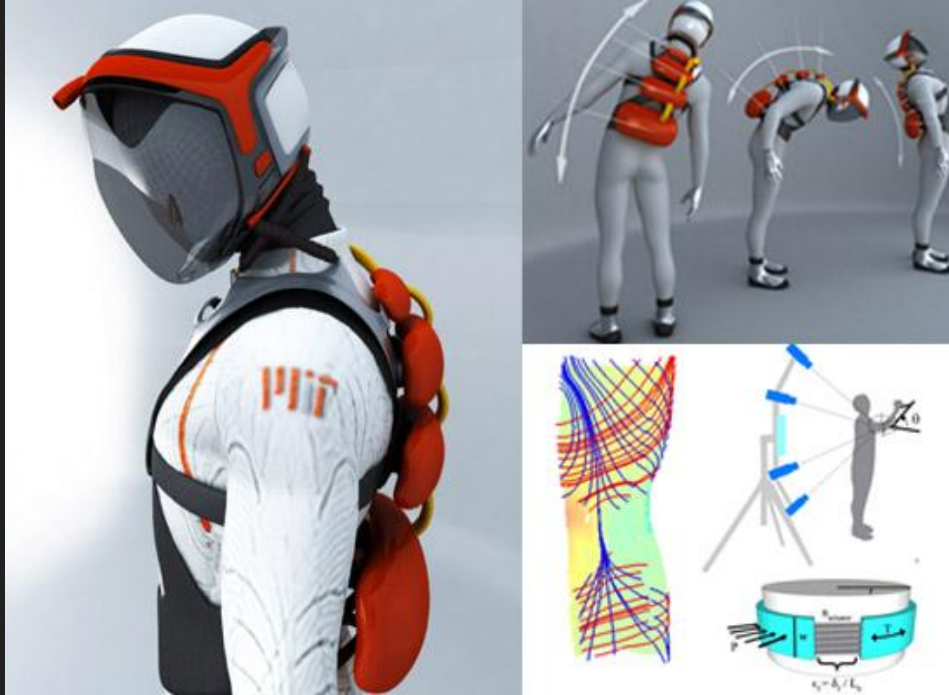


# “Smart” Artifacts

By Vsevolod (Seva) Ivanov

# MIT BioSuit



As for where the coils may be threaded within a spacesuit, Holschuh is contemplating several designs. For instance, an array of coils may be incorporated into the center of a suit, with each coil attached to a thread that radiates to the suit's extremities. As the coils activate, they could pull on the attached threads — much like the strings of a puppet — to tighten and pressurize the suit. Or, smaller arrays of coils could be placed in strategic locations within a spacesuit to produce localized tension and pressure, depending on where they are needed to maintain full body compression.

<http://news.mit.edu/2014/second-skin-spacesuits-0918>

<https://youtu.be/FbazOdEQxuE>

# TouchMan



Conductive gloves with stainless steel fibers - The "TouchMan" is made of stretchy material and is characterized by the best wearing comfort with the highest performance. Conductive yarn is knitted or woven into the fingertips of the glove. Our unique and simple design allows the user to use devices with touchscreen accurately and precisely without having to remove the glove. The gloves are washable and do not oxidize, making them a completely safe product for the skin and electronic devices.

Conductive fingertips, No oxidation, Machine washable,

Durable conductivity, High precision, Skin-friendly

<http://de.aiqsmartclothing.com/>

# Second Skin

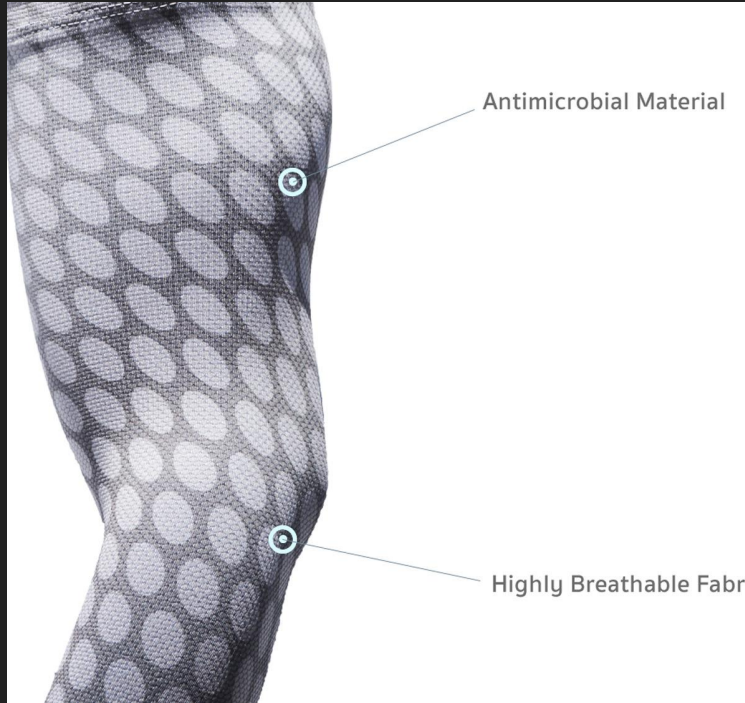


Human skin naturally sweats to get rid of the excessive heat and cool down the whole body, however, traditional clothes prevent this process from happening" says Lining Yao, a PhD candidate who worked on the design with a team of researchers. "In bioLogic, our 'Second Skin' reacts to sweat and facilitates this physiological process.

In the lab, the researchers had accidentally discovered that *Bacillus subtilis*—a bacteria best known as an ingredient in the Japanese fermented food natto—naturally transforms, swelling and shrinking depending on humidity.

<https://www.fastcoexist.com/3052801/this-shape-shifting-clothing-is-alive-and-powered-by-bacteria>

# AIO Sleeve



AIO Smart Sleeve Combines benefits of compression sleeve and activity monitoring including full time ECG and blood oximeter.

There's a nano trace built into the sleeve. It's a conductive material that's in a liquid form that connects one electrode to the other. That's how we can utilise the ECG from the point of the wrist to under the arm inside the bicep. The points need to be far away enough to measure the heart contractions. That was our number one challenge.

The AIO Smart Sleeve is designed with two different fabrics. The first uses a polyester Lycra blend, the standard material used for compression sleeves, and the second uses thin, breathable, antimicrobial polycarbon material. The AIO Smart Sleeve not only fits snugly and improves your daily reporting, but also provides a more comfortable alternative to today's activity bands.

<http://techaeris.com/2016/04/07/worlds-first-activity-monitoring-compression-sleeve-hits-kickstarter/>

# Heated clothes



Our electronically heated clothing keeps you warm - even without huge heating surfaces, which interfere with their weight in your outdoor or water activities. Our unique, coated stainless steel yarn is integrated into a special fabric to guarantee your safety and comfort. The ThermoMan is hardwearing, machine washable, soft and lightweight. The heating pad does not have to be removed before washing.

Lightweight, Machine washable, Fast warming

Uniformly distributed heat, Durability

<http://de.aigsmartclothing.com/>

# Solar-Powered Fashion



The designer Pauline van Dongen made a Wearable Solar project that shows how solar cells can be integrated into fashion, repurposing clothes as alternative energy sources. Pauline speaks about how the line could evolve through factors like better battery life and washability, as well as its potential impact on the future of woven textiles and fabrics.

<https://www.youtube.com/watch?v=rhUqDy4tg50>

photovoltaic fabrics

<https://youtu.be/m44EgocbkOc>



## Energy Storing Textiles

Fabrics embedded with electronic devices, such as a fabric heart rate monitor to record vitals. Smart textiles have applications in the medical, military and active sportswear fields. Some commercially available examples include the Nike Fit, and Adidas MiCoach.



To become viable devices, electronic textiles need an effective way to be powered! To date there is no commercially available "battery fabric."

Supercapacitors are energy storing devices like batteries. Unlike batteries, supercapacitors are capable of being made entirely of non-toxic materials and non-flammable electrolytes. This work we demonstrate a new concept using supercapacitive yarns and knitted fabrics to power smart textiles.

Scanning Electron Micrograph (SEM) of carbon fibers

Knitting is the looping and intertwining of yarns into textiles. This means a single continuous strand of yarn can be looped row by row into a full fabric. Knitting also allows for the specific placement of different yarns to make complex patterns, allowing for many different smart yarns to be incorporated into the same piece of fabric, demonstrated in the figures below. Some industrial knitting machines can incorporate up to 48 different kinds of yarn. With such equipment, the types of textile devices and configurations that can be "fabricated" are expensive and customizable.

The majority of textiles are made of yarn or string. Supercapacitors are comprised of four main components: an electrode, current collector, electrolyte and separator. The first step to making a textile supercapacitor is converting it's conventional charge storing materials into yarns. Once yarns are fabricated they can be assembled into full fabrics.

**Electrode:** a high surface area material (e.g., activated carbon) electrically charged to attract "ions" to its surface. The more ions are attracted, the more energy can be stored in the supercapacitor.

(+) Positive electrode

Anion (-)



(-) Negative electrode

**Current Collector:** Stainless steel yarn is used to carry electric charge to the less conductive electrode material. The 7  $\mu\text{m}$  steel fibers and electrode yarns are spun together.

**Electrolyte:** a solution that contains a dissolved salt, like salt water has sodium (Na<sup>+</sup>) and chlorine (Cl<sup>-</sup>) atoms. A **polymer (solid/gel) electrolyte** that does not leak onto the wearer is used. It is coated and dried onto the yarns. Because it is solid it can also act as the separator, that keeps each electrode from touching, and therefore electrically shorting.

(+) Positive electrode

(-) Negative electrode

Alternating positive and negative electrode wiring

1

SEM of knitted  
supercapacitor fabric



# Anti-radiation protection



Anti-radiation protection with the ShieldMan achieves a completely new dimension. With the EZ-Safer fabric from King's Metal Fiber Technologies, Cloth, which protects against electromagnetic radiation and consists of a fine metal fabric, is uniformly incorporated into the ShieldMan products. This allows us to provide complete protection without compromising wearing comfort or the fashionable style.

Unique shielding, Excellent fabric quality

Machine washable, Soft material

Lightweight, Skin-friendly, Antistatic

<http://de.aiqsmartclothing.com/>

# Touch Me



Chromogenic systems change colour in response to electrical, optical or thermal changes. These include electrochromic materials, which change their colour or opacity on the application of a voltage (e.g., liquid crystal displays), thermochromic materials change in colour depending on their temperature, and photochromic materials, which change colour in response to light—for example, light sensitive sunglasses that darken when exposed to bright sunlight

<https://www.youtube.com/watch?v=zyTtfj-40tU>

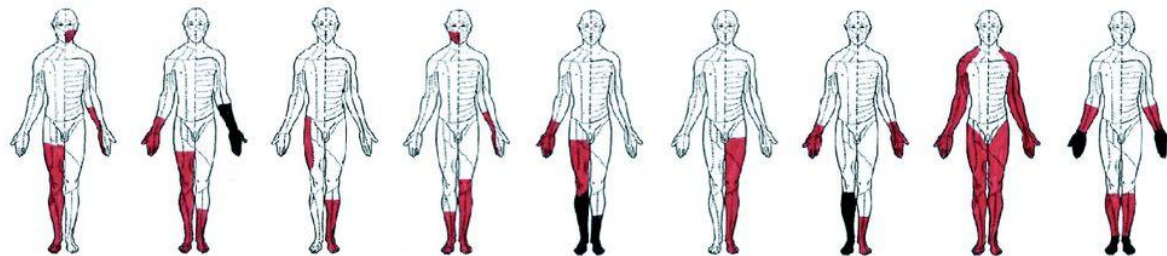
# Superhydrophobic coating



<https://www.youtube.com/watch?v=BvTkefJHfC0>

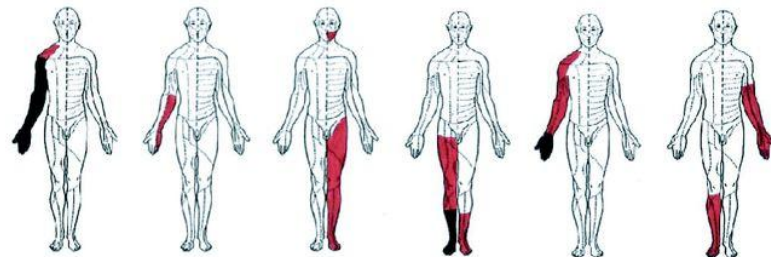
# Speculative Design

Case 1 Case 2 Case 3 Case 4 Case 5 Case 6 Case 7 Case 8 Case 9



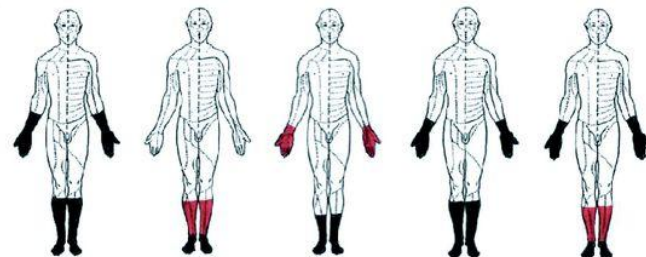
Neurolymphomatosis  
(pathologically-proven)

Case 10 Case 11 Case 12 Case 13 Case 14 Case 15



Neurolymphomatosis  
(FDG-PET-assessed)

Case 16 Case 17 Case 18 Case 19 Case 20



CIDP-type

Sensory  
ganglio-  
neuropathy

Vasculitic  
neuropathy

Paraneoplastic neuropathy

Mononeuropathy

=

Damage to a single nerve



# The Ulnar Nerve

- Muscles innervated
  - Flexor carpi ulnaris, flexor digitorum profundus, adductor pollicis, small digital muscles
- Motor functions
  - Finger adduction and abduction other than thumb; thumb adduction, flexion of digits 4 & 5; wrist flexion and adduction
- Sensory
  - Skin over medial surface of the hand through the superficial branch

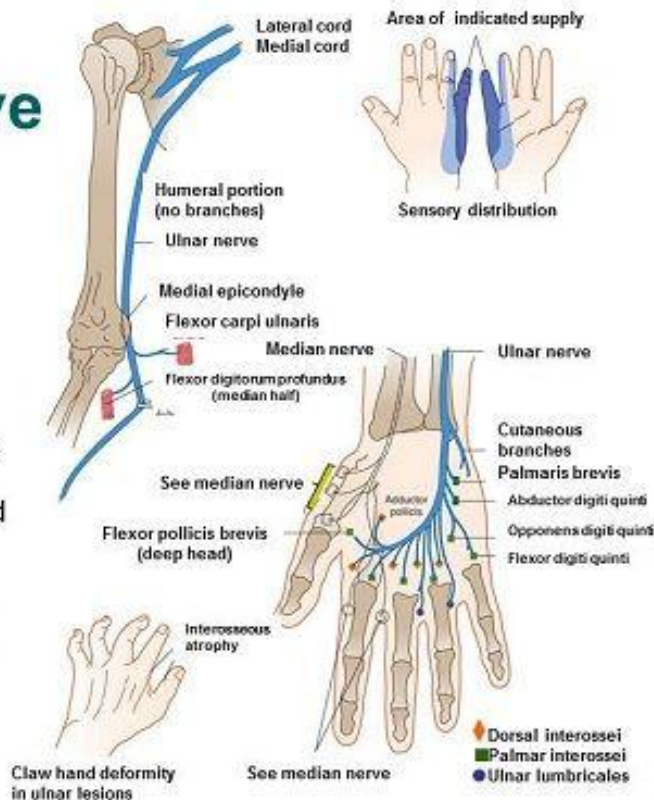


Figure 28-9 . The ulnar nerve (C8, T1). In: Waxman SG. Clinical Neuroanatomy, 26th ed. <http://www.accessphysiotherapy.com>. Accessed May 10, 2011.

2-Textiles  
1-wear

## Electronic Textiles

spends  
time  
describing  
technology

Wearable technologies promise to transform the fashioned body forever. As technologized textiles redefine garments as mobile, networked environments, they anchor the cerebral world of intelligence to the intimate environments of the modern human. The exchanges between them are facilitated by fabrics woven from fibres capable of conducting electrical impulses and transferring information. Known as electronic textiles, the new generation of fabrics are fibrous substrates into which microelectronic components and connectors have been seamlessly integrated. As technical hardware and tactile textures become one, the fabrics that result are free from the bulky external components that make earlier generations awkward to wear.

Like computing devices, electronic textiles can relay information via conductors, switches and sensors and exchange signals with remote systems via transistors and woven antennae. Threads coated with metals such as silver and nickel make excellent

# Bioamplifier clothes



The purpose is to use the Electroactive Polymer clothing to actuate motions in areas having motion handicaps. At first, we harvest nervous impulses using the 1-channel recording electrode. Then, we amplify this signals using small embedded amplifiers. In turn, they will generate an electrical charge which will make the Electroactive Polymer to change its shape to help the motion in question. The latter creates a bioamplifier clothes.

This idea combines the Greg Gage's SpikerBox and the Electroactive Polymer material.

Neuron SpikerBox [https://www.ted.com/speakers/greg\\_gage](https://www.ted.com/speakers/greg_gage)

Electroactive Polymer <https://www.youtube.com/watch?v=BgaxscXsIWY>