CFW PERSPECTIVE

Whole Grains—Issues and Deliberations from the Whole Grain Task Force

J. M. JONES
Chair of the AACC International Whole Grains Task Force
Food and Nutrition Department, College of St. Catherine, St. Paul, MN

This is the first of two articles on the work of the Whole Grains Task Force (WGTF). The WGTF began its work in December 2005. In that time it has addressed a number of issues. The WGTF works through conference calls with academic, industry, non-profit agency, and government participants. There are core participants who regularly attend the calls. In addition, there are individuals with special interests or expertise who participate from time to time. There is an attempt to have various industries and areas of the world represented. No person interested in participating in the calls has been denied a voice (while more than one person from a company may be on a call, during voting only one person per company or organization votes). Furthermore, the work of the WGTF is strengthened by smaller expert task forces convened to deal with issues specific to the processing of traditional whole grain foods such as barley, bulgur, and liming of corn (nixtimalization) or participation by regulatory people from groups such as Health Canada.

The role of the WGTF is to use science to answer questions that are important for moving the whole grain agenda forward with the following objectives:[1]

1. To encourage the use of whole grain products in many venues.
2. To provide a scientific background as the basis for promulgation of rule making by entities that label and encourage whole grain product use.
3. To set definable scientific standards that help the industry with product formulation and labeling guidelines. This will help minimize proliferation of multiple standards that could paralyze consumers and manufacturers.
4. To provide the consumer greater clarity in the marketplace in order to select whole grain-containing foods.
5. To support the use of foods made with a blend of whole and enriched grains, but that contribute dietarily significant whole grain content – not just foods that are entirely or almost entirely manufactured with whole grains. This will enable manufacturers to add whole grain to their lines and will allow consumers to adapt to products containing whole grains.
6. To use science to help make certain that industry develops whole grain products that deliver the nutritional advantages and are not simply functionally expedient.

This summary, which is in two parts, will highlight the WGTF's work and will outline a number of issues yet to be resolved. The WGTF work is summarized topically, not chronologically. Note that some of the material reflects ongoing discussions, whose issues have not been resolved. Throughout its discussions, the WGTF has continuously referred to the seminal work of the AACC Intl. definition committee of 1999 and uses the definition of whole grains approved by the AACC Intl. Board of Directors then. This definition continues to be an important starting point for all discussions.

Some of the work of the committee summarized in this paper is material that has been part of the official letters written by the WGTF and approved by the AACC Intl. Board of Directors. The letters and positions are available at www.aaccnet.org. Many of these have been in response to calls for comments by the U.S. FDA, USDA, or Health Canada, or questions by industry or government members. While much of the activity has had a North American focus, the WGTF has always tried to keep in mind an international focus and the need for international harmonization. While we have had some international participation, it has most recently come to the WGTF's attention that there needs to be a larger voice from EU members, because they will be working through Passclaim regulations in the near future.

This summary will start as the committee started: with the whole grain definition and issues that need greater clarity for grains in food. Part 2 of this summary will focus on specific grains for which there is some loss of grain in traditional processing.

Whole Grain Definition

AACC International's definition of whole grain was developed by a committee and approved by the Board in 1999 to clearly define whole grains in a scientific manner. It states that:

> ***"Whole grains shall consist of the intact, ground, cracked or flaked caryopsis, whose principal anatomical components—the starchy endosperm, germ and bran—are present in the same relative proportions as they exist in the intact caryopsis."***

For a letter to the U.S. FDA, a delineation of which cereal grains were included was needed. The committee used the botanical definition of a cereal, noting that cereals are generally considered to be the seed heads of grasses from the *Poaceae* (synonymous with *Gramineous*) family. Pseudocereals are seed heads of a number of different species of plants that do not belong

[1] The objectives, as stated, evolved from various official letters and minutes of the meetings and are compiled here.
[2] It was stated that many bakeries reconstitute at the bakery level. Health Canada has not ruled on this. It is aware of the practice and is not averse to it.
[3] As part of the discussion WGTF noted the irregularity of the U.S. whole grain health claim such that 100% brown rice is not allowed to use the whole grain health claim because of its lower fiber content (Table 1). *(Note: In May 2008, the regulation for this was amended to address this issue.)*

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to the grass family and do not include legumes or oilseeds. Both of these are listed in Table 1.

The WGTF agreed that the pseudocereals should be included with the cereals because the grain heads of pseudocereals are used in the same traditional ways, such as in the making of bread, starch staples, and side dishes. In addition, the overall macronutrient composition (proportions of carbohydrate, protein, and fat) of cereals and pseudocereals is similar.

The WGTF agreed, with some dissent, that legumes, nuts, and oilseeds are not whole cereal grains. While their important nutritional contribution was recognized, the decision to include only cereal grains was based on the fact that the macronutrient content of all cereal grains is similar. For example, nuts, seeds, and legumes contribute more protein and fat than whole grain cereals and have different amino acid profiles. Lysine is the limited amino acid in whole grain cereals. Legumes, nuts, and seeds are complementary in that they provide the needed lysine, but are limited in methionine and sulfur amino acids, which the grains provide.

The WGTF has also spent much time addressing some concerns prompted by the definition as written. The biggest issues occur because some grains are inedible or not used until they have been processed in some way. For example, in covered barley, the kernels are abraded to remove the hull. There is no practical way to remove the hull without losing a small amount of the pericarp. Other centuries-old, traditional processes, such as the making of bulgur from wheat or the nixtimalization of corn, have always resulted in the loss of some fraction of the grain kernel. WGTF members feel strongly that minimally-processed barley, bulgur, faro, durum wheat, and nixtimalized corn should also be considered whole grains, even though small amounts of the kernel are lost when using traditional processing.

The WGTF agrees that the categorization of an ingredient or food as a whole grain should make some allowance for slight losses that occur through traditional processing methods, in order to recognize their contribution in providing people with the health benefits associated with whole grains. The WGTF also discussed that these traditional processes may make the food safer and more nutritious. This occurs by minimizing components such as heavy metals and mycotoxins, which are concentrated in the outer layers, or by increasing the availability of certain nutrients as in the case of nixtimalized corn. It has also been noted that there is some migration of nutrients from the outer layers of the bran into the endosperm during the processing of whole wheat into bulgur.

The WGTF has been discussing several ways to address these issues. One strategy is to amend the definition as follows: (Note: Neither has been adopted.)

Proposed Alternate Definition 1

"Whole grains shall consist of the intact, ground, cracked or flaked caryopsis, whose principal anatomical components—the starchy endosperm, germ and bran—are present in the same relative proportions as found in the least-processed, traditional forms of the edible grain kernel."

Proposed Alternate Definition 2

"Whole grains shall consist of the intact, ground, cracked or flaked caryopsis, whose principal anatomical components—the starchy endosperm, germ and bran—are present in the same relative proportions as they exist in the intact caryopsis to the extent feasible by the best modern milling technology."

The other strategy has been to mount the difficult task of defining the level of loss allowed for each of the grains. This effort has been undertaken because WGTF participants feel strongly that minimally-processed bulgur wheat, barley, durum (grano), and nixtimalized corn should also be considered whole grains. The scientific basis is that the positive epidemiological evidence surrounding whole grains counted foods containing grains processed in traditional ways as whole grain foods. (This will be discussed in a future summary paper).

Whole Grain Definition and Recombining

The WGTF supports the use of the term whole grain for products of milling operations that divide the grain into germ, bran, and endosperm, but then recombine the parts into their original proportions before the flour leaves the mill. As part of this discussion, there were several factors that were considered.

- First, only an infinitesimal part of the whole grains in our food supply would count as whole grain if recombining were declared unacceptable.
- Second, and more importantly, most of the studies showing the health benefits of whole grains were done using recombined whole grains.
- Third, Health Canada has stated that it allows reconstitution of grains without any labeling differentiation. Further, it was noted that Health Canada is supportive of allowing for reconstitution of whole grain flour because of the potential need to reengineer all the flour mills if this were not the case.

The WGTF has briefly discussed he following:

1. What is the percentage of bran, germ, and endosperm that should be attained in a reconstituted flour? Is there enough data to specify what the appropriate proportions (or range of proportions) of bran, germ, and endosperm for various grains should be?
2. What are the most appropriate methods of measuring compliance with these proportions?
3. Are nutrients lost when recombining grain fractions? Is there data on this, and do losses make any difference in a backdrop of wide differences in nutrient levels among varieties?

Table 1 True Cereals and Pseudocereals

True Cereals	Scientific name
Wheat including spelt, emmer, farro, einkorn, kamut, durums	*Triticum spp.*
Rice, African rice	*Oryza spp.*
Barley	*Hordeum spp.*
Corn (Maize, Popcorn)	*Zea mays*
Rye	*Secale cereale spp.*
Oats	*Avena spp.*
Millets	*Brachiaria spp.; Pennisetum spp.; Panicum spp.; Setaria spp.; Paspalum spp.; Eleusine spp.; Echinochloa spp.*
Sorghum	*Sorghum spp.*
Teff (tef)	*Eragrostis spp.*
Triticale	*Triticale*
Canary Seed	*Phalaris arundinacea*
Job's Tears	*Coix lachrymal-job*
Fonio, Black Fonio, Asian Millet	*Digitaria spp.*
Wild rice	*Zizania aquatica*
Pseudocereals	**Scientific name**
Amaranth	*Amaranthus caudatus*
Buckwheat, Tartar Buckwheat	*Fagopyrum spp*
Quinoa	*Chenopodium quinoa Willd - is generally considered to be a single species within the Chenopodiaceae*

4. If the germ and/or the bran have been stabilized before recombining, should this be indicated on the label? Is it acceptable to use the stabilized portion in making a reconstituted flour?
5. How does stabilization affect the nutrient content of the flour? Preliminary discussion of this issue noted that steam sterilizing or dry roasting to inactivate rancidity-causing enzymes, especially lipase, could result in some nutrient loss (e.g., thiamine). However, the active enzymes also cause nutrient loss over time. What is the net effect on nutrients? Are nutrient losses due to stabilization the same as those that occur with further processing (to make bread or cakes) or are they added to other heating losses?
6. Does a label convey the correct information when the product says whole grain and it has been recombined? Are there labeling requirements in various countries that would allow or not allow this?
7. Where must the reconstitution occur? In terms of current practice, when does most whole grain get recombined?[2] Must recombination occur at the mill or can it occur at the bakery or manufacturing plant? Should the ingredient statement read "endosperm, bran, germ reconstituted to be whole grain_____" instead of "whole grain _____"?
8. Can different varieties or grains be recombined? U.K. guidelines allow the combination of fractions from different varieties, but disallow recombining components from different grains.

Whole Grain Labeling Issues

Amount of whole grain in a product

The issue of the amount of whole grain that should be in a food in order for it to be called a whole grain food has been the subject of many discussions. An agreement on this is needed for many position papers for government bodies, for fair labeling to help the consumer, and for setting an industry standard.

The WGTF did not support the use of 51% of total weight as whole grain - the percentage required in order to make a FDA health claim in the USA. They did not support this proposal in their letter regarding WIC regulations because the WGTF concurs that using total weight gives advantage to products sold by dry weight such as crackers and ready-to-eat cereal. Because foods like breads have a proportionally high water content, even some breads made with all whole grain flours but containing significant amounts of nuts, seeds and fruit would fail to meet the 51% by weight rule. Stated one participant, "Using total weight sets an uneven playing field, with moist foods like bread being held to a higher standard than dry foods."

In response to regulations on whole grain for WIC feeding programs, the WGTF also did not support the proposal that 51% of grain in the product be whole grain. While members of the task force thought this approach had some merit for products with much grain such as breads and cereals, it lacked merit for those with little grain. For example, a soup might contain only whole grain barley, but if there were only a few barley corns per serving, this would not deliver a dietarily significant amount of whole grain.

The WGTF did support the approach that to be labeled as a whole grain product, the food would contain 8 g of whole grain per labeled serving. While this concept was supported, there was a vigorous discussion around two aspects of this. One of these involved the number itself and its derivation (Text Box 2).

The WGTF's discussions showed awareness that successful dietary change in a population occurs gradually and therefore suggested a need for 'transition' products. Dietary data support the fact that consumers often get the bulk of their whole grains from partially whole grain foods. For children, some on the WGTF suggested that lower levels of whole grain might be needed as transition foods as we try to change palates. Data on kids showed that 25-30% whole grain in a product is the "stealth level" at which kids today will readily eat whole grain foods.

There were concerns as to whether the 8 g amount applied to a labeled serving, a US-defined Reference Amount Customarily Consumed (RACC) serving (the amount used for food labeling), or both (Text Box 3). For many foods, the RACC and the labeled serving are the same. The problem occurs in single-serve items with either a large or a small serving size. For example, some formulations for a bagel would not meet the 8 g of whole grain per 55 g RACC serving. Ironically, a larger bagel (90 g) packed in a single-serve package would contain the needed 8 g, even though both bagels were made from the same dough (the RACC for bagels is 55 g).

In contrast, there are foods such as crackers that have other ingredients for which the 8 g may be higher than possible. It was pointed out that the U.S. school lunch rules count whole grains as follows: 14.75 g counts as a full grain whole grain credit, 8 g counts as half a credit, and 4 g as a quarter credit.

The WGTF addressed the issue as to whether there is a minimum level of whole grain that should be present before any packaging claim can be made. It was noted that some products may not contribute large amounts of whole grain to the diet, even when all the grain in the product is whole grain. Examples might be a cookie or a vegetable soup made with brown rice. Since data show that the total whole grain in the diet is the most important factor, the issue that needs to be addressed is how to

Text Box 1—Whole Grains and Dietary Fiber

The WGTF affirms that dietary fiber is a very important dietary component. Further, we are painfully aware that most populations around the world ingest only one-third to one-half of recommended levels. Yet, the WGTF champions the fact that whole grains are filled with beneficial components beyond fiber. To limit the whole grain offerings to only those with the highest fiber (e.g., wheat and barley) is, not in the view of the WGTF, sound nutritional advice. For instance, brown rice[1] is low in fiber but high in other components such as unusual fatty acids that lower serum cholesterol. Even whole oats, when formulated into many oat-containing foods, would fail to meet the fiber needed for some health claims. The WGTF agrees that a rice cereal made from whole rice should not need to be augmented with exogenous fiber(s) in order to qualify as a whole grain. Interestingly, this was one point on which the entire committee was in agreement.

The WGTF was concerned about the FDA minimum fiber content for an FDA whole grain health claim. While the WGTF recognized that whole grain cereals make important contributions to dietary fiber intake and encourages their consumption, they note that some whole grains offer significantly more dietary fiber than others. In the interest of encouraging variety in the diet, including grains from many ethnic dietary patterns and providing whole grain foods to those with special dietary needs (such as celiac patients), WGTF recommended that all whole grains, regardless of their fiber content, be allowed for health claims and for feeding programs.

Text Box 2—Derivation of Amount of Whole Grains Needed Per Day

It was noted that the number was derived using epidemiological data that showed that 2.7 servings of whole grain foods gave beneficial health effects. Furthermore, many of the epidemiological studies showed that whole grain bread was frequently the food chosen to reach the 2.7 servings. An ounce equivalent of grain as recommended in dietary guidance (e.g., one USDA serving of bread) is 28 g. Because bread is 40% water, a 30 g serving would contain, on average, 16 g of whole grain flour along with some other minor ingredients. Thus, three servings of bread would yield 48 g of whole grain per day. If the serving contained 8 g of whole grain, then an individual could meet the whole grain requirement with 6 slices of bread containing the 8 grams. A consumer might instead have one serving of oatmeal and two slices of whole grain bread with 8 grams and reach the 48 gram target.

The WGTF did not support the use of a standard of 84 g of whole grain per day, because that would mean that if bread were the vehicle for whole grain, all grain servings would need to be 100% whole grain. Currently, the U.S. Dietary Guidelines recommend that eaters "make half their grains whole." An 84 g recommended level would require that a larger number of grain servings be whole grain.

give manufacturers credit for switching to whole grain in their products without misleading the consumer with taglines suggesting that a product is made with "100% whole grain" when it may contain only a small amount of total whole grain. Further discussion is needed on whether the WGTF should make a pronouncement regarding the claim, "made with whole grain."

Labeling Whole Grain Bread as 100% Whole Wheat with Exceptions for Gluten

The WGTF agree that 100% whole grain products be labeled as such only if the grain portions they contain are whole grain as covered by the U.S. food standards (21 CFR 136.110 and 21 CFR 136.180, respectively) (c)(18), while 21 CFR 136.110(c)(11). These regulations allow for nonwheat flours, nonwheat meals, nonwheat grits, wheat and nonwheat starches, any of which may be wholly or in part dextrinized, dextrinized wheat flour, or any combination of 2 or more of these, if the total quantity is not more than 3 parts for each 100 parts by weight of flour used.

Many 100% whole grain breads need vital wheat gluten at levels exceeding the 3 parts per 100 level to achieve a desired texture. The WGTF suggests that if the gluten levels are overly restricted, the number of available, desirable whole grain products may be diminished.

Labeling of Sprouted (also known as malted) Grains

The WGTF agree that sprouted/malted grains are whole grains if the sprout is not longer than the kernel length and the pericarp is ingested. The rationale is that sprouting does cause some enzymatic changes that also occur with fermentation in breadmaking and other processes. However, longer sprouts change the product to have more vitamin C and other components that make it more similar to a vegetable product.

Text Box 3—Serving Sizes and Discrepancy in U.S. Labeling

Whole Grain and Serving Size Discrepancies in U.S. Food Labeling Law

The principal dietary guidance provided by the U.S. government is the Dietary Guidelines for Americans. By law (Pubic Law 101-445, Section 301), the Dietary Guidelines is to be "promoted by each Federal agency in carrying out any Federal food, nutrition, or health program." The WGTF agrees that consumers would be well served if the information found on food packages better reinforced and supported the recommendations of the Dietary Guidelines for Americans.

Currently, the differences between the FDA's approach and the Dietary Guidelines are many – and they are confusing to consumers. For example, the FDA calls out individual nutrients while the Dietary Guidelines focuses on whole foods. The FDA also uses serving sizes (RACCs) that, in most cases, are appreciably larger than those used by the Dietary Guidelines and may legally be even larger on individual packets of foods. Some examples are shown in table 2 below.

The Dietary Guidelines, for example, recommend that everyone consume 3 or more servings (called "ounce equivalents") of whole grains daily. A consumer who wishes to follow this advice receives no clear guidance from standard packaging information.

The WGTF understands that both FDA and USDA are constrained by existing regulations; however, it urged that all parties find a way to move beyond these constraints to better serve the American public with a consistent message – and to conform with Public Law 101-445, Section 301. The WGTF recommended that AACC International work with industry, consumers, and government agencies to explore effective ways that package labeling can communicate whole grain messages to enable adherance to dietary advice.

Whole Grains and the Ingredient Statement

The WGTF recommends that all whole grain flours be so labeled to help consumers who are unfamiliar with terms such as "pearled" or "degermed." Label designations (e.g., whole oats (oatmeal) or "whole durum wheat flour"), when used on the ingredient statement, help consumers know that the product is whole grain, and in the latter case that it is wheat. For some foods like corn meal, the FDA standard of identity regulations define cornmeal in a way that many have interpreted to mean that whole grain cornmeal cannot use the term "whole grain." The North American Millers' Association (NAMA) has petitioned the FDA to rule that cornmeal can be whole grain.

The WGTF needs to weigh in on the best way to label multigrain foods that are predominantly whole grain but where en-

Table 2 Serving Sizes and Discrepancies

	DG/Pyramid serving	FDA RACC	Max. individual serving (RAAC × 200%)
Rice	1/2 cup prepared	140 g prepared (.71 cup)	1.4 cups prepared
Hot cereal	1/2 cup prepared	1 cup prepared	2 cups prepared
Bread, rolls	1 slice (~25-40 g)	50 g	100 g
Bagels1	mini-bagel (1 oz)	55 g	110 g
Pasta	1 oz dry	2 oz. dry	4 oz. dry

riched flour is the first ingredient. Since each individual whole grain is in a smaller amount than refined flour, is it appropriate to have the label say, "Whole grain flour blend (whole wheat, whole millet, whole oats, whole barley), enriched wheat flour…" so that whole grain becomes the first ingredient? This would have the advantage that consumers can then use the rule of looking for whole grain as the first ingredient. Or would the label statement depend on where the recombining occurred?

Whole Grain Bioactives and Particle Size

The WGTF has discussed the importance of identifying bioactive components and their functionality and possible use in identifying the amount of whole grain present in a product. The issue is complex since different grains vary in their bioactive compounds. Further research is needed to determine appropriate biomarkers and documentation of levels of biomarkers within and across both species and varieties. Thus, a strategy is needed to determine if there is a way to use bioactives as whole grain compliance markers, both in single-grain foods and in multi-grain foods and to determine which whole grain components are needed for optimal health.

Discussions are needed around particle size and its effect on the nutritional value of whole grains, especially with new technologies such as ultra-grain processing of whole grain.

Ultimately, AACC Intl. should work to compile a reference document detailing not only the normal proportions of bran, germ, and endosperm in each grain, but also typical levels of key bioactive components. Such a reference could potentially provide a better way to verify whole grains rather than using fiber, which can indicate either the presence of whole grain or the addition of other fiber compounds.

Whole Grains and Folate Fortification

Currently, U.S. FDA standards of identity for whole wheat bread and whole wheat flour forbid their fortification. Interestingly, whole grain cereals are all fortified. The debate on fortification is vigorous, with proponents advocating its importance in preventing birth defects and possible other chronic disease. Opponents worry about overfortification and potential adverse effects on the elderly and other vulnerable populations.

In terms of whole grain fortification, Health Canada is actively lobbying for industry to agree to whole grain fortification with folic acid. This is due to pressure from consumer groups who have questioned why, if fortification of enriched white flour has been so beneficial, the same benefits have not been extended to whole grain. The WGTF supports voluntary fortification at this time, because mandatory fortification would present trade issues with the U.S. Further discussions are needed regarding whether the WGTF wishes to champion this issue for the U.S. and perhaps other countries.

Whole Grains Task Force Comments to the USDA on Whole Grains in the Women's, Infants and Children (WIC) Program

In responding to the USDA WIC Program proposal, the WGTF applauded the USDA for recognizing the important health benefits of whole grains in its update of the WIC food regulations. We also suggested that the USDA's WIC Program Guidance to the states expand its existing guidelines (a+b below) to reflect its commitment to whole grain and recommend that:

a. All cereals meet the iron and sugar guidelines, but that natural/organic whole grain cereals that may not have added iron would be allowed (the WGTF was alerted that ferrous sulfate is on the list of approved non-organic ingredients that can be included in products still qualifying at the 95% organic level).
b. At least half of cereals have whole grain as the primary ingredient and meet labeling requirements for the whole grain health claim.
c. All cereals that do not qualify for the whole grain health claim should contain at least 8 g of whole grain per serving and, per RACC, a level previously defined by the USDA as "a significant amount of whole grain" (Note: The WGTF notes that research indicates that all incremental additions of whole grain to the diet contribute to health. It stated that WIC participants would benefit greatly if care is taken to recommend that all cereals include some whole grain, even if at a lower level than would qualify for the health claim.).

The WGTF made some specific recommendations about grain foods to be included in the WIC feeding programs. The WGTF wants to encourage many product options and suggests that the regulation include all whole grains as listed:

1. Breads that meet the standard of identity for whole wheat bread AND that have whole wheat as the first ingredient.
2. Breads that use other grains must meet the requirements of the FDA's whole grain health claim AND have a whole grain as the first ingredient.
3. Brown rice, bulgur, oatmeal, and barley with no added fats or oils.
4. Corn and wheat tortillas with whole corn or whole wheat as the first ingredient. 5. WG in other forms such as whole grain pasta with a whole grain as the first ingredient or that offer a significant proportion of whole grain in their formulations.

Conclusions

This summary is an overview of the WGTF's activity to date with the exception of discussions regarding grains where part of the granule is lost in traditional processing. Discussions include the definition of a whole grain, species that are cereals and pseudocereals, issues of recombining, issues of the amount of whole grain needed in the diet and in a serving of food, issues on the ingredient statement, special issues for WIC foods, issues on bioactives, issues on labeling compliance, and nutrient changes with processing. The second part of the review will deal with issues raised by grains that are considered whole grains in epidemiological studies but which experience some mandatory loss during traditional processing such as bulgur, durum wheat, corn during nixtimalization, and barley during minimal pearling.

Julie Miller Jones, a board-certified (CNS) and licensed nutritionist, is a professor in the Department of Family, Consumer and Nutritional Sciences at the College of St. Catherine in St. Paul, MN. She writes and speaks locally, nationally, and internationally on issues regarding nutrition and food safety, with special emphasis on whole grains and dietary fiber, carbohydrates and glycemic index, and dieting. She can be reached at juliemjones@comcast.net.