Chemicals within the body pose an interesting challenge to researchers that have been tackled in a variety of ways throughout the history of biochemicals. Chemicals within the body contain the same elements and atomic properties that they would in any other setting. However, within organic tissues chemicals take on a unique roll that is not seen anywhere else in nature. These chemicals not only help to compose natural tissue, they are produced by natural tissue to provide a variety of functions that are essential to the function of the body as a whole. What continues to prove to be a challenge for scientists is the fact that chemicals do not behave in an identical manner within different animals, in spite of containing the same molecular structure—and in many cases interacting with tissue with the same makeup. There have been a variety of methods used to help better predict molecular behavior so organic chemicals may be better defined. This process starts with creating a failsafe method for identifying and organizing chemicals discovered in organic tissue so they can be monitored and better understood—based on their properties and their behavior. This can also help to structure experiments that will create artificial versions of these chemicals to be introduced to organic tissue, as a means of controlling biological behavior.

Amino Acid Molecular Weight

Amino acids are commonly identified by their molecular weight, as a means of categorizing unknown chemicals along with chemicals that scientists work with frequently.

- Amino acids are the second largest component of cells for muscle and other tissues, only being surpassed by water. These amino acids can play a variety of roles within the body, but they are most often seen acting in biosynthesis functions or working as neurotransmitters.

- An amino acid is defined as an organic acid that is formed from carboxylic acid and amine. These are a functional group of chemicals, each with a side chain that can be formed from nitrogen, hydrogen, oxygen or carbon among other elements that can be used as an identifier for the chemical; each of these side chains is unique to the amino acid. These side chains also help to identify the role of the amino acid in an animal as it interacts with organic tissue.

- To date, there are around 500 known amino acids which are widely classified by weight, but they are also often classified in to gamma, delta, beta or alpha groups—based on their polarity level. Side chains of amino acids are grouped—based on the additional elements that are included in the chain, such as sulphur or hydroxyl. These groups are commonly listed as aromatic, aliphatic or acyclic.

All molecular weights are noted in g/mol
• Alanine- 89.1
• Arginine 174.2
• Asparagine- 132.1
• Aspartate- 133.1
• Cysteine- 121.2
• Glutamate- 147.1
• Glutamine- 146.2
• Glycine- 75.1
• Histidine- 155.2
• Isoleucine- 131.2
• Lysine- 146.2
• Methionine- 149.2
• Phenylalanine- 165.2
• Proline- 115.1
• Serine- 105.1
• Threonine- 119.1
• Tryptophan- 204.2
• Tyrosine- 181.2
• Valine- 117.1

Each molecular weight, also referred to as molecular mass, is the specific mass of a given molecule. This is calculated by adding the sum of the mass for each atom known to be contained in the atom multiplied by the
number of atoms in the molecule. Being able to define the molecular mass will help to determine the size of a molecule, which are then classified as a small, medium or large grouping. Small or medium molecules are defined using spectrometry which will help to determine the stoichiometry. This is how amino acids would be defined. Large molecules, such as full proteins, can be defined using a variety of method— such as light-scattering or viscosity.

- In most cases, it is more appropriate to refer to a molecule’s relative molecular mass because molecules are often given an assumed mass— based on their relevancy to C. Molecular and atomic masses are dimensionless but are measured in Daltons which can help to define the number for a mass of one molecule, when divided by the mass of C. This will help to provide a molar mass for chemicals so scientists are able to work with a unit gram of the substance.

There are 20 amino acids that have been defined as those that play a vital role in the function of an animal’s body. Of these 20, nine have been determined to be essential to the body because they cannot be created by compounds within the body itself, and therefore must be taken in from other substances. In many cases this helps to regulate the diet of an animal because they must consume foods that contain the proper balance of chemicals to create the necessary amino acid compounds. The specific amino acids that are essential to an animal will vary between species; therefore there is a wide variety of dietary needs. These may also change as the animal ages, presenting a more interesting look at the differences in the functions of animals. Understanding the classifications of these peptides will help to better understand which chemicals are being utilized by animals and how they are built or broken down— based on the interactions they have with the natural tissues.

**Short Peptide**

Peptides are groups of amino acids that work to make up different proteins within the body, each of which take on a unique roll when interacting with bodily tissues.

- Peptides are formed by short amino acid monomers that are linked by different types of peptide bonds to create a chemical chain. When the carboxyl groups of different amino acids interact with each other, it can create a
variety of covalent chemical bonds that will join different amino acids together. The number of amino acids joined in this pairing will help to define what type of peptide has been formed: a dipeptide, tripeptide, tetrapeptide, etc.

- It is important to note that peptides differ from proteins— based on how they function in the body as well as their size. As a general rule a peptide must contain 50 or fewer amino acids in order to receive this classification, whereas proteins will often contain significantly more, or may even be made up of multiple peptides that break off and act independently as the molecule interacts with bodily tissues or moves through the bloodstream. Proteins will also often bind to ligands to create cofactors or coenzymes which can create completely different proteins or grow to create macromolecules that take on a variety of roles within an animal.

- Scientists are currently working on learning more about the techniques that peptides use that differ from how proteins interact with the body. It appears as though there are size boundaries that help to determine whether or not a polypeptide or a protein may take on a certain role within the body. The specifics of this are still being learned— as many peptides react differently within different groups of tissues or even within different animals that have similar characteristics. It is also not uncommon to see peptides react differently within male or female animals within the same kingdom.

- If an amino acid becomes incorporated into a peptide it is referred to as a residue because this type of reaction will typically result in the release of hydroxyl— from the existing carboxyl in the amino acid. This will lead to the formation of water molecules every time an amide bond is made. All peptides have this type of reaction, with the exceptions of cyclic peptides. These, instead, create a residue known as C-terminal or the N-terminal— depending on the type of peptide that the chemicals are reacting with and the type of process that is being generated.

- There are no specific rules that distinguish proteins from polypeptides. In general, a long peptide that contains amyloid beta data can be classified as a protein, but small peptides, particularly those in the insulin family, are rarely reclassified into the protein group.

- Within the peptide group, peptides are divided into long chain peptides or short chain peptides. Long chain peptides, or ogliopeptides, may be split into shorter peptides as they are used in a variety of processes throughout the body. These are commonly seen within natural substances, creating the various biological processes that are necessary for the functionality of this tissue. When absorbed or created in animal tissue, they will begin to create a variety of new processes that can assist with tissue engineering. The animal's body will use the various elements used in the chemical bonds of a peptide to repair, enhance or replace biological tissue or functionality as necessary.

- Short peptides have a similar functionality to long chain peptides, but they are significantly smaller in size. They are sequentially bonded but do not contain any proteins. There is no specific number of amino acids that will allow a scientist to classify a chemical as a short or long chain peptide, though in general those with only two amino acids are placed in the short category.

- Both short and long chain peptides secrete hormones which can allow an organism to trigger different biological
processes within their body. These hormones can also be used to produce different biological processes as necessary. Short chain peptides tend to be more stable than long chain peptides because there are fewer bonds included in their construction, so in many cases these peptides are considered the ideal system for encouraging a biological process that would require longer or higher levels of stimulation to complete. Long chain peptides, instead, are designed to be broken down and absorbed by the affected tissue as the given biological process continues.

- Because short chain peptides are more stable, they have a longer shelf life, which makes them an ideal source for biological research. Short peptides are also more efficient when they enter an animal’s body, so it is much easier for scientists to track the changes that these chemicals are making in the body. For this purpose, short chain peptides are commonly the ones produced synthetically, as a means of testing the functions or the reactions of these chemicals on the tissues. While long chain peptides are occasionally used for this research, their length often causes them to collapse shortly after being applied to the tissue, which can result in inconsistent results or data during experimentation.

- Short chain peptide research generally focuses on the idea of being able to create biocompatible materials that will help to reduce the effects of the aging process on animal tissue. Amino acids that are used to create peptides can be harnessed by the body and used to complete biological processes more efficiently. If the body is not producing or being exposed to the necessary amino acids to maintain the tissues, scientists hypothesize that applications of peptides containing the proper amounts of the necessary peptides could be applied as a means of ensuring that the body continued to function at the right level, or even an enhanced level if desired.

- Short peptides are considered ideal for this potential biological application. Short peptides are often referred to as self-assembling peptides which contain the active motifs that the animal tissue would need to create a variety of processes. The short peptides that are capable of bonding without stimulation are able to replicate information that was created in the animal tissues and independently create or transmit this information as necessary. This allows the peptide to take on a variety of natural processes that do not require them to change their structure or alter their behavior within the body, which can include the stimulation of tissue engineering when the body is going through a period of growth.

- The idea of generating new tissue by stimulating the body using peptides is only in its initial stages. Both short and long chain peptides are being used to determine the potential effectiveness of this research, but as of today, most numbers that are associated with this practice are considered to be preliminary data that will be used to fuel pharmacological research in the future.

In an even more interesting biological system, it has been shown that peptides may, in some cases, mimic the reactions or processes of proteins in the body, helping the organism perform processes at a higher level of functionality—in spite of the normal regulations that their body may have. Scientists hope to harness this ability and use peptides in pharmacological applications in the near future, as a means of correcting diseases or deficiencies in humans. Research on animal test subjects often revolves around the application of synthetic peptides for this purpose, though this research will continue to be enhanced in upcoming years as scientists continue to understand the role different peptides play in animal tissue and how this reaction might vary if the peptide is synthetic in nature.
Polypeptide Chain

Peptides are divided into a variety of classes—based on the chains that are used to create them and the processes that they take on once they are created or enter an animal’s body.

• Ribosomal peptides are some of the most commonly synthesized peptides, though they are naturally synthesized from mRNA translations in an animal. These peptides will often reach their mature form by entering proteolysis, which higher organisms will use as a way of signaling molecules with hormones to generate the necessary biological processes the body requires. In some cases organisms can use these amino acids to create natural antibiotics including moccrocs, with the residues of these amino acids being used by the ribosome as necessary to create the biological process involved.

• More commonly, ribosomal peptides will enter into posttransitional modifications including glycosylation, palmitylation, sulfonation, phosphorylation or hydroxylation. These are generally a linear process, though some structures have created a lariat bonding structure during a specific set of biological processes. Some animals are able to use these amino acids to create a more exotic reaction—such as converting D-amino acids from L-amino acids to create venom in platypuses. These unique variations of the use of chemicals generate the need for far reaching research into the use of peptides, as every animal may react to the application of a synthetic peptide in a slightly different manner.

• Nonribosomal peptides are created by enzymes that are unique to that particular peptide instead of by the reactions of a specific set of ribosomes within the body. Glutathione is the most common peptide in this group, which is used by animal tissue to create an antioxidant defense that can be used to help protect the tissues from aerobic organisms. Additional common nonribosomal peptides include fungi, plant or unicellular organism processes that can be used to synthesize modular enzyme complexes which are known as nonribosomal peptide synthetases.

• Nonribosomal peptide synthetases usually contain a similar structure, but they will take on a variety of different modules to deal with chemical manipulations within the different types of tissue where they have been placed. This also helps a variety of organic tissues creating the necessary bonds to manufacture this product, given the natural properties the tissues possess. Nonribosomal peptides are typically cyclic and have complex structures, but there have been discoveries of linear nonribosomal peptides as well. The bonding of these peptides is commonly compared to the mechanics that are necessary to create polyketides or fatty acids in more complex organisms. It is not uncommon to see the bonding of a hybrid compound of these structures for this very reason. Compounds that were synthesized in this manner include thiaoles or oxazoles.

• Milk peptides are created with proteins from milk and are broken down using enzymes in the body, typically the enzymes that are used to fuel digestion, to create lactobacilli. This is the bacteria that are responsible for the fermentation process in milk.

• Peptones are those that are derived from meat or milk products that are digested using proteolysis. These contain small or short chain peptides that can be broken down or absorbed to create spray dried material such as salts, fat, metal, vitamins and a variety of biological compounds. These peptides are considered the essential
building blocks that fungi or bacteria will be used to grow within a nutrient media.

• Peptides are starting to become a prominent field of study within molecular biology for a variety of reasons. The peptides may be used to create peptide antibodies within an animal without needing to purify the protein that is to be used. This can be performed very simply by synthesizing antigenic peptides of the protein or sections of protein the scientist would like to work with. This can then be used to create antibodies against the given protein. Such research is commonly performed on mice or rabbits.

• Peptides are also becoming a subject of interest for scientists because they are instrumental in the research of mass spectrometry that allows researchers to readily identify proteins based on their sequence or their mass, greatly speeding up the time initial research takes to discover the necessary structures for a biological process. Peptides that are created the most frequently for this purpose include those in-gel digestions which are created after the electrophoretic separation of the given proteins.

• Research surrounding peptides are often used as a means of studying the function and structure of a variety of proteins. Synthetic peptides are often used as probes to discover where the bonds or interactions between proteins and peptides occur. The bonding of peptides must be replicated exactly, in order to ensure that these biological processes will react the same way they would in a natural setting, which has fueled additional research into the structure of the given peptides, particularly for those processes that require long peptides to complete. In some cases, scientists are shortening or enhancing the bonds on synthetic peptide structure in order to achieve the stability necessary to create a biological process that can easily be monitored or replicated in the tissues.

• Research into inhibitory peptides may eventually be used in clinical research to help inhibit cancer proteins or those from other diseases. There is a promising application of peptides that may be able to target and inhibit LHRH. In this case the peptides will act as an antagonist that will interrupt the way the LHRH cells can bind to the receptors on natural tissues within the body. Inhibiting these structures could be helpful in managing conditions such as prostate cancer, if research in animal test subjects continues to progress in a promising manner. At this time additional investigations will be necessary in order to determine if peptides truly have attributes that could be used to fight cancer. The properties that have currently been observed by peptides or similar structures are not yet at a point where it can be considered definitive.

As peptides are used by the body, they will be broken down which creates a variety of fragments. Peptides fragments can be used to identify the different proteins that were the source of this chemical reaction and quantify this protein source to help scientists better understand how to trigger these biological processes. In many cases, the products that are commonly used during enzymatic degradation would break down and make use of these peptides that can be replicated on controlled samples in a laboratory setting, but it can be difficult to compare these reactions to paleontological or forensic samples, because other natural effects can impact or degrade these samples before the process can be accurately observed.

Where to Buy Peptides

In order to continue research into the
understanding and potential use of peptides and their components in medical research, scientists will require a steady stream of peptides to work with during their experiments.

• In order to gain access to natural peptides, scientists will need to be able to control their release in the animal’s body and then harvest the chemicals as a means of further detecting their impact on tissues or other biological processes. This is not particularly practical, as peptides are naturally released in small amounts that are only designed to trigger a specific biological response. Furthermore, most peptides have a very short half-life, causing them to begin to break down almost immediately after being released to the body.

• To counteract this problem, a variety of companies have begun to create synthetic versions of highly known and used peptides. These peptides are bonded in the same chemical fashion as the original peptide to ensure accuracy when applied during medical research. However, additional research must continue, as some synthetic peptides have been found to react differently than the natural counterpart they have been modeled to replicate. This is largely theorized to be the result of external application of the artificial peptides, which are independent of the chemical and hormonal process that would trigger the use of this peptide in a natural setting.

• Peptide manufacturing companies will often sell large quantities of these peptides as a means of providing researchers with the samples they require to perform long-term research studies. Acquiring peptides from a singular source is considered ideal or even essential for many researchers because this allows them to guarantee a consistency of product that is necessary for research grade chemical tools. This also helps to guarantee that the bonding and chemicals used to produce the synthetic peptide will match, better ensuring a consistent performance as it is applied to animal test subjects.

• Much of the concern regarding using artificial peptides in research is ensuring that the product remains stable for as long as possible. This will help to ensure a consistent performance with the lowest possible level of side effects in animal test subjects. Some peptides have been altered as a means of controlling their half-life, to minimize their breakdown during transport or storage. Peptides are also freeze-dried and reconstituted as necessary as a means of ensuring that a premature breakdown will not occur.

• Any company that is not shipping peptides in a frozen, temperature controlled state runs the risk that their product will become damaged during transit: thus they may not be suitable for research-grade use. Similarly, these products should contain clear instructions for how they should be reconstituted, when they should be used and how they should be stored to ensure a maximum level of efficiency from the product.

• While a significant amount of care must be put into the transit and storage of these chemicals, peptides are not in fact difficult or costly to produce. Many who overcharge for peptides are simply attempting to take advantage of the popularity of these products in current research fields.

• Similarly, some companies add binders or preservatives to peptides as a means of lengthening the time that they can be shipped. However, these additional ingredients can interfere with the results noted when the chemicals are applied to animal tissues.

Maxim sells peptides at a reasonable price so it is easy for researchers to get the high amounts of product they
require—in order to complete their research fields. These peptides are stored, sealed and shipped in a way that guarantees to preserve the chemical composition of the product. Peptides are also shipped very quickly as a means of ensuring that there will not be a breakdown in the chemical structure before the researcher has been given adequate opportunity to use these products. No additional ingredients are added to any samples during the production processes to ensure accurate research results.

CJC 1293

CJC 1293 is often referred to in conjunction with the similar peptide, CJC 1294 which is commonly synthesized as a means of controlling biological research throughout the bodies of animal test subjects.

• CJC 1295 is a tetrasubstituted peptide hormone that consists of a 30 amino acid chain. This peptide will generally function as an analog to growth hormone releasing hormone GHRH. ConjuChem of Canada created this hormone as a means of better synthesizing this process. CJC 1295 was created as a means of improving the function of rHGH or GHRH research because CJC 1295 is able to bioconjugate with substances, such as serum albumen, which will increase the half-life of the product as well as the potential therapeutic window. This is accomplished by protecting groups of amino acids that would normally be susceptible to degradation from enzymes within GHRH.

• By contrast, CJC 1293 is the natural growth hormone releasing hormone GRF or GHRF which is also commonly classified as somatocrin or somatotiberin. This is a hormone that is designed to trigger the release of growth hormone. This peptide contains 44 amino acids and is produced naturally within the arcuate nucleus of the hypothalamus in an animal. The first indications of GHRH are commonly seen in the hypothalamus between 18-29 weeks of gestation which is used by the body to produce growth hormone and somatotropes as necessary within the fetus.

• CJC 1293 is released from neurosecretory terminals in nerves which are within the acruate neurons. This peptide is then carried through the hypothalamo-hypopyleal portal system that will deliver the chemicals to the anterior pituitary gland to stimulate the secretion of growth hormone from the growth hormone releasing hormone receptor. CJC 1293 is released in a pulsatile manner which will help to stimulate a similar release of growth hormone.

• CJC 1293 is also used by animal tissue to promote slow wave sleep in a way that is more direct than some other biological methods. Growth hormone is required for any postnatal growth or any growth of bone tissues. It is also used to help regulate carbohydrates, proteins and the metabolism.

• If CJC 1293 is bound with GHRHR. It can increase the production of growth hormone, but this is largely due to the fact that the cAMP dependent pathways will be increased as well as the phospholipase C pathways within minor pathway structures.

• cAMP dependent pathways are initiated by CJC 1293 binding to it receptors which will cause a confrontation with the receptors that activate G alpha subunits within G-protein complexes on the intracellular side. In turn this will cause a simulation of the adenylyl cyclase as well as an increase in the intracellular cyclic adenosine
monophosphates that allows any free subunits to translocate to the nucleus of the different phosphorylate and transcription factors of the cAMP response element binding proteins.

• Together with phosphorylated CREB and its coactivators CREB binding protein and p300 there is an enhancement of the transcription of growth hormone that allows for the binding of CREB proteins and cAMP response elements within the promoter region of growth hormone genes. This will also increase the transcription of GHRHR genes that can provide positive feedback on this process.

• Within phospholipase C pathways CJC 1293 stimulates the phospholipase C throughout the By complex heterotrimeric G-proteins. The activation of PLC will continue to produce inositol triphosphate and diacylglycerol which will in turn lead to the release of intracellular Ca that stems from the endoplasmic reticulum. This will increase the concentration of Ca that will cause vesicle which will release the secretory vesicles that contain a premade growth hormone serum. In some cases the influx of Ca will have a direct impact on the cAMP release that will create a distinct reaction that varies from the traditional cAMP dependent pathways that are used by animal tissue to activate protein kinase A.

• The activation of GHRHR using CJC 1293 is also used as a way to open Na channels by deploying phosphatidylcholinolnositol 4 and biphosphate 5. This will cause cell depolarization and this change can cause the intracellular voltage to open and trigger a voltage dependent calcium channel. When this process is completed it can result in a vesicle fusion that will in turn release growth hormone to the necessary stimulated tissues.

• Additionally, CJC 1293 can be expressed in a way that is demonstrated within peripheral tissues and cells that surround the main site of the hypothalamus. This type of reaction has been seen in gastrointestinal tracts of animals and the epithelial mucosa. In some pathological studies a similar reaction has been seen in the cells of tumors.

• CJC 1293 is a lead compound in a variety of functional and structural analogs including that of CJC 1295. There are a variety of analogs that are used in research chemicals for specific applications that require CJC 1293 to maintain their structure. Somatostatin is one of the most common functional fragments of CJC 1293 which is designed to assist with the diagnosis of deficiencies of growth hormone secretions. Tesamorelin is another analog that is designed to help diagnose lipodystrophy in those suffering from HIV with a highly active antiretroviral therapy program. As of 2011, research is focusing on the effects that these chemicals could have on elderly animals before it can be widely used for experimentation or use in humans.

CJC 1293 and the reactions it has within animal tissue are opposed by somatostatin (also referred to as growth hormone inhibiting hormone). When somatostatin is released from its neurosecretory nerve terminals which are designed to act as a perinventricular somatostatin neuron; this chemical will be carried through the hypothalamic-hypophysial portal circulation. This will deliver somatostatin to the interior pituitary where it will cease the effectiveness of CJC 1293 and inhibit the secretion of further growth hormone. If CJC 1293 and somatostatin are released alternatively it can increase the pulsatile secretion of growth hormone. A great deal of research is dedicated to comparing these reactions as a means of understanding how to control or replicate this processes using synthetic versions of these chemicals. With research into peptides and the potential to create synthetic
versions of these materials still very much in its infancy there is a great deal of potential for creating new therapeutic measures that will help to manage a variety of conditions or diseases that damage animal tissues. As researchers grow to understand the functionality and composition of peptides that much better, it is all the more likely that they will be able to create chemical structures that mimic or enhance the abilities of these chemicals to react with animal tissues. Research on tissue samples or animal test subjects currently indicates that there is a promising pharmacological component to these processes that could see use in humans in the upcoming years if all research continues to progress as planned.

Resource Box:

http://en.wikipedia.org/wiki/Amino_acid
http://en.wikipedia.org/wiki/Molecular_mass
http://en.wikipedia.org/wiki/Peptide