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Polysaccharide in Aloe Vera, The Magic Bullet

By Robert H. Davis, Ph.D.

Aloe Vera and it's Wound Healing Properties

The Aloe Vera leaf has polysaccharide in the parenchymal cells which is used by the plant for energy. Mucilage is a different storage form. All polysaccharides are not the same. When mucilage is placed over a wound, the wound remains moist and does not drop as does dry wounds. Epidermal and fibroblast growth factors come from the mucilage and stimulate the fibroblast directly for growth and repair. The cells as a result migrate within the wound in a proper manner to increase wound healing. The occlusive nature (cover) of **mucilage increases wound healing** from a mechanical and endocrine viewpoint.

Biologically Active Agents in Aloe Vera

Mucilage is also a good anti-inflammatory agent. Some polysaccharides are immune stimulatory and this immune property improves wound healing probably through the macrophage. The big polysaccharides appear to be immune stimulatory whereas the smaller ones have anti-inflammatory activity. When an animal bites into the Aloe leaf, a hole is made in the leaf so that there is opportunity for the gel fillet to leak to the outside. However, this does not occur. The mucilage in combination with the Aloe gel hardens which seals the hole. Mucilage always hardens and acts as a container for the inner gel fillet. The transformation which occurs here is a sol-gel transformation of mucilage. Aloe vera tends to improve the penetration of water whereas mucilage tends to block the escape of water from a wound. We have been able to transfer the sol-gel transformation of mucilage and Aloe to an animal wound in which it improves an incisional wound some 130%. If Aloe and mucilage are placed between two sticks, it takes some 1200 gms of force to pull the sticks apart. **Wound healing does not just require immune stimulation by polysaccharides but Aloes healing comes from growth factors, amino acids, glycoproteins, gibberellin, auxin and minerals such as zinc as well as polysaccharides.**



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These biologically active agents synergize to give us the miracle of Aloe vera. Polysaccharide is not a magic bullet in that these other biological agents make major contributions to the biological activity of Aloe vera.

Aloe vera processing procedures

In the making of Aloe vera, two major processing procedures are used by the Aloe industry to give us Aloe vera. The fillet method removes the rind by a mechanical means and the fillet is washed.

The whole leaf method grinds up the whole leaf and removes the rind by filter. The anthraquinones are removed by charcoal. The amount of aloin left is less than 5 parts per million. This amount is not detectable by the deification reflex. When the Aloe vera is freeze dried for both the fillet and whole leaf methods and the powders are stored on the shelf for eight years, no difference was recorded in biological activity. Both methods yield the expected activity that was recorded in the beginning. Processing of Aloe vera is supposed to break down the polysaccharide polymer (depolymerase enzyme) into fragments that have little or no activity. This may or may not be true as we have not seen the evidence. However, if it is true in Aloe vera, to assume that the smaller polymers resulting from enzyme breakdown of the polysaccharide do not have biological activity is a presumption. In fact, there are a number of small polymers that have great biological activity and are immune stimulators which are being sold successfully on the open market.

The breakdown of the polysaccharide in Aloe by enzymes must be presented and the resulting polymers must be evaluated across the board for biological activities using the original Aloe vera as the control test substance. In all the work that has been done with the polysaccharide, we have never seen Aloe vera as the test control to which the polysaccharide is compared. These things must be done before we claim that the various polysaccharides are the magic bullets. Are they much more potent than the mother Aloe vera from which they were extracted? This must be shown by peer review.

All Biologically Active Substances in Aloe Vera Contribute

Aloe vera contains a large polysaccharide molecule which we have called the conductor. This molecule leads the many biologically active substances into a symphony of biological events to **heal wounds, reduce inflammation and eliminate pain**. The



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conductor molecule fits into the fibroblasts, similar to a lock and a key mechanism so as to set up a cascade of important biological events, supported by Aloe substances which are part of the orchestra. The polarity of water is needed for the polysaccharide to communicate with the active substances to synergistically achieve the maximum desired benefits. **We opposed the theory that there is only one active molecule (a polysaccharide) responsible for all its beneficial effect.** We are convinced that all the biologically active substances in Aloe are necessary to achieve the maximum-end-benefit. Only Aloe can attach the entire spectrum of human conditions because specific synergisms are brought into sharper focus. We have observed that if the polysaccharide from Aloe is washed extremely well - that is to remove all agents from it, the polysaccharide has very little biological activity. In fact, what is called polysaccharide is a polysaccharide with active orchestra members attached to it giving it biological activity along the lines we have discussed. If the polysaccharide is prepared in different ways, some activities may be lost and others remain. The “magic bullet” apparently requires a communication with orchestra agents to have its best influence.

Aloe vera is a biological vehicle in that it acts as a physical or physiological carrier for active biological agents but, also adds biological activity to the test agent no matter what the pharmacologic agent under consideration is. In effect, it is a physical carriage plus added Aloe vera activity. This is the orchestra of active substances surrounding the polysaccharide conductor. Thus the Aloe vera can add to the biological activity of most test substances. Substances can be synergized and put into Aloe for a biological vehicle effect. Can the conductor (the polysaccharide) do this most important biological vehicle effect by itself without the surrounding orchestra agents? I think not. It needs the rest of the team. If it can, it needs to be published as data under peer review and not just a “commercial blurb” put out to stir up controversy.

Aloe vera contains water soluble compounds such as amino acids, enzymes and carbohydrates as well as oil soluble compounds such as vitamins, sterols and anthraquinones. Possibly, pharmacologic agents of both solubility's can be placed in Aloe and carried through the skin to blood vessels. In an indirect way, the biological agents in Aloe can help the conductor (the polysaccharide) produce the biological response at the cell receptor. **To suggest that the polysaccharide works alone is presumptive and it is unwise to call it the magic bullet.** The polysaccharide has biological activity but not of the order obtained by synergizing with the surrounding biological compounds.

The Wound Healing Orchestra Compounds in Aloe Vera



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Aloe vera has been called a modulator in that it brings biological systems into balance. Using the Gowda 50% ethanol extraction procedure on Aloe vera, we found that 78% of the anti-inflammatory activity was present in the supernatant. The wound healing activity was present in the precipitate with the polysaccharide and other precipitated agents. Nevertheless, in the supernatant most of the anti-inflammatory activity was present in the supernatant without the presence of the polysaccharide. Some of the wound healing orchestra compounds were precipitated with the polysaccharide to help with the wound healing activity. The carrageenan-inflamed synovial pouch response to Aloe vera confirms our biological results based on the Gowda experiment. The fibroblast stimulation activity of Aloe vera recorded in wound healing was clearly observed. The fibroblast response in the air pouch was not a chronic inflammation but rather a growth-repair response. Aloe stimulates the fibroblast directly to increase wound tensile strength. It stimulates glucosamine to form collagen and proteoglycan but zinc and vitamin C must be present. Mast cells of animals treated with carrageenan were found in connective tissue and pouch fluid. They were particularly increased in the inner being of the air pouch as a result of the inflammation.

Aloe vera reduced the inflammation and the pouch was vascularity but at the same time Aloe vera increased the pouch wall weight. This increase in air pouch punch biopsy weight by Aloe represents a healing and repair response. Aloe stimulates directly growth and repair by directly stimulating fibroblasts. Aloe vera has no anti-fibrosis effect but stimulates the fibroblast for growth and repair as seen in wound healing. Both of these studies clearly demonstrate that Aloe vera inhibits inflammation and stimulates wound healing at the same time which is the miracle of Aloe. We have not seen data to show that the magic bullet (the polysaccharide) can do this. In fact, this wonderful dual biological characteristic appears to be exclusive for Aloe vera.

Aloe Vera - An Immune Modulator and Immune Stimulator

The polysaccharide is an immune stimulator which increases the immune response to an antigen. La Badie has shown that Aloe vera can act as an adjuvant to enhance the immune response to an antigen. He found that there are two functionally and chemically distinct immunomodulatory compounds in the gel of Aloe vera. One fraction could enhance antibody formation and another could inhibit antibody formation such that La Badie called Aloe vera an immune modulator. Davis and La Badie showed that the Aloe vera can inhibit and stimulate phagocytosis as well as “mop up” oxygen radicals. Aloe vera acts as an immune stimulator on wound healing and an immune inhibitor on



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inflammation. Aloe vera can prevent and regress the autoimmune condition of adjuvant induced arthritis. This condition involves both antibody and cellular immunity.

Aloe vera can inhibit the infiltration of polymorphonuclear leukocytes into a site of irritation. This represents a block on leukotrienes. Under-nourished individuals have impaired immune responses which may be co-factors in the immunodeficient virus infection. This makes people more susceptible to viral infection. The many nutritional components in Aloe vera may help the infected individual fight off a disease as a co-factor as well as play a role in regulating the immune system (cell mediated immunity). No single component such as the polysaccharide can do the complete job. A treatment of many compounds as seen in Aloe vera would seem to be more beneficial for a multifactorial syndrome. The global AIDS problem may be out of control because there is no treatment. If the polysaccharide can contribute in this area, possibly, Aloe vera can even make a better contribution because it is multifaceted. Aloe vera has 200 biologically active agents as well as polysaccharide to act as a biological vehicle and a treatment possibility.

Aloe Vera and Anti-tumor Activity

Yagi presented data on the isolation of a glycoprotein (Aloe glycoprotein) which has bradykinin-degrading activity and a proteolytic activity against bradykinin. The Aloe glycoprotein has hemagglutinating and cytoagglutinating activity. It has mitogenic activity for lymphocytes. This glycoprotein is called Aloctin A. This glycoprotein has strong anti-tumor activity whose activity varies with the dose at microgram amounts. Aloctin A is non toxic and at very small doses causes complete regression of tumors. Like the polysaccharide, the glycoprotein appears to have an anti-tumor effect based on cell division and immune system response. Thus, the polysaccharide is not the only magic bullet, glycoprotein is another one. **In fact, Aloe vera has many magic bullets such as gibberellin, auxin, sterols and chromones to mention a few.** All of these compounds are found around the polysaccharide in the orchestra.

Aloe Vera and Skin Penetration

The penetration of topical agents through the skin may be influenced by the drug, the vehicle and the skin. Little attention has been given to the influence of Aloe vera and mucilage on the penetration through the skin. The stratum corneum acts as a barrier to drug penetration through the skin but also acts as a reservoir for molecules when a drug is applied on the skin. When hydrocortisone is applied to the skin, 99% fails to penetrate the skin stratum corneum and is wasted. Placing hydrocortisone in Aloe vera enhances the



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penetration and adds to the biological activity of hydrocortisone. Aloe vera increases the penetration of skin by water hydration, occlusiveness and by increasing compound solubility. Aloe vera increases the penetration through the skin whereas the polysaccharide mucilage acts as an occlusive seal forming a firm cover to keep moisture in the skin. Aloe can aid water soluble and insoluble compounds as a biological carrier so that it can be a good carrier for all kinds of drugs as well as contributing Aloe activity to the drug it carries. Can Aloe polysaccharides alone aid in skin penetration and add its biological activity to an agent it carries? We think it can not by itself. It needs the orchestra environment of biologically active compounds to complete the task. The properties of a large polysaccharide are completely different from those of a small polysaccharide. What is said of the smaller one can not be attributed to the larger one. In any event, we need to see the data to prove that the magic bullet - the polysaccharide - can act in a fashion similar to Aloe vera. The FDA must see the data recorded in “commercial blurbs” backing up all the claims made by people who say “If you don’t have our polysaccharide, you don’t have active Aloe vera.” This is not true based on scientific evidence. These claims are false and are made by people motivated by money and not by evidence.

Gibberellin in Aloe Vera

Gibberellin is a growth factor found in Aloe plants that has anti-inflammatory and wound healing activity in laboratory animals. It does this in normal and diabetic animals. Gibberellin’s wound healing activity is related to its ability to stimulate protein synthesis as well as the RNA-DNA cellular systems. It stimulates wound healing (open and incisional wounds) in a dose-response manner. Aloe vera and gibberellin can stimulate fibroblasts directly to form collagen and proteoglycans for wound healing. We also feel that Aloe vera (or gibberellin) can stimulate or modulate the macrophage to produce the traditional growth factors which stimulate fibroblasts. It appears that Aloe vera or gibberellin can do the same thing as proposed by the polysaccharide. Because of the contribution of other agents, they probably do a better job on open and incisional wounds. However, studies need to be designed to show this. **Aloe vera and gibberellin are anti-inflammatory even in the diabetic.** They improve wound healing, reduce edema and pain. Aloe vera has an additive “vehicle effect” with gibberellin on wound tensile strength. Gibberellin blocks hydrocortisone’s inhibition on wound healing similar to Aloe vera.

Hydrocortisone inhibits wound healing by blocking the formation of connective tissue. This increases the spread of infection. Aloe vera and gibberellin counteracts these detrimental effects of steroids. Gibberellin and Aloe vera block the steroid inhibition on wound tensile strength. Aloe vera contains three sterols that have good anti-inflammatory



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activity. They exhibit anti-inflammation in a dose-response fashion and may be a major contributor to the anti-inflammation in Aloe. Aloe vera blocks a wide variety of irritants that act by different biochemical pathways. However, it has no chronic anti-inflammatory activity because it stimulates the fibroblast for wound healing. However, we wonder if it aids the hydrocortisone's chronic anti-inflammatory activity since **Aloe vera prevents and regresses adjuvant induced arthritis**. Aloe vera acts as a biological vehicle for aspirin and it synergizes with its analgesic and anti-inflammatory activity.

Aloe Vera: Helps in Wound Healing, Produces Anti-cancer Effects and Stimulates the Immune System

Summarizing the main effects of Aloe vera, we must conclude that gibberellin, sterols, chromones, aspirin like compounds and auxins are magic bullets in Aloe vera. Mucilage improves wound healing, glycoprotein is anabolic and produces both anti-cancer effects and immune system responses that are anti-tumor. Both of these must be considered magic bullets as well as the polysaccharide found in the parenchyma cells of the Aloe leaf. Is it wise to precipitate the polysaccharide with alcohol and throw out all these wonderful biological agents? Is it wise to say that only the polysaccharide is worthwhile when you are aware of this data? I think not. It is acceptable to isolate the various compounds and evaluate them by themselves. However, do not run down Aloe vera from which they came. The data presented here refutes the concept that "If Aloe vera doesn't have a certain polysaccharide, its not Aloe vera." It rejects the concept that only the polysaccharide is active and important in Aloe vera.