

Leukemia and Optical Picbots: A Noval Therapy

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Abstract—Leukemia is a blood malignant growth brought about by an ascent in the number of white platelets in our body. Current leukemia study is gaining ground in the conveyance of remedial payloads, including medications and imaging operators. A picbot's agent basically triggers a payload-discharge system in the wake of being guided to an objective area in the patient's body. Light empowers us to see things at a scope of scales, from the perceptible to the petite where our own cells, microorganisms, and other smaller-scale living beings multiply. The goal of this paper is to utilize optical picbots as a treatment for leukemia in imaging the development, level of the contamination and state of the cancerous cell inside the patient's body.

Keywords—Cancerous Cell, Leukemia, Optical Imaging, Optical Picbots, Therapeutic.

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1. INTRODUCTION

At some point, a visit to the emergency clinic with a genuine disease could end not with medical procedure or jugs of pills, yet with an infusion of clinical microrobots. In the broadest sense, microrobots are just minute scale robots intended to perform chosen developments in light of explicit upgrades however their modest size implies that they could head out through the body to perform undertakings that no traditional robot could do. For instance, they may wipe out supply routes that are obstructed with plaque, perform profoundly focused on tissue biopsies, or treat carcinogenic tumors from within [3]. Comparable in size to living human cells, microrobots are far less inclined to cause tissue harm than traditional clinical mediations, for example, careful entry points and catheter inclusions. By focusing on explicit goals in the body, microrobots could radically lessen the symptoms of pharmaceuticals. Looking further ahead, when they can be controlled precisely and over and over at the subcellular size range, microrobots could empower tissue designing and regenerative medication, whereby harmed tissue and organs could be fixed or altogether reconstructed.

Current research is additionally gaining ground in the delivery of remedial consignments, together with medicines and imaging specialists. Weighed with the issues of building and movement, medicate conveyance is moderately clear: A micro-robotic specialist just triggers a payload-discharge tool in the wake of being guided to an objective area in the body. Fruitful tests have been confirmed in vivo for little creatures. For instance, self-governing microrobots driven by hydrogen microbubbles have been utilized in live mice to treat gastric bacterial infection [4]. These microrobots improved payload-standards for dependability by squeezing the medication straightforwardly against the stomach divider. Contrasted with customary medication conveyance strategies, which frequently depend on detached dispersion to arrive at an ideal zone, effectively guided microrobots offer an approach to convey on-request payloads a lot nearer to the objective area. This exactness conveyance implies that a higher convergence of the medication will show up at the most valuable site and that the danger of potential reactions is limited in light of the fact that the medication is substantially less prone to diffuse to the encompassing tissue.

Engineers have thought of a baffling number of ways to deal with portable microrobot incitation. One methodology is acoustic incitation, in which microrobots move towards the sound-created pressure focuses motivated by swaying sound waves that are functional to the liquid encompassing them. Concoction incitation techniques incorporate the propulsive compound engines that oust microbubbles or utilize vicinity substance angles to create push powers. There are moreover biohybrid plans that exploit the independent vitality and versatility of living cells, customarily by coupling microbes, sperm, or muscle cells to imitation structures and controlling them remotely by changing the encompassing temperature, acidity, lighting conditions, or other attractive fields. Optical stimulation can create creeping velocity on elastomer tools, which contract when legitimately warmed by lasers. The issue with huge numbers of these techniques is that they can be utilized distinctly in controlled situations and require calibrating for applications in vivo. In the proposed method, optical imaging is the mainstream constraint concerted [2].

2. LEUKEMIA

A. *What is leukemia?*

Leukemia is essentially a gathering of various malignant growths of the platelets. Leukemia can be an intense or the constant, and individuals with interminable leukemia may not see any indications before the condition is determined to have a blood test. Intense leukemia is bound to cause side effects. Indications of all types of leukemia are identified with the expansion of strange platelets and substitution of the bone marrow by the carcinogenic cells. The side effects

of leukemia incorporate fevers, night sweats, and swollen lymph hubs that are commonly not difficult or delicate. Exhaustion, weight reduction, and bone or joint torment are other potential side effects. Simple wounding and draining inclinations might bring about the seeping from the gums, purplish fixes on the skin, or little red spots under the skin. In leukemia, irregular platelets are created in the bone marrow. Typically, leukemia includes the creation of strange white platelets, the phones liable for battling disease. Nonetheless, the strange cells in leukemia don't work similarly as ordinary white platelets. The leukemia cells proceed to develop and separate, in the long run swarming out the typical platelets. The final product is that it gets hard for the body to battle diseases, control dying, and transport oxygen. There are various kinds of leukemia, in light of how rapidly the illness creates and the sort of strange cells delivered [1]. Leukemia is called an intense leukemia in the event that it grows quickly. Enormous quantities of leukemia cells amass rapidly in the blood and bone marrow, prompting manifestations, for example, tiredness, simple wounding, and helplessness to contaminations. Intense leukemia requires quick and forceful treatment.

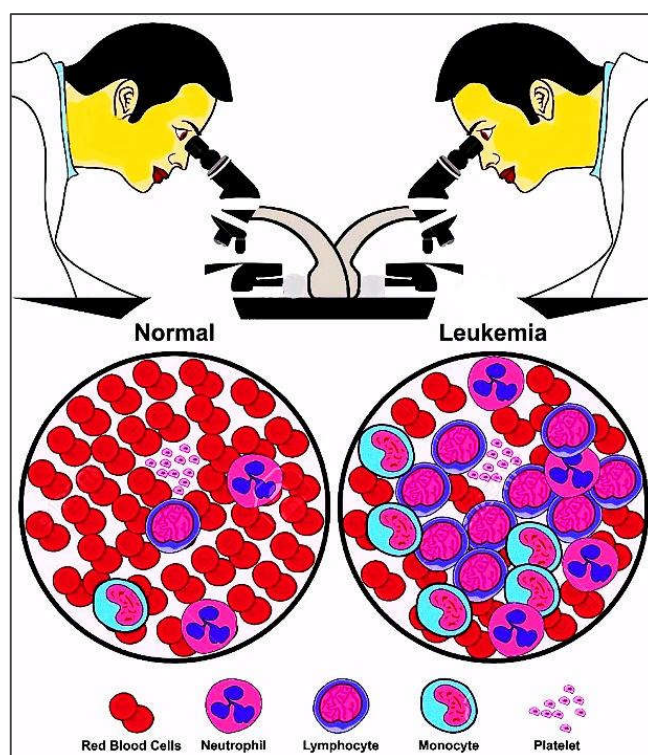


Fig. 1. Normal versus Leukemia Cells.

There are around 60,000 new instances of leukemia every year in the U.S. also, more than 24,000 passings because of leukemia [6]. Leukemia makes up about 3.7% of all new malignancy cases. Incessant leukemia grows gradually after some time. This leukemia may not cause manifestations toward the start of their course. Whenever left untreated, the cells may, in the end, develop to

high numbers, as in intense leukemia causing comparative side effects. Leukemia is additionally named myeloid or lymphoid, contingent on the kind of white platelet that makes up the leukemia cells. A vital comprehension of the typical improvement of platelets is expected to comprehend the various kinds of leukemia. Ordinary platelets create from foundational microorganisms that can possibly become numerous cell types. Myeloid undifferentiated organisms develop in the bone marrow and become juvenile white cells called myeloid impacts. These myeloid impacts further develop to turn out to be either red platelets, or particular sorts of white platelets. Lymphoid undifferentiated cells develop in the bone marrow to become lymphoid impacts. The lymphoid impacts form further into T or B lymphocytes (T-cells or B-cells), implicit kinds of white platelets. Myeloid or myelogenous leukemia are comprised of cells that emerge from myeloid cells, while lymphoid leukemia emerges from lymphoid cells. Knowing the kind of cell associated with leukemia is vital in proper treatment [7].

B. Types of leukemia

Leukemia is grouped by the kind of white platelets influenced and by how the illness advances. Lymphocytic leukemia (also called lymphoid or lymphoblastic leukemia) creates in the white platelets called lymphocytes in the bone marrow. Myeloid (otherwise called myelogenous) leukemia may also begin in white platelets other than lymphocytes, just as red platelets and platelets [5]. As far as how rapidly it creates or deteriorates, leukemia is delegated either intense (quickly developing) or constant (slow-developing). Acute leukemia is fast advancing and brings about the aggregation of youthful, functionless platelets in the bone marrow. With this sort of leukemia, cells imitate and develop in the marrow, diminishing the marrow's capacity to deliver enough solid platelets. Constant leukemia advances all the more gradually and results in the amassing of moderately develop, yet at the same time irregular, white platelets. The sorts of leukemia include:

Acute lymphocytic leukemia (ALL) advances quickly, supplanting sound cells that produce practical lymphocytes with leukemia cells that can't develop appropriately. The leukemia cells are conveyed in the circulation system to different organs and tissues, including the cerebrum, liver, lymph hubs and testicles, where they proceed to develop and separate. The developing, separating and spreading of these leukemia cells may bring about various potential side effects.

Acute myeloid leukemia (AML), otherwise called acute myelogenous leukemia, acute myeloblastic leukemia, acute granulocytic leukemia or acute nonlymphocytic leukemia, is a quickly developing type of malignant growth of the blood and bone marrow.

Chronic lymphocytic leukemia (CLL) is a regularly slow developing malignant growth that starts in lymphocytes in the bone marrow and reaches out into the blood. It might likewise spread to lymph hubs and organs, for example, the liver and spleen. CLL creates when an excessive number of anomalous lymphocytes develop, swarming out the typical platelets and making it hard for the body to battle infection.

Chronic myeloid leukemia (CML), called interminable myelogenous leukemia, starts in the blood-shaping cells of the bone marrow and afterward, over the long run, spreads to the blood. In the long run, the ailment spreads to different territories of the body [3].

Hairy cell leukemia (HCL) is an uncommon subtype of chronic lymphocytic leukemia that advances gradually. HCL is caused when bone marrow makes such a large number of B cells (lymphocytes), a kind of white platelet that battles contamination. As the quantity of leukemia cells increments, less solid white platelets, red platelets and platelets are delivered.

Myelodysplastic syndromes (MDS) are a gathering of firmly related maladies wherein the bone marrow delivers too hardly any working red platelets (which convey oxygen), white platelets (which battle contamination), or platelets (which forestall or quit dying), or any blend of the three. The kinds of myelodysplastic disorders are analyzed dependent on specific changes in the platelets and bone marrow. The phones in the blood and bone marrow (additionally called myelo) typically look unusual (or dysplastic), henceforth the name myelodysplastic disorders.

As indicated by the American Cancer Society, around 13,000 individuals a year are determined to have MDS. Previously, MDS was regularly alluded to as a preleukemic condition (and it is still now and again called preleukemia) on the grounds that a few people with MDS create intense leukemia as a complexity of the illness. Be that as it may, most patients with MDS will never create intense leukemia. By show, MDS are renamed as acute myeloid leukemia (AML) with myelodysplastic highlights when blood or bone marrow impacts reach or surpass 20 percent.

3. NANOBOTS AND LEUKEMIA

Consider it another sci-fi turning out to be logical truth. Specialists have since a long time ago longed for creating tiny robots that could meander about inside our bodies, conveying drugs with extraordinary exactness, and chasing down and decimating malignant growth cells [4]. They had created robots a couple hundred nanometers across there are 25 million nanometers in an inch and when they infused them into the circulation system, the nanorobots could wither tumors by obstructing their blood supply. The nanorobots were produced using sheets of DNA folded into

the tubes holding a blood-coagulating drug. Outwardly, the specialists put a little DNA particle that ties with a protein discovered uniquely in tumors [8].

At the point when the bots arrived at tumors, this particle joined to the protein, setting off the DNA cylinder to unroll and discharge the medication. Furthermost malignant growth sedates ordinarily have awful reactions since they can't find disease cells and solid ones. The scientists demonstrated that the nanorobots just focused on the tumors and didn't cause thickening somewhere else in the body. They state this offers a promising eventual fate of malignancy medicines liberated from symptoms. Such a gadget is totally different from the human-scale bots that fabricate our vehicles and vacuum our floors. Be that as it may, the nanorobots can detect their condition, explore, and complete mechanical assignments simply like huge robots.

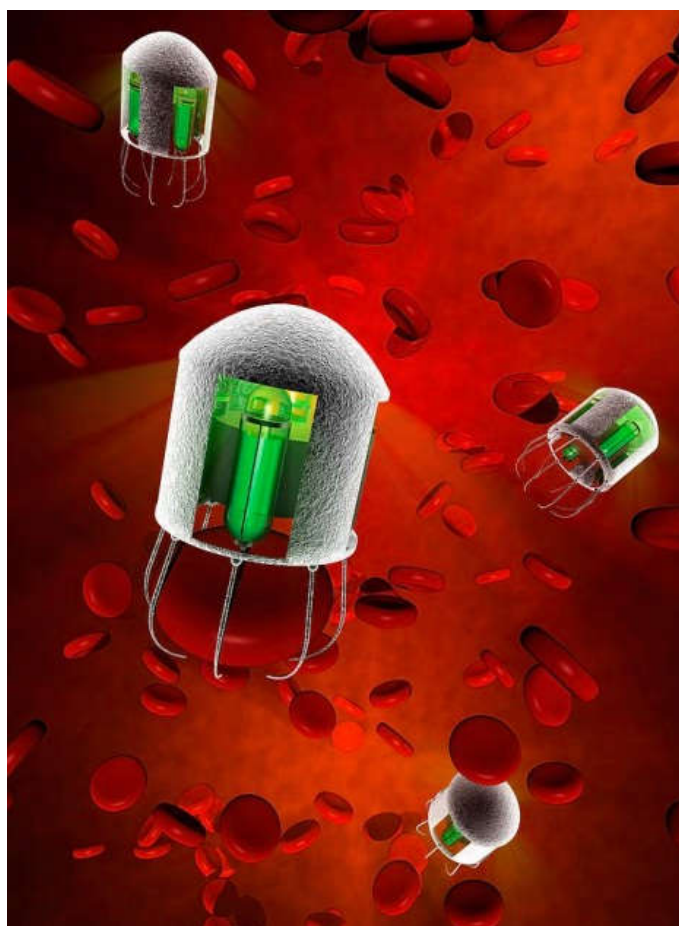


Fig. 2. Nanobots confronting the Leukemia Cells.

Be that as it may, being capable of access hard-to-arrive at regions of our bodies could have significant ramifications for medication, so researchers are scrambling to discover approaches to power and control inside-the-body bots. Notwithstanding boosting the adequacy and decreasing the reactions of ground-breaking drugs, nanorobots sauntering in the circulatory system could go

about as early notification frameworks for illness. What's more, little remote careful apparatuses could let specialists perform clinical systems without cutting individuals open [1]. It is developing robots simply under a millimeter over that are worked from flexible polymers loaded up with attractive particles that can be hauled through liquids and activated to get a handle on objects. These little bots are constrained by exact attractive fields produced by a variety of electromagnets. The robots could inevitably be reused to gather tissue biopsies or convey medicate cases inside the body.

4. OPTICAL PICBOTS

Light is a significant research device. It empowers us to see things at a scope of scales, from the plainly visible to the minute where our own cells, microorganisms, and other small scale living beings multiply. A less common property of light is the energy that it conveys. This component powers concentrated light to trap, move, and position minute items. This has had significant impacts, especially in biomedical science, by empowering scientists to utilize light to expand their 'hands,' and control organic examples with incredible exactness. Furthermore, optical powers are non-intrusive and can work through fixed and clean organic chambers.

Notwithstanding misusing force to trap and move objects, the light may now be able to be utilized to produce auxiliary impacts, for example, heat. Before, neighborhood warming in a microfluidic situation was accomplished by utilizing metal surfaces and metallic nanoparticles. These strategies have powered valve activity, stream control, and blending. They can also drive as impetuses for concoction responses and have even been applied for malignant growth treatment. Be that as it may, confinement confronted when utilizing metal layers in microfluidic gadgets emerges on the grounds that they are generally fixed to a specific locale. Conversely, the movement and position of nanoparticles are difficult to control [2]. To take care of this mobility issue, we need to incorporate metallic structures into another sort of light-determined nanobots, here optical picbots. Ongoing upgrades in the fields of optical control and microfabrication can take into account progressively advanced research. We can use these advancements to make new utilitarian automated apparatuses for light-based microbiological tests.

A custom-manufacture method, known as two-photon polymerization can be utilized to achieve 3D microprinting. Right now, laser shafts are utilized to harden a fluid polymer sap, accomplishing printed include sizes of down to a small amount of the composing frequency. Likewise, with 3D printers, various plans can be created to impeccably suit specific applications. The structures that have been planned and incorporated in the optical picbots and, all the more as

of late, empty nanorobots for the material vehicle. Besides, light-started physical responses empower new functionalities in these optical nanorobots for imaging applications. Among the functionalities that have consolidated, a syringe activity empowers the optical nanorobots to mountain and empty a modest freight, making them fit for the material vehicle.

The photoresist that was utilized in the manufacture of these light robots is basically straightforward to the catching bar frequency and in this manner produces next to no heat. Metals are productive vitality to-warm converters of light, so to upgrade laser-initiated heat age in the polymerized light robots; inserted a dainty metallic layer inside every one of them utilizing fume testimony. For this object was kept a titanium attachment layer and a gold layer (of 1 and 5 nm thickness, individually) as a roundabout plate inside the body of each light robot.



Fig. 3. A Typical Optical Picobot.

Once the picbots were brought into a cytometry cuvette, they are singly bendable utilizing four counter-proliferating pillars that trap every one of the round handles. Moreover, an additional shaft is utilized for controlled warming of the inside metallic layer. Adequate laser warming structures a microbubble around which the solid convection flows are created. The consequences of the trials show that the convection flows can draw $2\text{ }\mu\text{m}$ -width silica dots into the structure. By consolidating the convection flows with optical control, each picbot is made equipped for getting freight in various areas. The hydrodynamic impact that is utilized to move particles can be very solid and, as opposed to optical catching and control, doesn't depend on the refractive-file differentiate. Nano-cargo can in this manner be launched out by moving the warming shaft over the body of the nanotool. Many intriguing marvels can be seen here, for example, thermo-fine air pocket relocation, a directional difference in the warm slope, and the inversion of Marangoni convection because of the nearness of numerous particles.

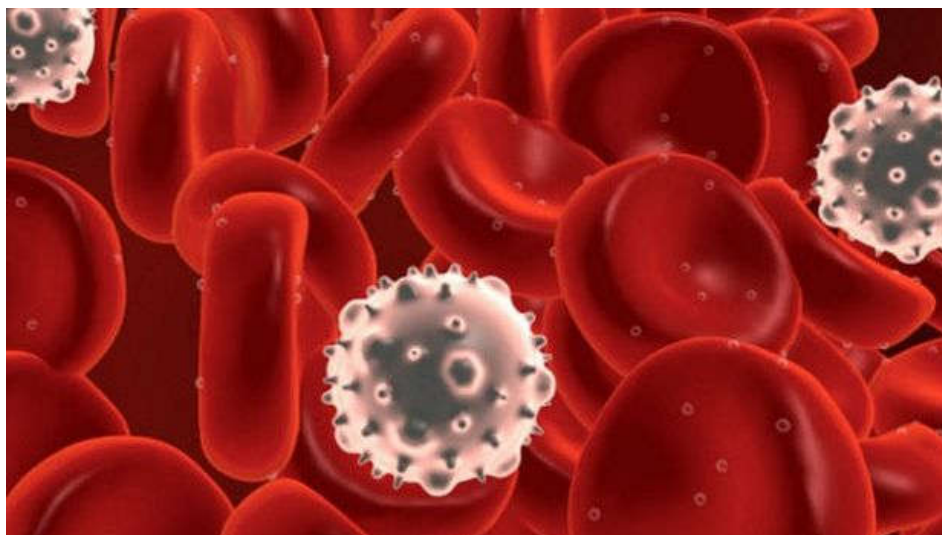


Fig. 4. Optical Image of a Promising Cure for Acute Leukemia through the Optical Picbots.

In outline, an optical picbot with an assortment of novel capacities and highlights was created. Among these, the capacity to optically control stacking and emptying could have potential practice in new medication conveyance approaches for single-cell tests. The optical picbots can alike be utilized to give physical and substance boosts to natural examples. This control isn't confined to a solitary robot and might be stretched out to an enormous bunch utilizing propelled programming i.e., swarm intelligence, accordingly empowering nanorobots to commonly organize to uncover better approaches for associating, examining, and obtaining data (e.g., for 3D microbiology). At last, the estimate that light mechanical autonomy will prompt totally new and problematic plans for ongoing 3D communications with the minuscule world. Later on, the possibility of uses for light mechanical autonomy, specifically those recognizing with nano-biophotonics imaging can be anticipated.

5. CONCLUSION

Eventually, working with in-the-body robots without any preparation will give us a lot more prominent command over their usefulness. In any case, we are as yet far from having the option to replica nature's advancements, so, until further insignia, this optical picbots are a savvy thought. As of right now, there is a convincing contention for utilizing these life forms that are now useful and attempting to adjust them to do what our future objective is. They have significantly more usefulness than the gadgets we can manufacture today apart from medicating leukemia.

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