in one hour “one unit.” Describe the rest of the changes in terms of that unit. Is there a pattern? There should be.
- The construction of an ocean kayak is very personal. The shape of the kayak is according to the shape of the person, using body parts for measurement. Can you discover these measurements and determine why the stability and maneuverability of a kayak is related to these body part measurements?

- Splitting driftwood and other trees is a skill and science known to only a few people. Can you rediscover this art/science and demonstrate it, describing the process in terms of stress?
- Drying lumber shrinks. What percentage of shrinkage in length and width does lumber in your area experience between the time the tree is cut and the time it is dry enough to use for a finished surface?
- How does radar work in fishing boats? What materials reflect radar waves the best? Least? How did people navigate before radar?
- What is the science involved in human survival in the open ocean after a fishing vessel has sunk?
- What is the science involved in building an emergency fire shelter?
- What materials are best for firestarting in your area? Compare these with commercial firestarting materials. Compare all materials dry and wet (spruce gum, birch bark, dry shavings, dry grass, etc.) You might want to have a panel of 4–5 judges while you do the tests.
- How can you tell the speed in miles per hour of a local stream, river, or ocean current? If a water generator can generate one amp per mile/per hour, how many amps could this current generate?
- Why do salmon prefer certain streams over others? Can something be said for the bottom of the stream? What frightens salmon in shallow water? Can you sneak closely without being detected?
- What is the difference between a seine net and a gill net? What is the advantage of each?
- How could it be that blackfish "come alive" after being solid frozen? What amazing features do they have that allow this? How and why do they make holes in the ice during winter?
- What is a red tide? Why does it effect bivalves? Why do they become deadly poison after a red tide? Some people say you can eat bivalves in all the months that contain an "r." If this is true, why is it so? How many months does it take for bivalves to be cleansed from the effects of a red tide?
- Some people say that cedar shavings work well to repel spiders from tents and homes. If this is so, which works better, red or yellow cedar?
- What is hypothermia? How can we prevent it? Can one part of our body experience hypothermia while the other parts are still functioning?
- Why does smoke follow you around the campfire?
- Over a campfire, put a new coffee pot next to one that is already blackened. Does the water boil slower or faster in the new pot? Why is this so?
- It is difficult to melt snow in a coffee pot over a campfire. However, if there is a little water in the bottom of the pot, the snow melts easily. Why is this?
- How can you tell time by the big dipper during the winter nights?
- What are the names of the constellations as identified by the Elders in your location? How are the constellations similar/different from those of Western culture?
- Oldtimers had a simple loop and stick arrangement for hooking sled dogs to a towline. We now use metal snaps. Can you discover their method? It must be able to attach easily, stay attached under all conditions, and be disconnected without great trouble. However, it doesn't swivel.
- Which are the strongest Alaska woods?
- Boards cut from local Alaska lumber shrink considerable when they dry. Cut boards of different types of lumber in your area. What percentage of width and length do they shrink when they dry? How does this relate to board-and-batten siding?
- What kinds of local Alaska woods rot the

easiest? What kinds resist rotting? What are favorable conditions for wood to rot? What are the applications of this knowledge in making traditional artifacts (sleds, boat ribs, housing, and building foundations?) The woods that are originally the strongest might not be as strong after a year or two.

- What is permafrost? What happens to permafrost when the tundra is removed? What kinds of foundations are in your village and how do they relate to your findings? Which houses need more frequent leveling? What is the best foundation for a house built upon permafrost?
- Oldtimers say that the little birds fly up to the cranes and hide in a hollow place under the cranes' wings as the cranes circle the tundra in the fall. The cranes carry the little birds to the Lower 48 and back again in the spring. To my knowledge, this has never been researched. It would be fascinating to see to what extent this is true. We do know that the cranes and small birds depart and arrive at the same time each year.
- What kinds of native Alaska woods or common driftwoods rot the easiest? Which ones resist rotting? What are the favorable conditions for rotting? How can you apply this knowledge to the making of traditional artifacts?

Traditional Lighting

The long winter months of Alaska make lighting very important. While recent years have brought electricity to the villages, many remote cabins and camps still rely on traditional methods of lighting.

In the Recent Past

We used kerosene lamps, Coleman lamps, and candles for years before we had electricity.

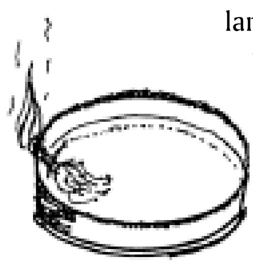
Traditional Lighting

Upriver people used rendered bear, caribou, and moose fat for lighting. Coastal people used fish, seal, whale, and walrus oil. In Southeastern Alaska, the hooligan fish gave so much grease trade routes were built on its supply,

Whaling boats decimated the Alaska whale population in the late 1800s in order to supply lighting for the East Coast of the United States. Whole cities were lit by Alaska whale oil.

A simple lamp can be made from a jar lid, a piece of cloth, and some shortening or vegetable oil.

EXPERIMENT



There are three parts to a traditional lamp: the container, the wick and the fuel. The fuel is from seals, moose, whales, bears, fish, etc. The lamp itself must be of a material that won't burn such as rock, clay, sea shells or metal. The wick was traditionally of certain mosses, but cotton replaced moss long ago. The wick lifts the oil from the lamp by capillary action and provides a surface for burning to take place.

Container

Traditionally the lamp was of a hollowed stone and sea shells. More recently, jar lids and metal cans were used.

EXPERIMENT

Make several lamps with different containers. Use jar lids, stone, metal, aluminum foil, anything you can find that won't burn.

Use shortening for oil and a wick of cotton cloth for now. Soak the wick in oil before lighting it.

Which materials work best for the container? It takes a bit of skill to keep the wick properly trimmed. Push it into the oil if it burns too brightly, and expose it more if it is too dim.

Don't leave the lamp unattended.

EXPERIMENT WITH WICKS

Try different materials for wicks. Try the traditional mosses used in your area. Oil or grease the wick before lighting it the first time.

Try strips of different kinds of cloth. If the wick has any nylon in it, it will work the first time, but will not wick the second time.

Adjust the flame height by moving the wick in or out of the oil. Which wicks last the longest? Which ones fall apart after several uses?

EXPERIMENT WITH OIL

Try all kinds of oils: margarine, bear fat, vegetable oil, seal oil, etc. **Do not** use volatile fuels like gasoline or Blazo. **They are far too dangerous.** Do all experiments on a clean flat surface that cannot burn, like dirt or concrete. Do not leave lamps unattended. Sooty flames give headaches after a while.

One time we were stuck with no lights and didn't even have margarine, so we used 30W motor oil for lamp oil. It gave a decent light, but the next morning the inside of our noses were completely black from the soot!

Observe the soot content of the smoke from each oil.

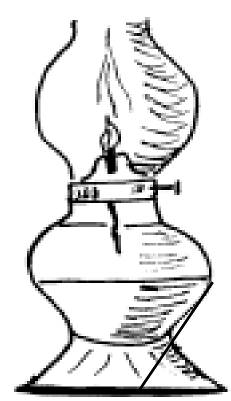
Which oils burn the cleanest? Which burn the longest? Which give the most light?

To render bear, moose or caribou fat, cut it in very small pieces, and put it in a pot with a small amount of water. Turn up the heat. Keep the fat from boiling as it is being rendered. All the water you started with should boil away, or the grease will sour in time. Pour the rendered grease into a container as you would bacon fat.

Rendering can be done with any kind of fat, including fish oil. We have done it from the whitefish entrails as they come out of the lakes in the late fall. They are exceptionally fat at that time. There are several ways to render seal oil.

Other Adaptations

Kerosene lanterns evolved from oil lamps. Is there any way you can make a chimney that causes the oil lamp to burn



cleaner, better or more controlled? Experiment with chimneys of different lengths. A tomato paste can or coil of aluminum foil might serve for experimenting purposes.

CONCLUSIONS

When you are done experimenting, you should know what containers and wicks are most efficient and safe. You should know which oils burn the cleanest, brightest, and longest.

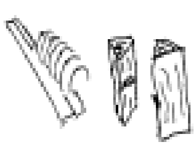
Firestarting

Everyone who has spent time out in the woods in Alaska has relied heavily on the ability to make a campfire. This isn't much of a challenge when the weather is good and conditions favorable. However, the times we need a fire the most, when we are wet and cold, sometimes freezing, are the times when it is much more difficult to start a fire. There are times when firestarting skills are a matter of life and death. You look at your fingers holding the match, tell them to move, and nothing happens.

The best time to learn hard things is during easy times. If we are in a desperate situation we don't have the resources and time to *experiment* and learn. Now is the time to do a little science that might save us later.

Three steps to firestarting

- Matches, lighter, or other methods
- Kindling
- Firewood



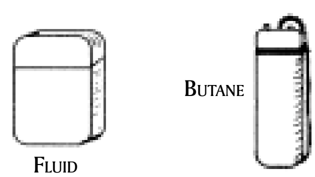
To get the large pieces of wood burning, we must first get the smaller kindling burning. To get the kindling burning we need a match or lighter.

Matches

Matches have two parts, the head and the body. The match head is made of chemicals that ignite at low temperatures. By rubbing the match against a high friction striker, enough heat is produced to ignite the chemicals. The bodies of most matches are either wood or paper.

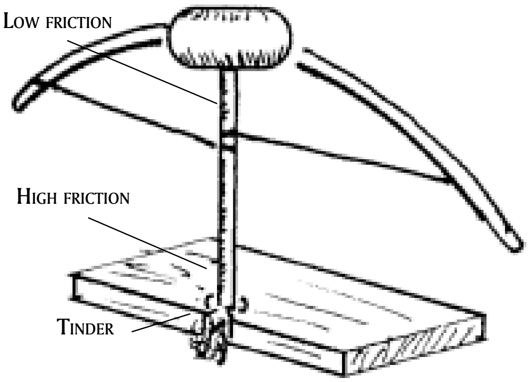
Lighters

There are two kinds of lighters, those with liquid fuel and those with gaseous fuel, like butane.



Most lighters ignite the fuel by a spark from a steel wheel spinning against a piece of flint.

Some people use magnesium strikers in place of a match. Simply scrape some magnesium into the tinder, then strike the magnesium with a knife blade, forcing sparks onto the magnesium chips. A hot flame is immediately present.



Traditional methods

Traditionally, fire was made with a bow and drill or flint and steel offered in trade. The secret of such a firestarting effort is in the tinder. The bow and drill create enough heat by friction to get the tinder glowing. It is easy to make smoke, but another whole story to turn the embers into a flame. The type of tinder used varied from region to region. Tinder must be kept very dry. See the next chapter for details.

Kindling

There are different kinds of kindling. Kindling burns hot and fast. It doesn't last long, but its heat is enough to get the bigger pieces of wood burning.

Birchbark

The loose bark on the outside of a birch tree is one of the best materials to get a fire going.

Paper

Dry paper and cardboard are also adequate to ignite small branches.

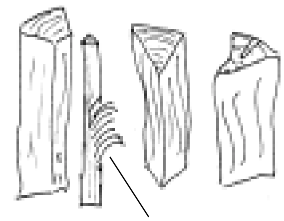
Spruce pitch

In Southeast Alaska, where there is lots of rain, pitch from the spruce trees is the only effective firestarter. It burns hot and long, giving damp kindling a chance to dry out and ignite.

Spruce Branches

The dry underbranches of a spruce tree are excellent kindling. The fine tips of the branches are easily lit by birchbark, and burn with enough heat to get much larger branches burning. We take small spruce branches and bark into the tent at night when it is raining. They are dry for the morning fire.

Split spruce and shavings



When weather has soaked the birchbark and underbranches of a spruce tree, a good way to make a fire is to chop sections of drywood and make shavings and small splinters of wood from the dry inner part of the tree. Knowing how to do this has saved lives during winter storms when ice and snow cling to every branch.

Dry branches from willow and alder

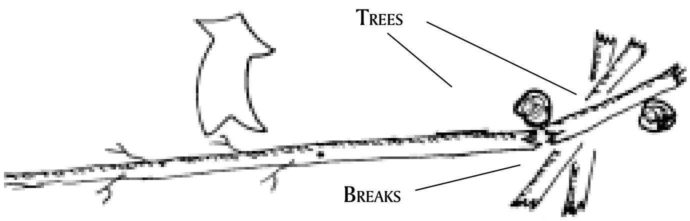
Willow and alder branches don't have the potential heat that dry spruce branches do, but they are adequate when there is nothing else available.

Gasoline

Some people start fires with gasoline. This is **very** dangerous and should **never** be done! It is particularly dangerous when the first effort hasn't succeeded, and fresh gasoline is poured on smouldering embers. Some people dip a stick in a gas tank, and light that. That is safer, but still far too dangerous.

Firewood

Firewood provides the heat to boil the coffee, cook meals, dry the clothes and warm our cold bodies. Larger pieces of wood

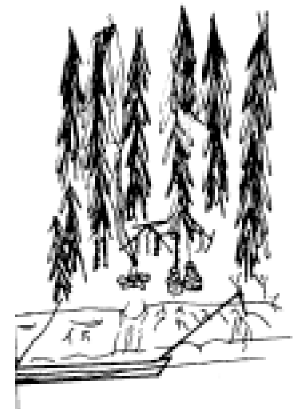


burn longer and slower. Smaller pieces burn faster.

Foraging for firewood with an axe is much harder. If the wood is long and thin, we often break it between two healthy trees rather than chopping it.

Having a chainsaw available really makes a difference. Whole dry trees can be cut up and used. Cutting blocks of wood with the chainsaw then splitting the inside portions insures dry pieces of wood when it is raining. Before chainsaws, we used swede saws. They are light and easy to carry, cutting fast if they are sharp.

Choosing a site for a fire



We usually make a driftwood fire on a sandbar during the summer because the wind on the river helps to keep the mosquitoes away. During the rest of the year, we try to find a patch of timber that will have adequate kindling and firewood to last the night.

THE EXPERIMENT

Matches and Lighters

Test different kinds of matches, wooden and paper. Which kind ignites kindling more consistently? Which kinds are better in damp conditions? When they are damp, do some of the strikers tear apart before all the matches are used?

Look at a paper match under a magnifying glass. Is there a chemical on the body of the match, close to the head that helps the paper burn?

Hold a lit match with the tip up. Hold it with the tip down. Which way does it burn faster?

Store matches in different containers, Zip-Lock bags, metal boxes, your pocket, etc. Dip wooden matches in wax. During a camping trip, experiment to find the container that keeps matches the driest.

Test different striker materials for wooden matches. Which work best?

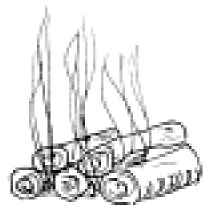
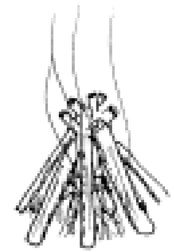
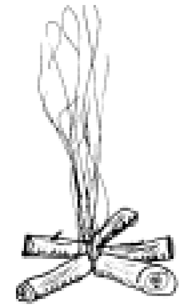
Try a liquid fuel lighter and a butane lighter when it is very cold or put them in the freezer. Which one burns the strongest when cold? Would you carry a butane lighter in the winter? If so, where would you store it?

Compare the heat of the flame of a wooden match to the flame of a lighter. Test by trying to light slightly damp paper. Which is hotter? Which is preferable in camp away from home?

Kindling

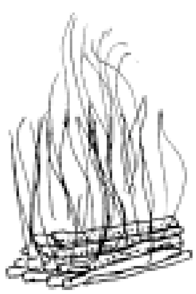
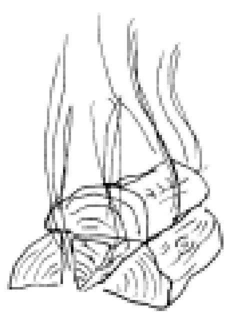
Experiment with the different kinds of kindling: birch bark, paper, shavings, etc. Which ignites the quickest and gets the bigger wood burning? Why? Which is the easiest? **Do not** try gasoline. Many young people have been seriously burned doing this. My son's friend spent a long painful time in the hospital after they mishandled gasoline.

Firewood

Test the different kinds of wood in your area. Which is most plentiful? Which ignites more easily? Which gives the most heat once it is burning? Which burns the longest?

Split pieces of wood, and leave others unsplit. Make two nearly identical campfires, and then put the split wood on one fire, and the unsplit wood on the other. Which burns hotter and faster. You might test this by putting a coffee pot of water over each fire and see which one boils water faster. Use measured amounts of water, and time the experiment carefully.

Which wood is better for campfire, dry spruce, driftwood, birch, willow, cottonwood, cedar, or alder?

Experiment with the way wood is placed in the fire. Parallel, teepee, crosshatched, etc. Which way burns faster? Which way burns slower? Which would you use to boil water?

What effect does the flow of air have on the different methods of placing the wood on the fire? How does this effect the burning rate? If your are roasting meat or warming yourself, you will build a different fire. How do fires differ with the needs?

In the chart below, rate the types of kindling from best to worst. Rate the types of matches/lighters, etc.

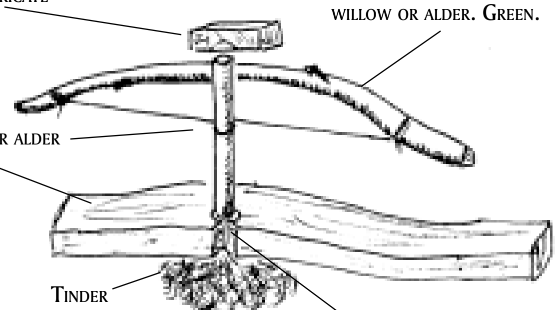
What conclusions do you come to regarding firestarting and the building of a campfire? What are the applications to your life?

Are you ready to pass the test the next time you are shivering cold on a boat trip or in the winter when your hands are too cold to hold a match? Firemaking under adverse conditions is a timeless Alaskan skill.

Make one fire in a new location. Make another fire with the charred sticks and logs from a previous fire. Which is easier to ignite? Why?

Be careful where you make a campfire, often the fire will burn deep in the moss for days and erupt as a forest fire. One year near the Canadian border, a fire burned under the snow all winter, and surfaced in the spring to continue burning the moss.

	Best				Worst
KINDLING					
MATCHES/LIGHTERS					
FIREWOOD					
WEATHER					
LOCATION					



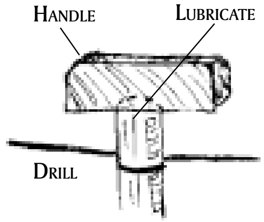
Traditional Firemaking

Traditional firemaking with a bow and drill remained a mystery to me until I was shown a few secrets.

The bow is made from a thick piece of live willow or alder. It must be strong enough to pull the string tight.

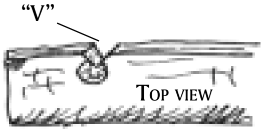
The string can be of any stout cord.

The drill and bottom piece of wood should be made from soft hardwood, that is, willow or alder. They both must be very dry but not rotten.

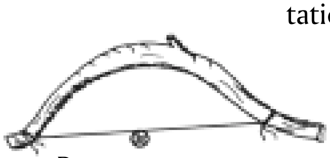


The handle can be of any material. There should be a shallow hole in the handle to fit the drill. Lubricate this. It does not need friction.

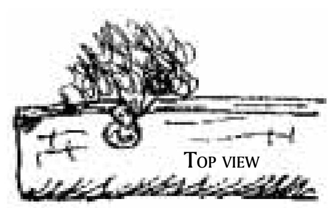
The tinder must be of very fine materials. The "cotton" from cottonwood works fine. Traditional materials vary from region to region.



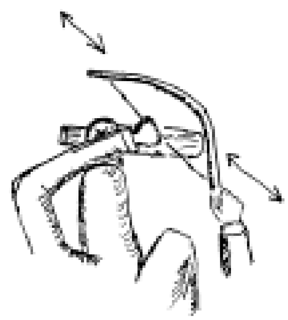
Flatten the bottom piece of dry willow or alder on two sides. With a knife or drill, make an indentation, and then cut a "V" up to the middle of that indentation.



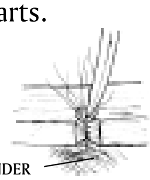
Twist the drill into the string of the bow. The drill should be on the outside of the string, not the inside. If it is on the inside, it will jam between the bow and the string.



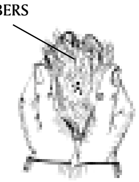
Put a large quantity of tinder under the bottom piece of wood.



Start sawing away. Friction will soon cause enough heat to make smoke. **This is as far as you are going with the bow and drill.** It will never burst into flames as we always assumed. Drilling gets very hard once the smoke starts.



Quickly scrape the glowing particles from inside of the heated groove onto the tinder.



Fold the tinder around the glowing particles to keep the heat in. Gently blow on the glowing particles. As the tinder starts to glow, there will be more smoke, but it won't flame yet.

Getting the tinder to burst into flame is the next step. A very thin piece of birchbark held in the midst of glowing tinder works for me.

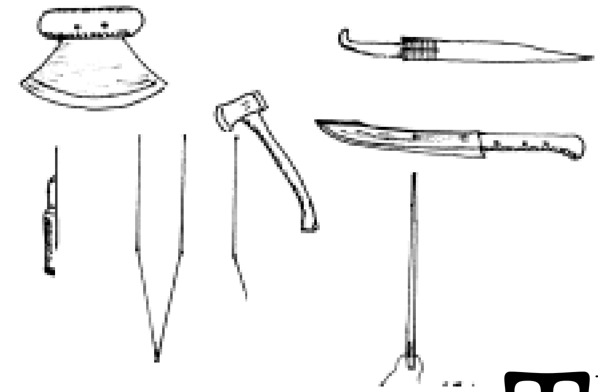
I felt a great sense of accomplishment when I first did this. After many years of knowing it was possible, I was shown and was successful.

EXPERIMENT

Try different kinds of tinder. This is the challenge. All must be bone *dry* and *very fine*. Shredded inner cedar bark works well, but that isn't available in most of Alaska except Southeast, and there it is hard to find anything dry. Experiment with different materials in your area. We also tried shredded manila rope. It was a bit too coarse. Jute cord from a garden shop has worked for us, but also tends to be too coarse. Materials that burn at a low temperature are desirable. Test first with a lighter or match. If it burns easily with a match it might also be good tinder.

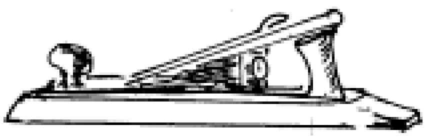
Try different materials for the drill and the bottom piece of wood. Soft deciduous trees seem to work best. Soft woods make a lot of smoke, but don't produce glowing embers the way soft hardwoods do.

Find out from the Elders what was traditionally used in your area. Some regions of Alaska used flint and steel obtained through trade routes and never did use a bow and drill.



Sharpening

Throughout the centuries, the ability to sharpen tools has been a matter of great importance to Alaskans.

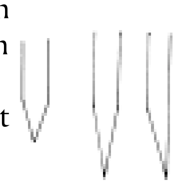


Today we have a variety of knives, and a variety of sharpening tools. Each has its own purpose. A good experiment will determine the application of each. A knife that is good for skinning beaver would be almost worthless to cut salmon. A knife that is good for butchering a walrus is undesirable for carving a wooden spoon.

Four Variables

There are four variables in sharpening a tool:

- **Material to be cut:** Cutting meat and fish are quite different from carving wood.
- **Type of steel, shape of the blade and shape of the tool:** There are many types of steel in cutting blades, each one with advantages and disadvantages.
- **Sharpening instrument:** Files, stones and steels ae all diffeent. Each has its applications.
- **Thickness of the edge:** A thin edge will act differently from a thicker one. There are different shapes of the edges: smooth, serrated, flat on one side, or beveled on both. An edge too thin will break off easily. An edge too thick will not penetrate easily



VARIABLES INVOLVED IN SHARPENING A KNIFE

Material to be cut	*Type of Steel in the blade*	*Sharpening Instrument*		*Thickness of Edge*
Wood	Soft steel	File	Smooth Coarse	Thick edge
Fish or meat	Hard steel	Stone	Smooth Coarse	Thin edge
	Stainless steel	Steel	Butcher steel Diamond steel Hunter's steel	One sided edge

EXPERIMENT

Try different combinations of the above. Find out which works best under certain conditions. Example: When cutting fish, a knife with a very hard blade might hold an edge longer, but it might be too tedious to sharpen. A softer knife that can be quickly stroked with a file might be better

What kinds of steel are more efficient for different applications? (Soft steel, hard steel, stainless steel, etc.)

Which works best on soft blades, hard blades, and stainless steel blades: a file, a stone or a sharpening steel?

What is the best angle to sharpen a knife for meat, for fish, or for wood? Which one penetrates better? Which one lasts longer?

Is a smooth edge better on wood or meat? Is a rougher edge better on meat, fish or wood?

Explore

Look at a sharpening stone, both coarse and fine under a magnifying glass. Describe and/or draw what you see.

Why do people use oil or saliva on the stone?

How is a used stone different from a new one?

How do electric grinding wheels differ from hand stones?

Look at different files under a magnifying glass. What do you see? How are the teeth shaped?

Which files are faster? Course or fine?

Which ones smoother?

Under the magnifying glass, can you see the difference between a dull file and a new one?

What materials plug a file? File brass, aluminum, steel, wood, and other materials.

What materials dull a file?

Look at a butcher steels under a magnifying glass. What do you see? What is the difference between a butcher steel and one impregnated with diamonds?

Experiment with porcelain and diamond sharpeners.

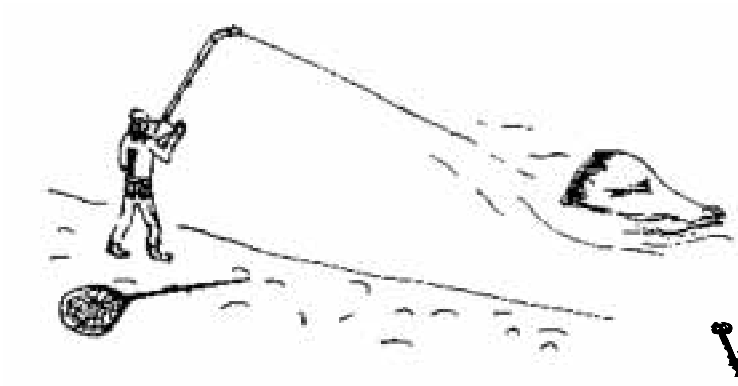
Which is quicker and more effective for sharpening a hard blade: a file or a stone? Gerber or Buck knives are hard. Schrade Walden is softer steel.

Where did people in your area get sharpening stones in traditional times? The village of Sleetmute actually means "Village of the Sharpening Stones." Oldtimers knew where to find them or trade for them. Explore this in your region.

When old-time barbers sharpened the razor they stropped it on a piece of leather. What do you think this accomplished? How is this similar to the methods used by Native women when they cleaned skins?

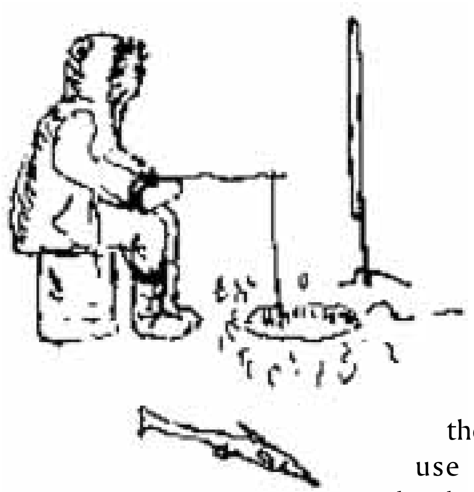
Sharpen a piece of slate on sandstone. Wet the slate regularly. Then try to cut a fish with the slate edge.

I have found that learning how to create the proper edge for a given job is a lifetime experiment, but one that pays off in smooth effective cutting.



Fishing with Lures

February brings longer days. People get restless and so do the fish in many of Alaska's lakes. People chop holes in the ice to spend hours hooking for pike, trout, shea fish, burbot, and others.



In the fall people hook for grayling and shea fish through the shore ice; during the summer we often use artificial lures to catch salmon, pike, shea fish, grayling, and others.

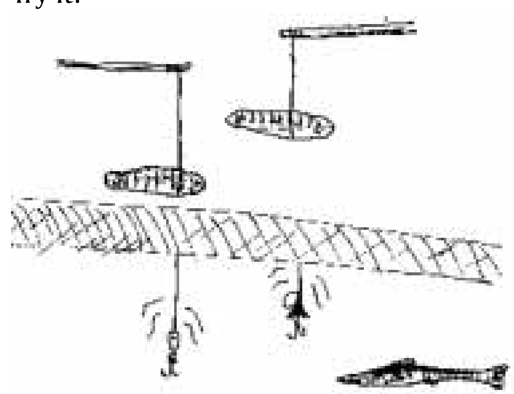
Sometimes we go home with a sack of fish and other times we go home with nothing. This poses scientific questions. Were the fish not hungry? Did we fish in the wrong place? Did we use the wrong lure or bait? Was our technique wrong? Did we fish too deep or too shallow? Or are we just unlucky? Which variable influenced our lack of success? Many people believe fishing success is greatly improved by giving the first fish to one of the village Elders.

The First Test

There are many variables in the fishing experiment, but if we are careful, we can control most of them. For now, lets think about hooking through the ice in February.

If we want to test a new fishing lure, we will first have to make two holes close together. Put the new lure on one line and an old favorite on another. If two people fish side-by-side using the same hooking motion and fish at the same depth, the effectiveness of the new lure should be evident.

Try it.



Variables

In doing the above we kept everything the same except the lure. To do a truly fair scientific test, have both fishermen trade lures back and forth through the experiment to rule out "fisherman's luck."

Different Tests

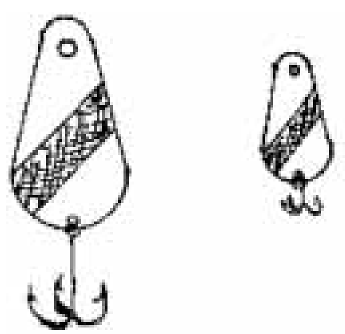
Test whether one location is better than another by having two people fishing with:

- the **same lure** at
- the **same time** with
- the **same technique** in
- **different locations**.

A.M. P.M. P.M.

The fishermen should swap locations several times during the test to control the variable of luck.

- How could you test for the time of day?
- How could you test for the **size** of the lure?
- How could you test for color? (Gold, silver, red, orange, yellow)



- How could you test for depth of the lure?
- How could you test for technique?

More Questions

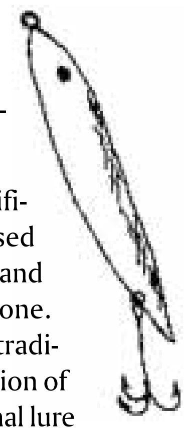
Would more valid tests be done by a larger group of people rather than only two individuals?

Do you think that the **noise** the fishermen make impacts the fishing? My wife thinks the sound of her new ice auger *attracts* fish. It could be.

How could you test the sound of a person walking on the ice? Driving a snowmachine on the ice?

Can you devise a way to observe the fish's reactions to different lures and the sounds on the ice?

Talk with people who are considered "lucky" for fishing. To what do they attribute their success?



Find out what kinds of artificial lures the oldtimers used in your region. Make one and test it against a modern one. Put a treble hook on the traditional lure. Is the combination of modern hook and traditional lure a good one?

What are the fish eating? Check their stomachs. Might live bait be more effective than a lure?

What effect does "chumming" have on fishing? (Chumming is putting oatmeal, salmon eggs, or other food in the water. This attracts small fish that attract bigger fish.)

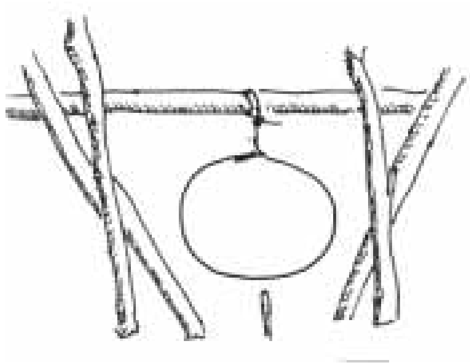
The Test & Results

Test the above variables, and try to determine the most favorable conditions for fishing each type of fish in your region in different seasons.

Keep a calender and a record of fish caught, time of day, lure or bait used, and other variables.

How do your conclusions compare with those of the Elders in your village?

Save your conclusions for your children and grandchildren.



Rabbit Snares

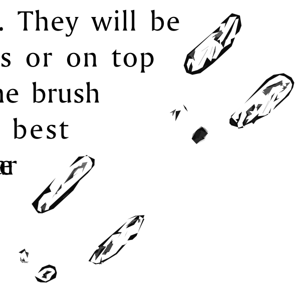
Snaring rabbits has been the first step into hunting and trapping for many young Alaskans. It has also been the means for survival for many adults during hard times.

Population Cycles

Rabbits eat willow and alder bark as well as other green shoots. They eat grass in the summer. Rabbits are, in turn, eaten by many predators, including fox, lynx, wolverine, wolves, bears, owls, and eagles. Floods often drown many rabbits, both in the spring and in the fall. Their population has many other pressures including sickness.

Setting snares

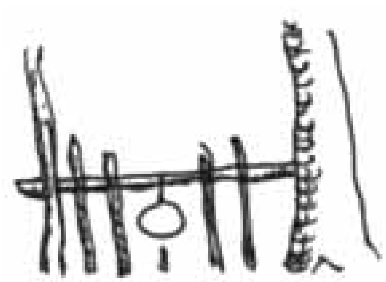
The first consideration is where to set rabbit snares. They will be found on islands or on top of banks where the brush is thick. The best place to set a snare is where there are the most tracks.



EXPERIMENT

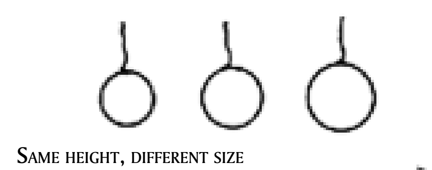
There are several variables in setting a successful rabbit snare. Experiment with the size of the hole. Experiment with the height of the snare. Experiment with snares that have a fence and those that do not. Of the snares that have a fence, experiment with live and dead sticks.

Also test different kinds of wire. Which is the most durable? Most people use braided picture hanging wire, but there are different thicknesses, 25 lb, 40 lb., 60 lb., etc.

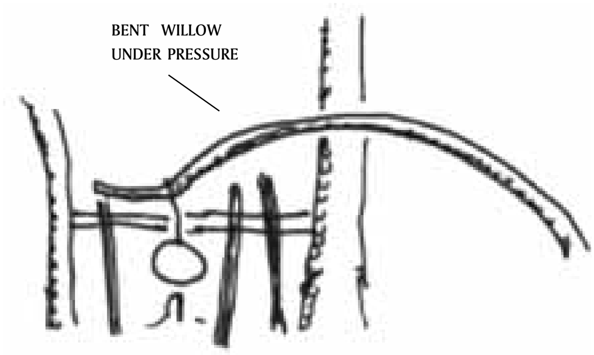


There are basically two kinds of snares, those that hang the rabbit in the air and those that do not. The simple kind that does not hang the rabbit is easy to set, but the rabbits taste a bit strong because they struggle. The kind of snare that hangs the rabbit in the air dispatches the rabbit quickly, giving a better taste.

SAME SIZE, DIFFERENT HEIGHT



SAME HEIGHT, DIFFERENT SIZE



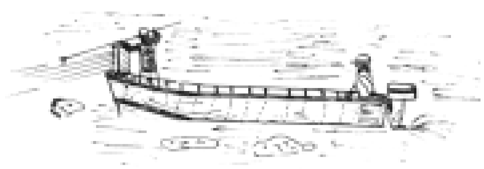
Other factors and methods

Snares are usually set for rabbits between freezeup and breakup. Rabbits can carry disease more in the summer, and people do not usually eat them unless there is nothing else. When the snow depth is great, rabbits tend to follow the same trail. When there is little or no snow, they wander all over and are much harder to catch.

We used to have rabbit drives on islands in the winter. A large group of people would start on one end of an island walking parallel down the island while making a lot of noise. A few people with .22s would wait for the rabbits on the other end of the island. This is a lot of fun, but the people with the .22s must be *extremely* careful, or one of the drivers could be shot.

It is much safer to have a rabbit drive with a fence of dead sticks across the end of the island, and snares in the openings of the fence. The fence can be used in future rabbit drives too.

Spearing Fish and the Refraction of Light



For many centuries Native people of Alaska have lived from the abundant supplies of fish, those that remain locally and those that migrate.

There have been a variety of ways of catching fish:

- Nets and dipnets
- Fishtraps
- Spearing
- Hooks/lures

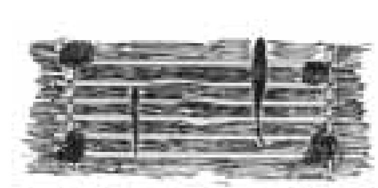
Day to day, a family's survival depended on the ability to catch fish.

In our area, we spear whitefish in the fall when ice is running in the river. We go out in boats at night. For lighting, we put a Coleman lamp in a five-gallon can that has been opened on one side. The five gallon can protects the eyes of the fisherman from the bright light, and reflects more light onto the river. From the front of the boat, we spear whitefish.

While the river is still running ice in the fall, we also chop a wide hole in the shore ice and spear whitefish through the hole.

Traditionally this was an important source of fish, as fish stored at this time of year can be frozen and kept all winter. Nowadays people can catch fish at any time and put them in the freezer. Spearing from a boat while ice is running isn't as important now, but it was and is an exciting adventure.

We also spear pike as they migrate between lakes in the spring. They are camouflaged quite well against the dark creek bottom, and are almost impossible to see as they swim in the creeks.



To gain an advantage, we peel spruce poles, lash them together, and sink them with rocks. The poles are crosswise on the creek bottom. When the fish swim with or against the current, they show up clearly as they swim over the light colored poles. A white sheet or cloth held on the bottom by rocks serves the same purpose. However, if you spear too many holes in your mom's sheets, she will not be too happy. Wooden poles are better in that regard.

Years ago, before nylon nets were available, upriver people speared salmon from canoes. If king salmon are speared in the right place, just behind the brain, they quiver and die easily. If they are speared in the wrong place, the fisherman is in for a wild ride in his canoe!

ACCURACY IS IMPORTANT

The challenge

It is exciting to spear fish, but our first efforts are usually frustrating. There is a science principle that must be understood before we can successfully spear fish. We see the fish, aim the spear well, and miss, again and again. Sometimes they are too fast for us, but other times, it seems that we are being tricked. The oldtimers understand the science principle quite well. That is why the older people can catch more fish than younger people even though the younger people are quicker and have better eyes.

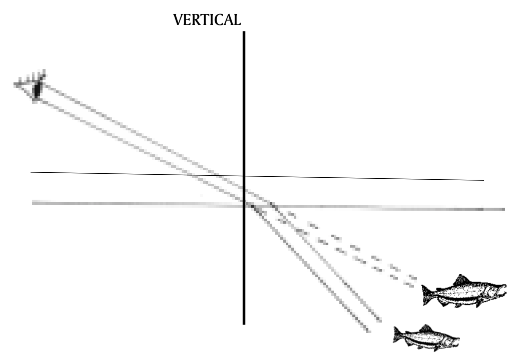
Understanding Refraction

When light passes through air, it travels in a straight line. However, when light passes from the air to the water, or water to the air, it is *bent*, or *refracted*. When light passes through any two substances of different densities, the light changes speed and is bent.

We think we see exactly where the fish is. Actually, the fish is *lower* than we perceive. It appears closer to the surface than it actually is. If you put the tip of your spear in the water, it will seem bent.

The secret of spearing fish is to know how much below the image to aim the spear. The fish isn't where you think it is!

The greater the angle (from the vertical) the fish is viewed from, the more the light is bent. Spearing from directly above, the fish will appear to be in the same place, but will appear bigger and closer to the surface than it really is.

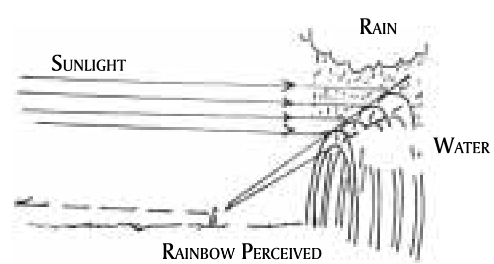


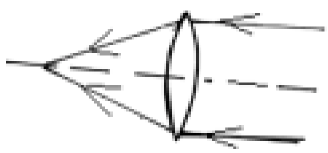
Do you think eagles and other birds of prey that catch fish need to understand this science principle too? They must miss a few meals until they learn this science lesson.

Other applications

When sunlight passes through air, and then passes through a cloud or rain, we see a rainbow as the light is refracted and reflected within the raindrops.

White light is separated into the individual colors shown in the rainbow. (Look up Snell's Law for more information.)



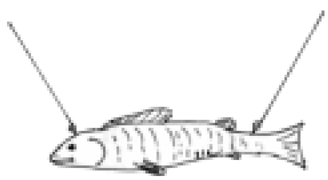


When our eyes don't focus properly, we wear glasses that also refract the light, bending it in exactly the right way so we can see clearly.

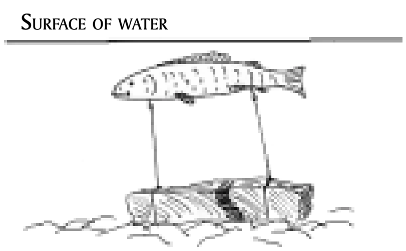
Can you think of other applications of this science principle?

Experiment

Make a long blunt spear. Hang a wooden fish (about 18") in the air and practice spearing it until you get fairly accurate. Poke at the fish, do not throw the spear. If you hang it by two strings it won't spin as much.



With that same spear, go to a clear creek, lake or river, and put the tip of the spear in the water. Does the part of the spear that is in the water seem to bend? Attach a target to a string (perhaps the same wooden fish). Attach the string to a weight and sink it so the target is 6" beneath the surface. Practice spearing the fish. How much below do you have to aim? Does this change with the depth of the target? Experiment at different angles, above the target and at a short or long distance. Imagine that if you miss, you will have to skip your next meal.



Try the same experiment with blunt spears of different weights and lengths. Which is best for you?

If it is winter, you can still do this experiment with a long washtub. Suspend one fish target over the tub, and sink one in the water. From different distances, test your skill, eye and estimation of refraction.

In the preceding experiments, what percentage of hits can you make for the fish out of the water? For the fish in the water? Which target is easier to hit?

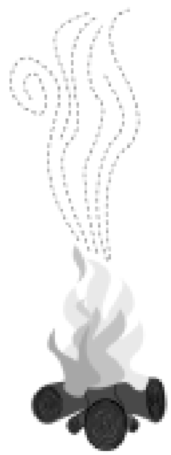
If you are practicing on a creek, river, or lake, do this experiment on a sunny day, and on a cloudy day. Try it with the sun at your back or in your face. Do it at dusk after the sun has gone down, but before dark. Try the same experiment with different kinds of light at night (flashlight, strong flashlight, Coleman lantern, torch.) What differences do you notice? What conclusions can you draw from this? What are the best conditions to spear fish? What are the worst conditions? Do Polaroid sunglasses help?

Ask the oldtimers in your village what kinds of fish they used to spear. What time of year did this occur?

What were the best conditions for this activity (night, day, calm weather, etc.?) What were the best locations? Ask them how they stored those fish. Is this activity still possible today? If possible, try it. What kinds of spear heads were used in the recent past? Were they store-bought or homemade? If they used homemade spear heads, make one according to their directions. What kinds of spear heads were used long ago?

Ask the oldtimers in your village where the fish are going and where they are coming from when they were being hunted. Why are they traveling in the river or creek? What is the advantage of spearing over hooking?

Find what the Alaska Department of Fish & Game know about the fish in your area. Compare their knowledge with that of the local Elders.



Chill of the Campfire

The Question Arises

The boat ride or snowmachine ride has been cold. We shiver as we try to convince our fingers to hold and strike the match to get a fire going. They are slow and don't function they way they usually do. We stand by the fire, turning slowly like a barbecue to warm all of our body, front, back and sides. It feels so good to stand by the fire.

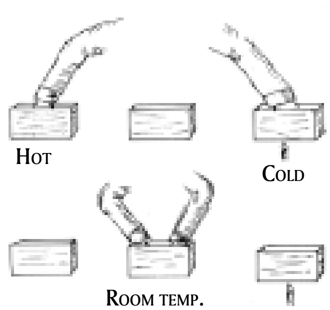
Finally, after the remains of the teapot or coffee pot have been poured into the thermos bottle, we walk away from the fire, back to the boat or snowmachine.

We feel colder walking away than when we approached the fire. We ask, "How can this be? I just warmed myself to the point of roasting."

A science question is formed.

EXPERIMENT

The best way to answer this is to do the following experiment.



Put a pan of cold water on the right, a pan of very warm water on the left, and a pan of room temperature water in the middle.

Put your left hand in the warm water. Put your right hand in the cold water. Leave both hands there for one to two minutes. Then, put both hands in the room temperature water.

How does the left hand feel?
How does the right hand feel?

Explain this.

Once you can explain this, apply the understanding to the effect of walking away from the campfire.

Research

How are signals sent to the brain from the extremities?

Are "cold" and "hot" signals sent to the brain through the same channels?

How does the body adapt to excessive heat and cold, particularly in the extremities (hands and feet)?

Further experimentation

Switch the bowls of hot and cold water. Now the right hand is in the warm water, and the left hand is in the cold. Do the above experiment again. Does the same effect occur with the opposite hands?

Try different temperatures of water, from ice water to lukewarm, from lukewarm to “dishwater hot.” Is the effect more obvious with the greater temperature differences? Or, does this happen about the same with all temperature differences?

Put your hands in the bowls of hot and cold water for one to two minutes. This time, plunge them into the opposite bowl. Don’t use the middle bowl of lukewarm water. Is the effect greater? When the extremes of temperature are greater, does hot sometimes feel like cold and does cold feel like hot? How do you explain this?

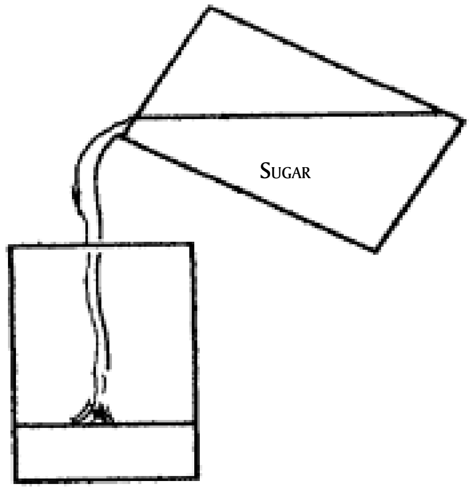
Try the above experiments, but keep your hands in the water for only 30 seconds rather than one to two minutes. Does the **difference in time** change the outcome at all?

Let three to four different people do the same experiments. Is the outcome different for different people. Is there any difference in young, middle age and older people? Is any age group more sensitive than another?

What conclusions can you draw from the above experiments?

Why do we feel cold when we walk away from a campfire?

Ask the Elders in your area if they experienced feeling cold when walking away from a campfire. Is there a way to avoid the chill that accompanies walking away from a campfire?



Solution vs Suspension

Many of Alaska's rivers contain large amounts of river silt. Of the Tanana it is said, "It's too thick to drink and too thin to plow." Many of our islands and riverbanks are made of silt that has been carried downstream for thousands and thousands of years.

When a substance is dissolved in a liquid, like sugar in coffee, the substance remains in the liquid. It is a **solution**

When a substance is floating around in a liquid, held there by current or turbulence, it is a **suspension**It will eventually settle if the water is still.

The Yukon is a mighty river, yet ocean boats cannot enter the mouth. Why? There has been too much silt deposited in the mouth. We often talk about the Yukon-Kuskokwim (Y-K) Delta. A delta is the land formed by the deposit of silt in a river mouth. The current has slowed as it bucks the tides, and the silt comes out of suspension and settles.

EXPERIMENT: DISSOLVING

Heat water in a clear Pyrex container. Pour in measured amounts of sugar while stirring until it can hold no more sugar. It is now saturated with sugar. Pour the liquid off the top into another container.

As long as the water is kept at that temperature, all the sugar remains in solution.

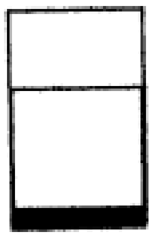
Now cool the sugar water. What happens? What conclusions can you draw about the ability of water to hold dissolved sugar? Heat it again. Does the sugar again dissolve?

Can you taste the difference in the amount of sugar dissolved in the hot and cold water?

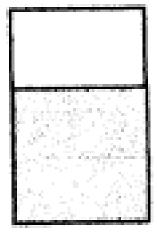
Pass the water containing dissolved sugar through a coffee filter. Is the sugar filtered out? By taste, compare some filtered sugar water with unfiltered sugar water.

You might try some of the above activities with salt. Is sugar the only substance that will dissolve in water?

EXPERIMENT: SUSPENSION



Sediment



Suspension

Collect river water from a silty river. Let the water sit overnight. What happens to the silt? Stir it up again. Let it settle. What conclusions do you draw?

Heat the water in a clear container and keep it heated with an alcohol lamp or other heat source. Let the silt settle. Does the temperature of the water influence the amount of silt that can be held in suspension? Or is that influenced by the motion of the liquid?

Pass silty water through a coffee filter. How much of the silt passes through the filter? Let the filtered water settle for a while. Can you see the silt in the filter?

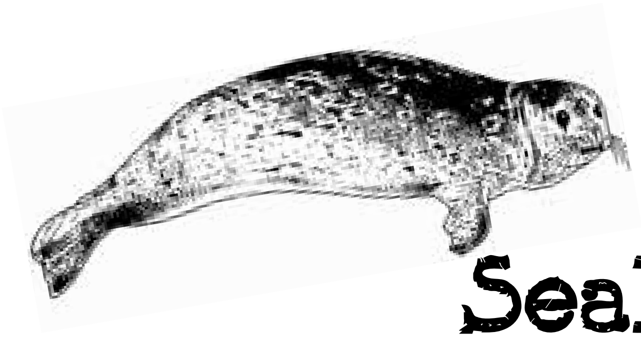
Boil silty water. Does the silt settle faster in boiled water than in cold water that hasn't been boiled?

If you are able, obtain silt samples from upstream, middle region and downstream of a large river. What are the differences? How can you explain this?

Your Conclusions

From the above experiments, what can you say is the difference between a solution (being dissolved in a liquid) and a suspension?

How are river deltas formed?



Seals & Beaver, Floating & Sinking

Coastal people shoot seals in the open ocean. If the water is undiluted by fresh river water, and the seal is fat, the seal will float. If the seal is shot in the river, it will sink. They tend to float more in the winter than in the summer because of fat content. Why is this so?

Upriver people used to shoot beaver in the fall and spring. Grandma Charlie of Sleetmute told me, "In the spring, if the leaves are as big as the beaver's ear, the beaver will sink. Before that, they float." This was important because years ago as we used to shooting beaver in the spring. There is no use to shoot them if they sink and drift away.

A moose or caribou shot in the water will float. A black bear or brown bear shot in the water will sink.

What is happening? Why do some animals float and some sink?

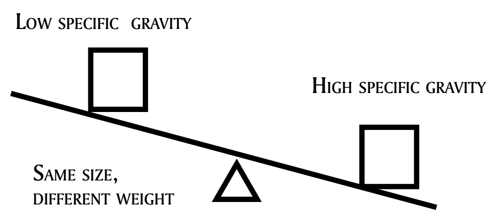
To understand this, we only need to understand **specific gravity**.

Defining and Determining Specific Gravity

What is density? Density explains the **relationship** of:

- How much something weighs compared to
- How much space it takes up.
- How **dense** it is.

An object that has great weight and takes up little space has **high** density.



An object that has little weight, but takes up much space has **low** density. Two objects might take up the same space but have different weights. The heavier one has a greater specific gravity.

Water is one of the most common and most important substances in the world, so everything is compared to water. One cubic centimeter of water weighs one gram. Anything that has a volume of one cubic centimeter and weighs one gram is said to have a *specific gravity of one*.

Anything that has a volume of one cubic centimeter and weighs *more* than one gram has a specific gravity of *more* than one. Gold has a specific gravity of over 19. That is, a cubic centimeter of gold will weigh over 19 grams.

With a specific gravity over one, the object will sink in fresh water.

Anything that has a volume of one cubic centimeter and weighs *less* than one gram is said to have a specific gravity of *less* than one. Most types of wood have a specific gravity of less than one. They float.

Animals

What determines whether a beaver floats or not? If the beaver's specific gravity is greater than one, it will sink. If it is less than one, it will float. It is that simple.

Let's say that another way. A beaver's body displaces a certain amount of water. If the beaver weighs *more than* that amount of water, the beaver will sink. Another beaver's body displaces a certain amount of water. If the beaver weighs *less* than that amount of water, it will float.

When I am swimming, my legs have a specific gravity of less than one. They sink. My body, particularly my chest area, has a specific gravity of less than one, and I therefore float with my back out of the water and my legs hanging downward. My average specific gravity is less than one, so I float.

Again

The specific gravity of fresh water is one.

If an object has a specific gravity of greater than one, it will sink in fresh water.

If its specific gravity is less than one, it will float in fresh water.

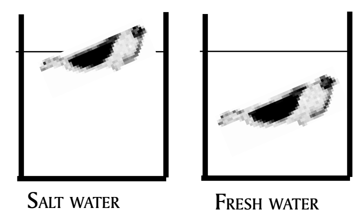
The Application

Why does the seal sink in fresh water? The answer is easy. Its specific gravity is greater than one. It is heavier than the water it displaces.

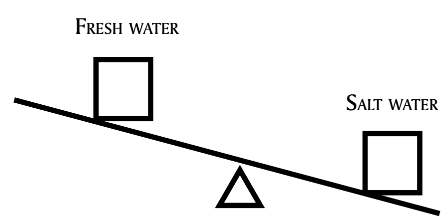
Why then does the seal float in salt water?

The salt content in the ocean water makes a cubic centimeter of salt water *heavier* than a cubic centimeter of fresh water. Its specific gravity is greater than fresh water.

A seal has a greater specific gravity than fresh water, so it sinks. However, the specific gravity of a seal is *less than* the specific gravity of salt water, so the seal floats.



This science principle works constantly. Fresh water will actually float on salt water because it is lighter. It will float until they mix. At the mouth of Alaska's rivers, the water on top is less salty than that on the bottom.



Warm water will float on colder water because its specific gravity is less. Water in any condition will float on mercury because the specific gravity of mercury is over 13. A copper penny will sink in water, but float on mercury.

Back to the moose, caribou, black bears, and brown bears. The bears sink because their specific gravity is much greater than one. Moose and caribou float, partly because their hair is hollow, but also because their bodies aren't as dense as the bears. The average if their specific gravity is less than one. Their horns and bones tend to sink, but their hair and lungs float.

A Story

I heard a funny story 30 years ago. A bear was swimming across the river in front of a village. Four men hopped into a long riverboat. Knowing that the bear would sink if they shot it, they put a rope around its neck, planning to drown it behind the boat. The pilot accelerated the boat to pull the bear

under the water. However, the rope they used was tied to the front of the boat. It was shorter than the long boat. The bear came alongside the boat with the rope around its neck, and crawled into the boat. With two men on either side of the bear, no one dared to shoot. The pilot crashed into the bank as everyone dove out of the boat. The bear, still dripping, with the rope around its neck, followed the two men out of the front of the boat. On the beach it met its end. Unfortunately for the four hunters, the event took place with the whole village watching.

They knew about the bear's specific gravity, but didn't take time to estimate the rope's length. They got A in science but a D-minus in math that day!

Back to the Question

We could ask, "Why do the beaver sink when the leaves are as big as his ear, but not before?" The answer is: the beaver loses some of his fat after breakup when the leaves are growing. Fat has a very low specific gravity and helps keep the beaver afloat.

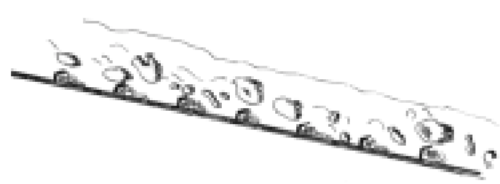
If you shoot a beaver and it sinks, it will stay on the bottom. If there isn't much current, you can see little bubbles coming up, and snag the beaver with a hook on a long pole. Oldtimers used to split the end of a long willow. They poked the bottom until they found the beaver. They then pushed and twisted the willow until the beaver's hair was caught in the end of the willow. They slowly drew the beaver to the surface.

If you lose the beaver, it will float in a couple of days, as the gasses produced by decomposition will increase the size of the beaver, and therefore decrease the specific gravity to less than one. Of course, at that time, it would not be fit to eat.

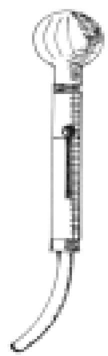
A seal that sinks in fresh water will also float in a few days.

Other applications

1. Gold mines usually separate gold from the other rocks by a two step process.



First they screen and size the material. Then they use the very high specific gravity of gold to separate it from the other rocks. Water and the ore are kept in motion down the sluice box. Gold and black



sand will always settle to the bottom before the other materials because of their very high specific gravity.

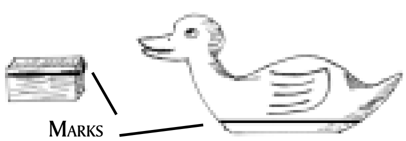
"Country rock" that accompanies gold has a specific gravity of 2.5 to 3.5. It quickly goes to the top while gold and other heavy metals go to the bottom of the sluice box, jig, or recovery system. The country rock is washed away and the gold and black sand remain.

2. A battery tester for a 12 volt automotive battery tests the specific gravity of the acid in the battery. The acid in a charged battery has a greater specific gravity than the acid of a discharged battery. The float in the tester will float higher in the acid of a charged battery than a discharged battery.

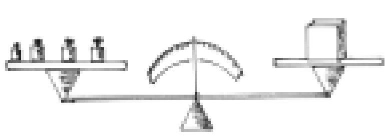
3. The tester for antifreeze in a car or truck works the same as the battery tester. It doesn't test at what temperature the antifreeze becomes solid. It only measures the specific gravity of the antifreeze.

From a built-in chart based on the manufacturer's experiments, the tester indicates the freezing point of the fluid.

EXPERIMENTS, PROJECTS AND QUESTIONS

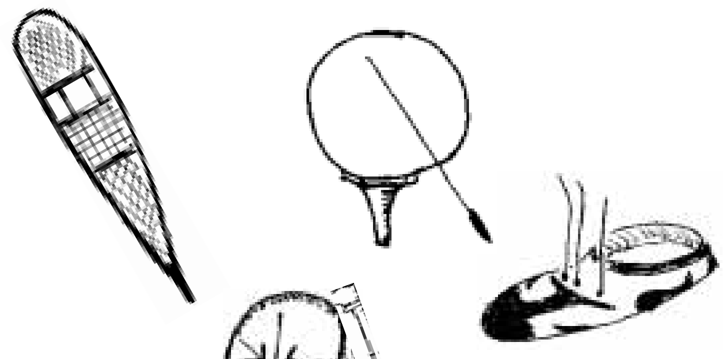


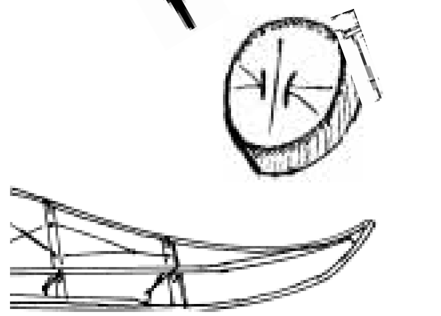
- Test eight to ten different small objects for their ability to float in fresh water. Put a mark on the waterline of the objects that float. Put as much salt or sugar into the water as will dissolve. Test each of the objects again. Do they float higher or lower? Do some that sank previously now float?
- Try floating the same objects in other liquids. Do they float higher or lower? (Liquid laundry detergent, pancake syrup, shampoo, rubbing alcohol, etc.)
- Does stove oil float on water, or water on stove oil? First predict what will happen, then test the above eight to ten objects in stove oil. Which float and which sink?



- Weigh a liter of fresh water. In the same container, weigh an *identical* amount of ocean water. Can you determine the difference on your scale or balance, or is the difference too small to be detected?
- Put food coloring into hot water. Can you pour the colored hot water into a container of cold water gently enough to see the hot water *float* on the cold water? Do this again with colored, salted hot water. Is there a difference?
- If there is a lake free of ice, take the temperature of the water at the surface and again at the bottom. Is there a difference? How could you explain this in terms of specific gravity?
- In the winter, it is warmer at higher elevations than on the rivers (if there is no wind.) Why is this? Why do you think moose migrate from the rivers to the mountains in October until the snow gets too deep in January and February?
- On a very cold day, take the temperature on the river. Go quickly to a high point and record the temperature. What is the difference? How could you explain this regarding specific gravity of colder and warmer air?

- If your class or family goes on a trip to a location with a swimming pool, test each student or family member to see who can float the highest, and who sinks the deepest. What conclusions can you draw about flotation and body types?
- Do you think someone would float higher or sink deeper in the Great Salt Lake in Utah than they do in the ocean? Why?
- Ask the oldtimers in your area which animals float and which ones sink and if that changes with seasons. If you live where a river flows into the ocean, ask them about the animals in both fresh and salt water. How do people catch seals in fresh water? How do they keep from losing them?
- Test different animal's fur for flotation. Which ones float and which ones sink?





Steaming

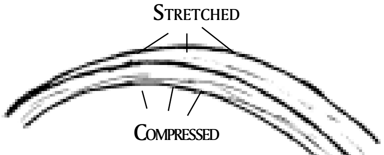
For untold centuries oldtimers have been bending natural materials. Some materials bend more easily than others. We have always been looking for ways to improve the bending of natural materials.

The most common traditional applications of bending are: Aleut bentwood hats, snowshoes, drum frames, canoe ribs and sled parts.

When we bend materials, there are two stresses.

- The inside of the bend is being compressed.
- The outside of the bend is being stretched.

Obviously, the thinner the material is, the easier it is to bend as the inside is compressed less and the outside stretched less.



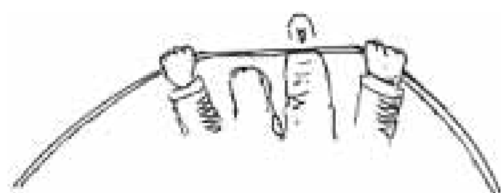
Oldtimers spent much time looking for the choice piece of wood that would not break when it was bent.

Steaming

When wood is dry it isn't very flexible. Wetting the wood helps the bending process. Steaming helps even more. However, there are advantages and disadvantages of each. Excessive steaming weakens the wood.

Many people wrap the wood with a hot steamy towel as it comes out of the steamer. This keeps it from drying and cooling until bending is complete.

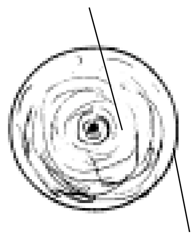
It is important to bend the wood gently, flexing it gradually, being careful not to



bend too much in one place. If there is a spot that doesn't want to bend, we put it over our knee at that place and gently flex it. If it still doesn't bend, we take a timeout, and thin it at that spot with a hand plane or knife.

If the fibers start to split off, quickly wrap that place with string, keeping the fibers intact. Continue bending gently.

EXPERIMENT

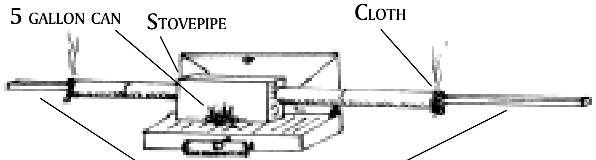


Cut or split identical pieces of green wood about two feet long. Identify which side is from the outside of the tree and which side from the inside. Try bending two ways: inside of tree on the outside of the bend, and outside of the tree on the outside of the bend. Which way seems to bend the easiest? Which way breaks more easily than the other.

EXPERIMENT: EASE OF BENDING

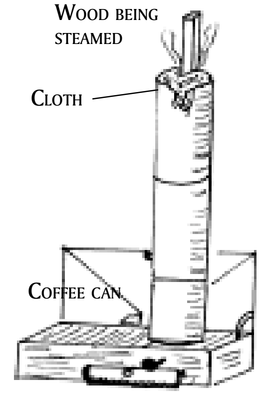
Cut or split identical pieces of green wood. Try to bend the first piece. Try to bend a second piece after it has been soaked in cold water for a time. Try a third piece after it has been soaked in hot water, and a fourth piece after it has been steamed. What differences do you notice?

You can make a steamer like either of the ones illustrated here.



Be careful, as steam and hot water can inflict severe burns. Use gloves and eye protection. Some people say the steamer needs to have a great deal of water, and to use a drum.

Try bending different materials, birch, spruce, willows, and other natural materials after they have been steamed or soaked in hot water. Many people have spent hours shaping a piece of wood, only to have it crack before taking shape. Learn how to steam on scraps first. Then steam and bend carved pieces.



Traditional steaming

In parts of Alaska, steaming was done by digging a pit, and making a fire in the pit. The ashes were scraped from the hole. The wood was wrapped in seaweed or wet grass. The wood was placed in the hole and buried with hot dirt and topped with hot coals, the moisture from the seaweed was heated by the dirt and coals, and the wood rendered soft and pliable.

EXPERIMENT: WEAKENED BY STEAMING?

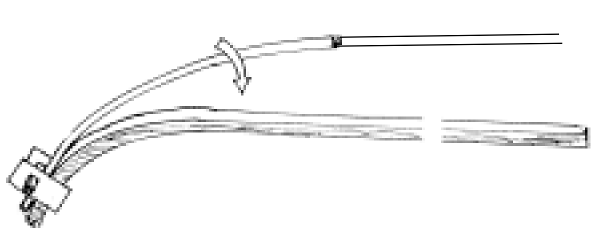
Cut or split two identical pieces of wood. Soak one in very warm water, bend it, and let it dry. Steam the other piece for quite a while, and bend it and let it dry. Test both pieces. Is the piece that was steamed for a long time weaker or stronger than the piece that was only soaked in warm water?

Since it is impossible to find two pieces of wood that are identical, it might be best to try to bend four pieces, two in warm water and two steamed.

Bending Jig

When wood is bent, we often need a form or shape to bend the wood upon. Many such forms, or jigs are possible. Below is a jig to bend sled runners. The runners are clamped to the jig until they dry. Slow careful drying prevents cracking.

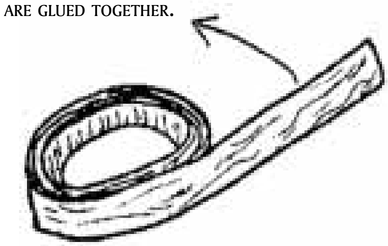
Snowshoes are bent around a jig that shapes them to the proper size and form.



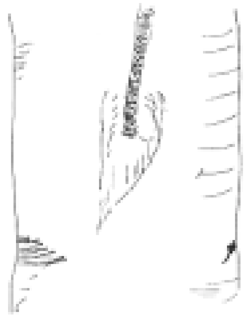
Aleut bentwood hats are often bent around a frame, and then the pieces are held together with clamps. The wood is soaked in a wide pan of hot water, not steamed.

Drum makers often cut very thin strips of wood, steam them, then bend them around a circular jig, gluing the different layers

Bending a drum frame in thin strips that are glued together.

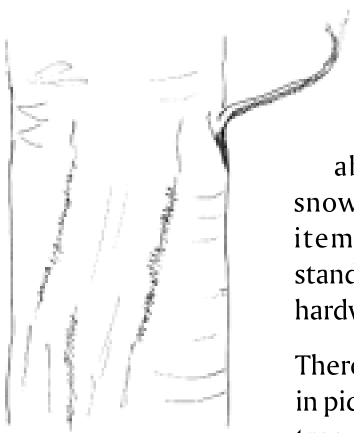


together into a very strong round frame.



Selecting a Birch Tree

For centuries, Alaska Natives have made all of their tools from local resources. Only a few materials were traded with the Russians.



Alaska has several different kinds of trees, but there is only one hardwood that is suitable for making dogsleds, snowshoes, and other durable items. The Alaska birch tree stands alone being the toughest hardwood in the state.

There are several considerations in picking a birch tree for use. The tree must be straight splitting, have few or no knots, have a minimum of heartwood, and have tough fibers. There are few trees available that have all these qualities. As oldtimers traveled, they constantly watched for "the tree" from which they would make their next snowshoes or sled.

It often takes longer to find the perfect tree than it does to make the snowshoes or sled.

On the average, trees from the Lower 48, like oak, hickory, and ash are stronger than Alaska birch. However, experience shows that a well-chosen birch tree is tougher than commercial hickory and ash. This is particularly true since lumber comes to us sawn from trees with little regard for the grain of the wood. If the grain is straight and intact, the wood of any tree is stronger than if it is sawn.

Alaska birch does tend to rot easily, and must be stored carefully.

Straight grain

There are several ways to determine the grain before falling a tree and attempting to split it.

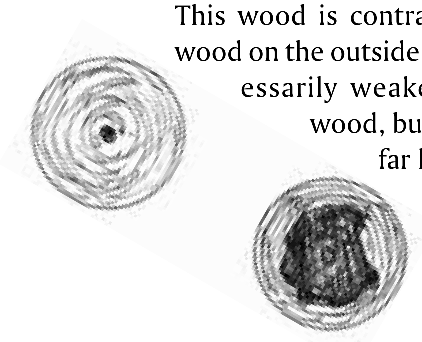
1. Look at the grooves or ridges on the tree. Do they go straight up, or do they twist to the side? Look under the knots. Often there are grooves leading up to the knot. Are they straight or twisted?
2. Another way to check the grain is to remove some of the bark and look at the grain. Chop a little of the wood, and peel the fibers from the tree. Do they split straight down, or do they twist a little to the side?

If the grain is twisted, it is better to find another one. Snowshoes and sleds are difficult to make. It is worth the time and effort to find the right tree.

Knots

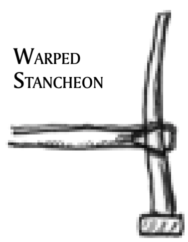
It is very difficult to find a tree with no knots. They disrupt the grain of the wood and weaken it, particularly on thin pieces like snowshoe frames. There is a difference between knots, however. Obviously some are larger than others. There are live knots and dead knots. A live knot is the knot of a branch that was alive when the tree was harvested. A dead knot is from a branch that was dead. Live knots are *much* stronger.

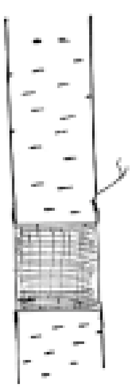
Heartwood



Inside many birch trees is dark heartwood. This wood is contrasted with the white wood on the outside. Heartwood isn't necessarily weaker than the outside wood, but the water content is far less. If a sled member has a little heartwood and the rest is white wood, it will tend to warp strongly towards the white wood when it dries, shrinking more on that side than the heartwood side.

Warped Stancheon





When women peel birch trees to make birch baskets, the tree isn't killed. Oldtimers say the tree reacts by producing much more heartwood.

It is often easy to tell how much heartwood is present in a tree by noticing the black flecks on the bark. They look like woodpecker holes. The more black flecks there are, the more heartwood there is.

Tough fibers

Trees are like people. Some are tough and some aren't. If a tree has tough fibers, the snowshoes and sleds will last a long time. Strong pieces can be made smaller and therefore lighter. One tree might be three to four times stronger than another.

There are several things that make a tree tough

Genetics

If a tree comes from the seeds of tough trees, it too will be tough.

Soil

A tree on good soil with proper minerals and water content can also be a tough tree.

Location

If a tree is in a sheltered place, the fibers of the tree will tend to be weaker. If the tree grows in a windy place, the tree will tend to be more gnarled, but the fibers will be very strong, as the wind bends and flexes the tree, toughening the fibers. I once built a dogsled from small trees that had grown on a hilltop, and it was the strongest sled I ever owned. The wind had conditioned the wood to flex without breaking.

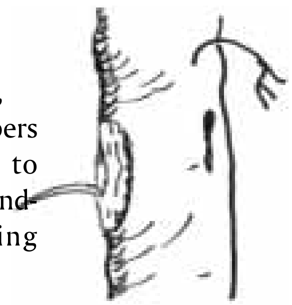
Picking a Tree

To choose a good birch tree, it is important to be looking all year long. A hunter might be chasing a moose and pass a good tree in a location he has never been before. He makes a mental note where the tree is.

The first qualities to look for are:

- Is the tree physically straight for the length of the piece you want to make? Are there too many knots?
- Next, look at the topmost branches. Are they straight up or drooping? If the branches are drooping, the fibers tend to be more flexible. If they are straight up, the tree tends to be more brittle.

- Look for ridges on the sides of the tree or under the knots. Are they straight up the tree or do they indicate the grain of the tree is twisted?
- Look for the black flecks that indicate excessive heartwood.
- Chop a little of the bark away from the tree. Chop a few fibers and pull them away from the tree. Do they split off quickly indicating that the wood will be easy to break? Do they split in a way that indicates the grain is twisted, or is it straight up and down the tree? Bend the fibers that peel off. Are they tough or do they break easily? If it is winter and the wood is frozen, put the wood fibers in your mouth to thaw before bending and testing them.

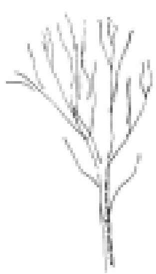


Splitting

You will have to ask Elders in your community to learn how to split. Even a good, straight-grained tree will split crooked without the proper methods. Splitting is an art.

EXPERIMENT

Test the above statements by observing the qualities of different trees. Test the fibers of five to ten trees.



Compare the fibers of a tree that has droopy branches to ones that have straight branches. Which flex better without breaking?

Compare the fibers of trees grown in protected groves with those grown in windy places. Which seem tougher?

Compare the amount of heartwood in trees that have many black flecks on the bark with those that don't. Which have the most heartwood? (Does someone in your village have birch in the woodpile where you can easily observe this?)

Chop a sliver of bark from several birch trees. Test the exposed wood fibers. Can you detect a difference in their strengths? Can you tell if the grain is straight or twisted? Look for the outward signs of twisted grain or straight grain. Compare those signs with the actual grain. Do the outward signs give a clear indication of the true grain of the tree?

Split a thin piece of birch from a block. Saw another piece identical in size to the split one. Try bending them. Which bends best?

Test a good birch tree with some strips of oak, ash, and hickory. What conclusions can you make about quality, grain, weight, strength, and durability?

What conclusions can you draw about selecting a good birch tree?

Spruce & Other Roots

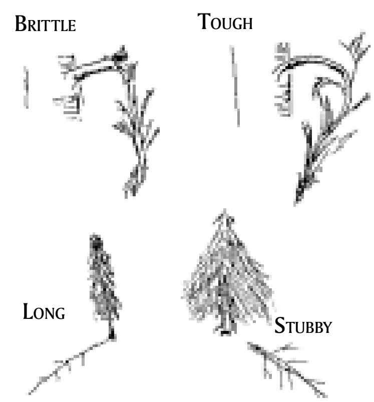
There are many traditional uses for spruce roots: birch baskets, canoes, fish traps, a variety of lashings and even whole baskets made of woven roots.

Location

Look for a patch of smaller spruce trees 10–20' tall. They might even be among cottonwoods. The roots on very large spruce trees are often too deep to dig easily

You can tell the quality and nature of the roots by the tree itself

- If the branches are brittle, the roots will be brittle and easy to break. Test the branches to see if the roots are strong.
- If the tree has many branches like a Christmas tree, then the roots will tend to be short with many small branches. If the trunk of the tree is long and slim, the roots will tend to be the same way
- If the roots are too deep they are hard to dig.



- If you can't tell spruce roots from cottonwood or other roots as they are entangled with each other in the soil, smell or taste them. They have the same distinct smell as the needles, branches, and bark of the spruce tree.

Oldtimers used a stick to dig roots.

Nowadays we use a carpenter's framing hammer

DIGGING STICK

EXPERIMENT

Test the trees, then test the roots. Do you notice a connection between the toughness of the branches and the toughness of the roots?

Is there a connection between the configuration of the tree trunk and its roots? (long vs. stubby with many branches)

1. Try gathering roots with your hands, then
2. Make a stick like the oldtimers.

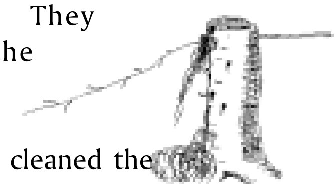
   Try a framing hammer. Which method do you prefer?

Some people gather the roots exposed on cutbanks. This is a very easy method, but the roots are too dry to clean unless gathered right after being exposed.

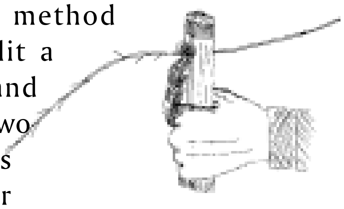
Cleaning the Roots

Cleaning the bark from the roots is easy or hard, depending on when they are gathered. If it is June or July, the bark comes off quite easily. Before or after June/July they peel with more difficulty, although cleaning is never the hardest part of the job. Digging the roots is the difficult part.

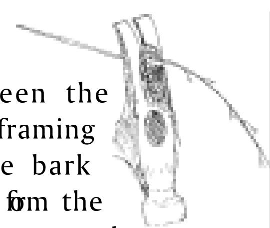
1. Oldtimers used to chop a tree down that was 2”–3” in diameter, leaving the stump at least 12–18" above the ground. They split the stump with an axe, and cleaned the roots by pulling them through the crack in the stump. This works quite well, but the crack tends to plug requiring frequent cleaning.



2. Another method is to split a stick, and tie the two pieces together on one end. Holding the stick together while the spruce roots are pulled between them cleans the bark from the roots. It is easy to clean the bark from the crack in the stick.



3. Nowadays we pull the roots between the claws on a framing hammer. The bark peels easily from the roots. This seems to be the best method, as it cleans the roots quickly and is itself easy to clean. We use the same hammer to dig the roots. It is a two-in-one tool.



EXPERIMENT

Try cleaning roots gathered before, during, and after the June-July season. Is the difference noticeable?

Try the above three methods of cleaning roots. Which do you prefer?

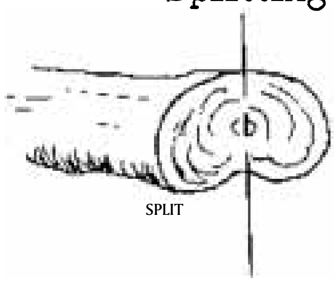
Willow and Cottonwood roots

Cottonwood roots look good, but after they dry, the break by themselves. You can hear the popping noise as your basket comes apart.

Willow roots are often good, but there are many different kinds of willows.

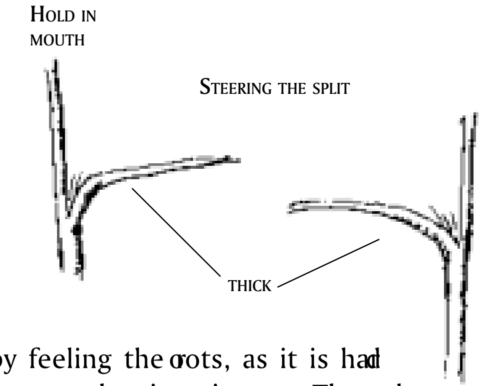
They can be gathered by pulling up willows on a sandbar, or collecting them as they hang from cutbanks. The only way to find a good place for roots is to try many different locations. Some are long, some short. Some are tough and some break easily.

Splitting



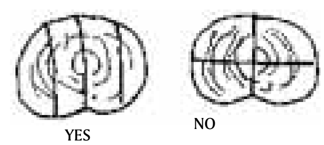
Once the roots are gathered and cleaned, they also need to be split, as one end is thick and the other thin. The roots often have a natural indentation. Start the split there.

Split the root down the middle as accurately as possible. When one side gets thicker than the other, bend the thick one. The stress on it will cause the fibers to split over towards the thinner side. The split is "steered" by bending or holding straight the both sides of the split. We usually hold one side of the split in our teeth. We split



by feeling the roots, as it is hard to see what is going on. The rule is "Stress the fat one."

How thick or thin they need to be depends on the use. When we split a root into fourths, we do as shown on the left, not as on the right.



Splitting willow branches is very similar to splitting spruce roots. We often let young people practice on willow branches as they are much easier to gather. Once they have mastered splitting, we let them do roots.

EXPERIMENT

Some people split the roots first and *then* clean the bark from them by scraping with a knife. Try both methods:

1. clean then split, or
2. split then clean. Which is easier?

Compare the strength of spruce roots to those of willow and cottonwood. Do several tests with roots of similar size. In the past, people from different villages traded with each other. You might have to trade with other villages too.

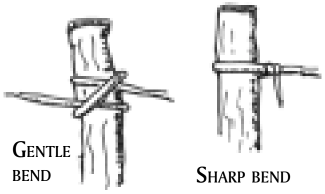
Compare the strongest of these with modern materials like nylon and cotton. We split the straps used to wrap our groceries and use them for lashing. They split very easily and are incredibly tough.

Storing

We usually store roots coiled in small plastic bags in the refrigerator or freezer. This keeps them from drying out, although dry roots can be soaked in water and restored.

Knots

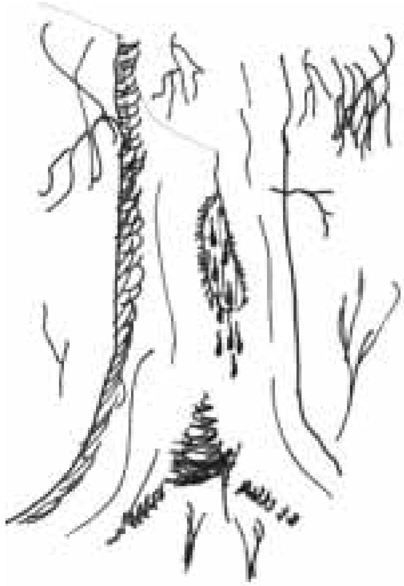
Bending the fibers in roots greatly weakens them. All knots and lashing should be done in a way that bends the fibers as little as possible.



Ask the Elders which knots were used for different applications. Experiment with different knots in those applications. Which knots work best for you?

Planning ahead

It is impossible to get roots in wintertime. The wise basketmaker gets an adequate supply in the summer and fall. That is wealth.



Spruce Gum

Modern technology has brought us many different sealants and adhesives. Oldtimers had a traditional solution that was free, versatile and available almost everywhere: spruce gum.

Oldtimers used spruce gum to fix leaky canoes and other watertight containers.

Preparing

If we try to apply spruce gum as it comes from the tree, it will not adhere well, and will soon crack. The secret is to heat a mixture of spruce gum with the right amount of oil or grease.

- If there isn't enough oil, the mixture will be too brittle.
- If there is too much oil, the mixture will be too soft.

DIFFERENT MIXTURE EXPERIMENT

Find out the right gum/oil mixture.

- Collect some spruce gum in a small can. Most older trees have an injury or two that is dripping gum. Many trees on top of cutbanks have such injuries from collisions by ice during breakup.
- Sew two pieces of birchbark together.
- Slowly heat the spruce gum in a small can, and carefully apply it to the seam of the sewn bark. When it cools, test it by bending and twisting.
- Now try the above with different amounts of oil mixed with the spruce gum.

What proportion seems to work best?

Experiment with different types of oil: vegetable oil, shortening, even motor oil. Use animal fats, like seal oil or bear fat if you can get some. What type of oil works best, or are they all about the same?

Different Temperature

You just conducted the experiment with the materials at room temperature. If you were patching a canoe, the gum mixture would be working at the temperature of the water in the lake or river. Put some on your fingers and test it in the water (don't burn yourself.) What differences do you see in the spruce gum mixture at this temperature?

I have used spruce gum to fix a boat in the past. Test the gum between your fingers in the river water, making sure the mixture was pliable at that temperature before applying it to the boat.

What is the ratio of gum to oil? What is the temperature of the water?

Is gum a better adhesive or sealant?

Now, prepare the best mixture from your experiment above. Put beaver, moose or other fur in the gum mix. Does this increase its strength?

What conclusions might you draw about spruce gum as a calk or sealant on a boat?

Is there a difference in the types of spruce gum? Is the clear gum better than the gum that has turned white and hard, or do they both melt down well in the can?

EXPERIMENT

You might also want to test the gum mixture as a sealant on different materials: birch bark, wood (dry and damp), aluminum, and skin (as used for skin boats). What conclusions can you draw from this?

Compare spruce gum with silicone or other sealants.

Is spruce gum affected by gasoline or other solvents after it is applied to a seam?

What conclusions can you draw about spruce gum as a sealant on the above materials?

Other Applications

Spruce gum is also very effective to stop bleeding and infections in cuts. Oldtimers put spruce gum in a cut and left it there. Its medicinal value is high. Try softened gum in a cut the next time a small accident happens.

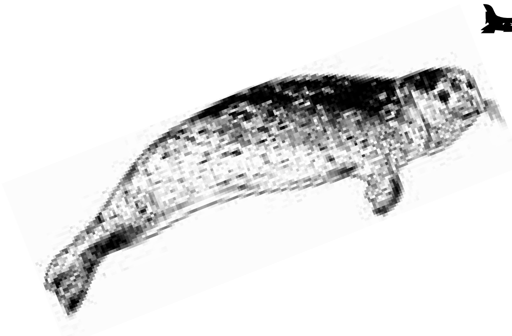
People who understand medicinal plants say to get gum from a young strong tree. A tree that is too small is like and infant, and isn't healthy enough yet. A tree that is too old is losing its life force. A tree that is the equivalent of a 20–30 year old person has the most resistance to bacteria.

Spruce gum is a healthy replacement for chewing gum. However, it is quite sticky. We sometimes heat it and mix in a little sugar, letting it cool again. Some gum is very dry on the tree, other gum is quite pitchy. Experiment to find the best gum for chewing. Don't be discouraged in the process. There is a certain texture you are looking for.

We chew spruce gum after eating salmon eggs to remove the sticky eggs and other food particles. Try it.

To remove spruce gum from hands or clothing, rub in some shortening. When it has removed the gum, wash them both off with soap and water.

Spear Throwing

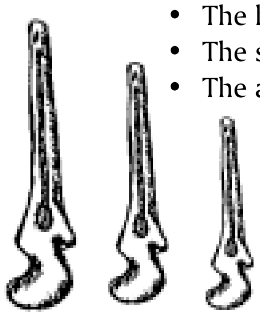


In certain seasons in certain water conditions seals sink when shot. Losing a seal is always a possibility. Even today, many people living in the mouths of Alaska's rivers spear seals rather than shoot them with guns so they can be retrieved before sinking.

For centuries, people experimented with spears and throwing sticks called atlatls. A precise science has been developed by seal hunters to obtain the greatest distance and accuracy.

There are three variables in throwing a spear:

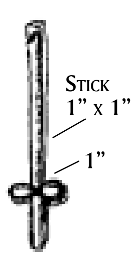
- The hunter
- The spear
- The atlatl

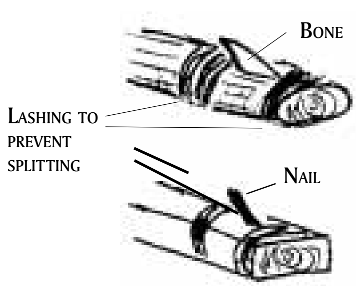


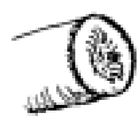
Experiment with different atlatls. Make a long, a short, and a medium length atlatl. Traditional atlatls look something like those on the left:

You can make a simple one like this:

On the end of the atlatl is a pin that was traditionally made of bone or a tooth. You can make it from a nail while experimenting.

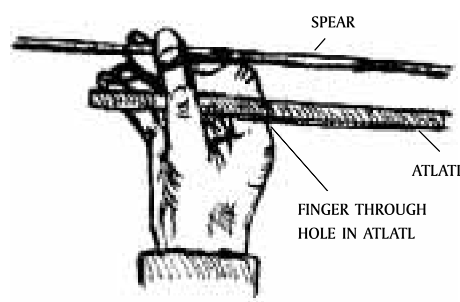






Hollow the tip of the spear so the nail will seat in the end of the spear and not slip off.

Throw a spear ten times measuring each throw for distance.



Throw the spear ten times measuring for accuracy (How many times you can get the spear within a 10' circle from 50'.)

Which atlatl gives the greatest distance, the long, medium, or short one? The best accuracy?

Now experiment with different spears. Try a long spear, a short one and a medium length spear.

Try a spear with feathers in the back.

Try a spear with a weight in the front.

Try a spear with feathers in the back and weight in the front.

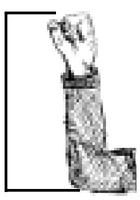
What is the most effective combination of altatl length, spear length and spear design?

Experiment with different weights on the end of the spear. Put on a heavy, a medium, and a light weight. (I test by wrapping with strips of lead.) Which is most effective for distance and accuracy?

With your ability to throw a spear, would you eat supper tonight or go hungry?

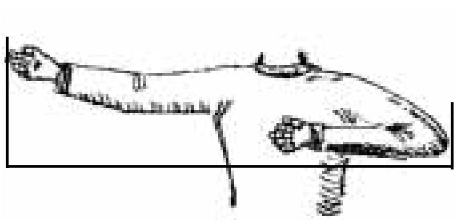
I have always wondered if the long slim shape of the Aleut bentwood hat was to keep the hunter from knocking his hat off when he threw a spear.

Traditional atlatl length



Traditionally, the length of the atlatl is from the elbow to the first knuckle.

The length of the spear is from the elbow of one arm to the outstretched finger of the other arm.



spear length elbow to fingertip

Another person bigger or smaller than you should try the same experiments with the same atlatl. Are the results the same for a different size hunter, or does the size of the "perfect" atlatl vary with the size and strength of the hunter? Do left-handed people have an advantage or disadvantage.

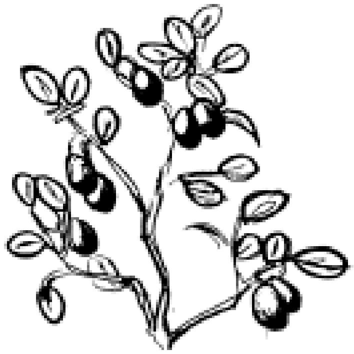
Again, there are three variables:

- The hunter
- The atlatl
- The spear

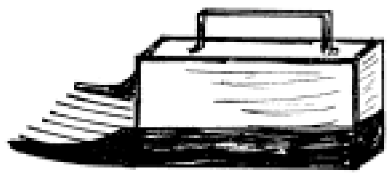
Long ago, hunters threw while sitting in a kayak. Nowadays, they stand up in the front of a large boat.

Compare your distance and accuracy while sitting vs. the results while standing. Use the same atlatl and spear. From which position can you throw farther? Is this true for other hunters too?

This enjoyable experiment has very important conclusions.



Berry Pickers



During the fall of every year, most Alaskans are very busy. One of the most important activities is picking berries to store for winter. For many decades steel berry pickers have been available.

They have several advantages:

- They pick berries very fast.
- They hold a quite a few berries before needing to be dumped into a bucket or other container.

They have disadvantages:

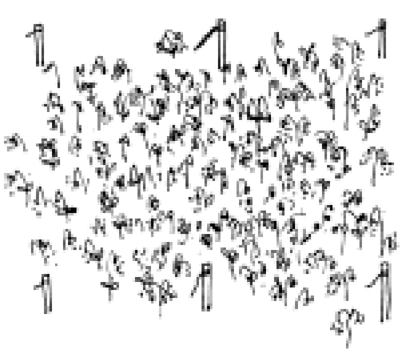
- They also pick leaves, sticks, and other undesirable material, making the berries *dirty.*
- There is also a controversy. Some people say the berry pickers damage the blueberry bushes. Other people say they do less damage than bears, and are therefore not harmful. No one says they harm lowbush cranberry bushes.

One village will allow anyone to come and pick blueberries in their area, but won't allow anyone to use steel berrypickers.

It will take time, careful observation, and measuring to do the following experiment, but a good scientific answer is possible.

EXPERIMENT

Find several patches of blueberries. With flagging, divide the blueberry patches roughly in half. Harvest the berries on one side by hand, and the other side with a berry picker. There are three ways to measure the harvest from each section: by weight, by volume, or counting each berry. I would probably go by weight.



Record the weight, volume or number of berries from each section.

Examples: Handpicked area =1356 grams of berries. Picker area = 834 grams. The berries from the handpicked area represents 62% of the berries in the patch. Another area has 378 handpicked berries while the picker area has 276. The berries from the handpicked area thus represent 58% of the berries.

To be accurate, mark and harvest several patches in this same manner recording all data.

Considerations

There are many variables involved in a blueberry harvest:

- Amount of rain, sunshine, spring snow melt
- Timing of rain and sunshine
- First frost, etc.

Do the same measurement for two more years in exactly the same spot. Does the percentage of berries decrease in the area harvested with the berry picker?

The number of berries in one year might vary greatly from one year to another, so compare the percentage of berries picked in the two sections, metal picker and hand picked. The question you are trying to answer is: Does a berry picker help or harm the berry production? Does the percentage of berries from the area harvested with the steel picker go up, down, or stay the same from year to year?

You might want to put a sign over your berry patches asking people to leave the berries alone because you are doing a scientific experiment there.

Some scientific experiments take many years. A bear or birds harvesting in your patch one year might throw the conclusion off.

You will have to pick the berries at the same time each year. When berries are overripe, the berry picker smashes berries, and the count will be off if you are measuring by volume.

This is an important experiment that needs to be done. We want to care for our berry patches, and we don't want unnecessary conflict between people. This experiment will take the discussion from the realm of opinion into the realm of fact.

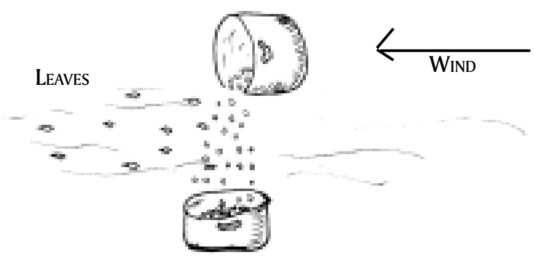
Cleaning Berries

After the berries are picked, they must be cleaned. Some people pick berries very clean and some (like me) pick like a brown bear (lots of rubble).

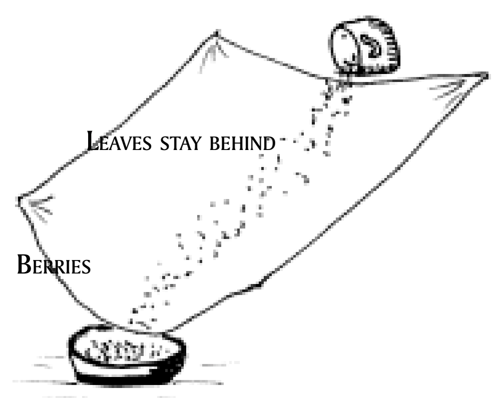
There are several ways of cleaning berries.

Our oldest daughter goes over every berry on the table, plucking the stems from *each berry.* That's too tedious for most people.

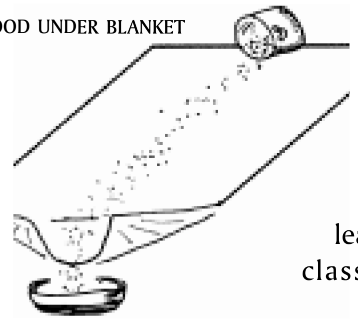
Oldtimers used to pour the berries from one container to another in a strong wind. The leaves and sticks have more surface area and less weight than the berries, and therefore blow away. The berries are heavier and drop into the bottom container. The only problem is the lack of a strong wind at the critical time of cleaning. If berries sit too long, some of them smash and the wet leaves stick to the good berries. They must be cleaned by wind soon after picking.



My wife and I had another way. I drove the boat and she poured the berries. We created our own wind. We didn't have electricity for a fan in those days.



Plywood under blanket



Oldtimers also cleaned berries by pouring the berries down a blanket. The berries roll, and the leaves don't. They are classified by shape. Round rolls and flat doesn't. This works well, but the pitch of the blanket often varies. If it is too steep, the leaves tumble into the bucket too.

We put a piece of plywood under the blanket, funneling only the bottom to channel the berries into the bucket.

EXPERIMENT

Try different methods of separating berries from the leaves and sticks by using wind. A variable-speed fan provides many opportunities to experiment. You will note that berries that fall a long ways will damage when they hit, especially those picked later in the year.

Try rolling berries down a blanket. Try different pitches of the blanket. Put a piece of plywood under the blanket. Does this help control the angle of the incline? Does the type of blanket make any difference (wool, cotton, nylon, etc.)?

What percentage of berries must be green to get the same gelling effect as the commercial pectin? 5%, 10%, 25%, etc.

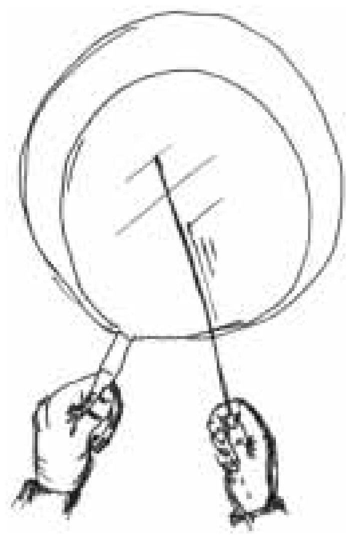
Does it help to smash the green berries, making the pectin more readily available to the jam?

While commercial pectin is relatively inexpensive, the time might come when it won't be available, and we need to know the answers to these questions.

Jam

We now use commercial pectin to make jams and jellies. However, green berries contain pectin that can take the place of the commercial product.

Of course, there are more green berries available in the beginning of the season than there are at the end of the season.



Drum Frames

While many traditional drums appear simply made, much care is given to their construction. There is a tremendous amount of science involved in determining the pitch, timber and durability of a drum.

Tlingit people make drums about 12"–16" in diameter, covering them with deerhide. Fermenting the skin for a while allows the hair to slip easily.

Drums are culturally very significant, so check with the Elders in your area to be sure the following suggestions are appropriate.

The skin is washed and fleshed after the hair is removed, then cut to shape and lashed to the frame in a variety of ways, Experiment with the different ways. Which way keeps the skin tight and is easiest to retention? Which way is traditional in your clan or village?

The outer part of the drum frame should be beveled. If the top of the frame is flat, the drum will have a strange twang. Make one with a beveled top and one with a flat top. Can you hear the difference? A few people make their own frames, but most folks buy them already formed. They are made of thin strips of wood laminated together around a round frame.

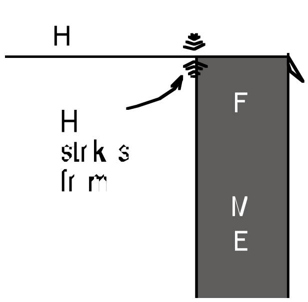
The striker is made of a stick, often devil's club, and a head, which is wound string or cloth covered with leather. Make different strikers: one hard, one soft. What difference do you notice in the sound?

Does humidity change the pitch of the drum? Why do people often heat the drum head over a fire before playing it? After painting, does the drum have a different sound?

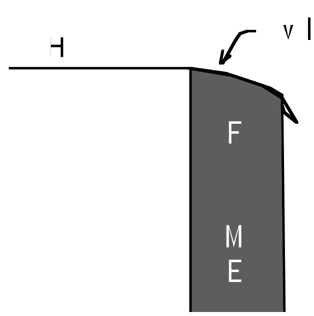
Which makes the biggest difference: the size of the drum frame, shape of the frame, thickness of the skin, tension of the skin, or type of striker?

Yupik and Iñupiaq drums are made quite differently. They are large, two to three feet in diameter. They are held with the face down and struck with a long slim stick, often hitting the rim. The rim is thin, made of driftwood, with a wooden handle lashed onto the bottom of the frame.

Some people have speculated that Yupik and Iñupiaq drums are larger because it is



Twangy sound



Clean sound

much more difficult to bend coastal driftwood than the live trees of the Interior and Southeast Alaska. The drums had to be bigger to keep the frames from snapping.

The covering used to be made of walrus gut, but nowadays people use airplane fabric. The sound is almost the same, and fabric is much easier to obtain and maintain.

EXPERIMENT

Make different size drums. Use different size strikers. If you can, compare the sound of a drum made with walrus gut with one made of airplane fabric. Experiment with different tensions on the surface: tight and looser. What happens if you make it too tight? How do you tighten the airplane fabric?

Make different size drums. Do the pitch and sound change? Does humidity affect the sound?

Contemporary Athabascan drums are similar to Tlingit drums, but some people say they used to hollow out a cottonwood or spruce tree and stretch caribou hide over it. Someone should make one of both kinds and test them for the sound. With science and experimenting, the reasons for the original materials and shape could be rediscovered.

Drums make interesting science. There are several variables and the result is always a product that will last many years.

Conclusion

If you have done many of the activities in this book, and read it with a mind to learn, your life has been changed. Science helps us to approach unknown situations with confidence. It helps develop good conclusions that will be usable today and helpful in the future. The oldtimers in Alaska were always experimenting with new ways to hunt, trap, travel, and preserve food.

If you have done a collection, you have learned basic science skills. If you did a demonstration, you developed an ability that will be with you for the rest of your life. If you took on a project where you had to *observe and think*, you have developed a habit, a thinking pattern, that will serve you again and again. If you have done an *experiment*, you are on your way to being a mature scientist.

Whether you become a scientist as a career or just as a practical person who wants accurate conclusion, you're a winner.

There is a *natural high* that comes from a good project. There is no end to questions that can be asked and explored. There are not enough hours in the day to pursue them all.

Village people constantly apply new materials and technologies to traditional activities. Recently, I experimented by putting a sheet of white sled runner plastic under my boat. The plastic protects the part of the boat that rubs the bank. Better yet, I found that I could run over shallow places, beaver dams, rocks, and other obstacles where I would have been stuck before. My hypothesis was correct. The benefit was well worth the money and effort.

If you have caught the spirit of this book, you are in for some great adventures, most of them right in your own yard or village.

Your partner in curiosity,

Alan Dick