ANALYTICAL CONTROL DE MORI

MicroDay

Sicurezza e innovazione nel laboratorio microbiologico

Padova 29/05 Milano 31/05

AVIDITY SCIENCE

LABORATORY WATER SYSTEMS

Dr Mina Brett-Pitt

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Who we are

Avidity Science has provided water purification solutions to the research market for a combined 100+ years*

Started in 1969, Edstrom is the world leader in automatic watering solutions. We support animal-based research in academic, pharmaceutical and clinical segments.

Started in 1998 and acquired by Edstrom in September 2017, Triple Red has become a leading player in the U.K. by providing water purification systems, laboratory equipment, consumables and unmatched after-sales support for life sciences and healthcare customers.

Started in 1987 and acquired by Avidity in September 2018, CTC has become a leading player in the design and manufacture of filtration cartridge solutions.

We have built our company of 280+ employees through the unique combination of

3 CORE COMPETENCIES

WATER PURIFICATION AND DELIVERY

ISO 9001 2015 certified manufacturing in the USA & UK

MONITORING OF CRITICAL ENVIRONMENTS

Proprietary platforms to control watering systems and monitor research equipment

SERVICE

Nearly 25% of the company's current employees are field-based service technicians

**Edstrom and Triple Red were unified under the Avidity Science name on August 1, 2018*

Part 1: What will be covered?

- Water contaminants and quality measurements

- Laboratory Water – Classification

- Avidity Science Laboratory Water systems:

-Puro

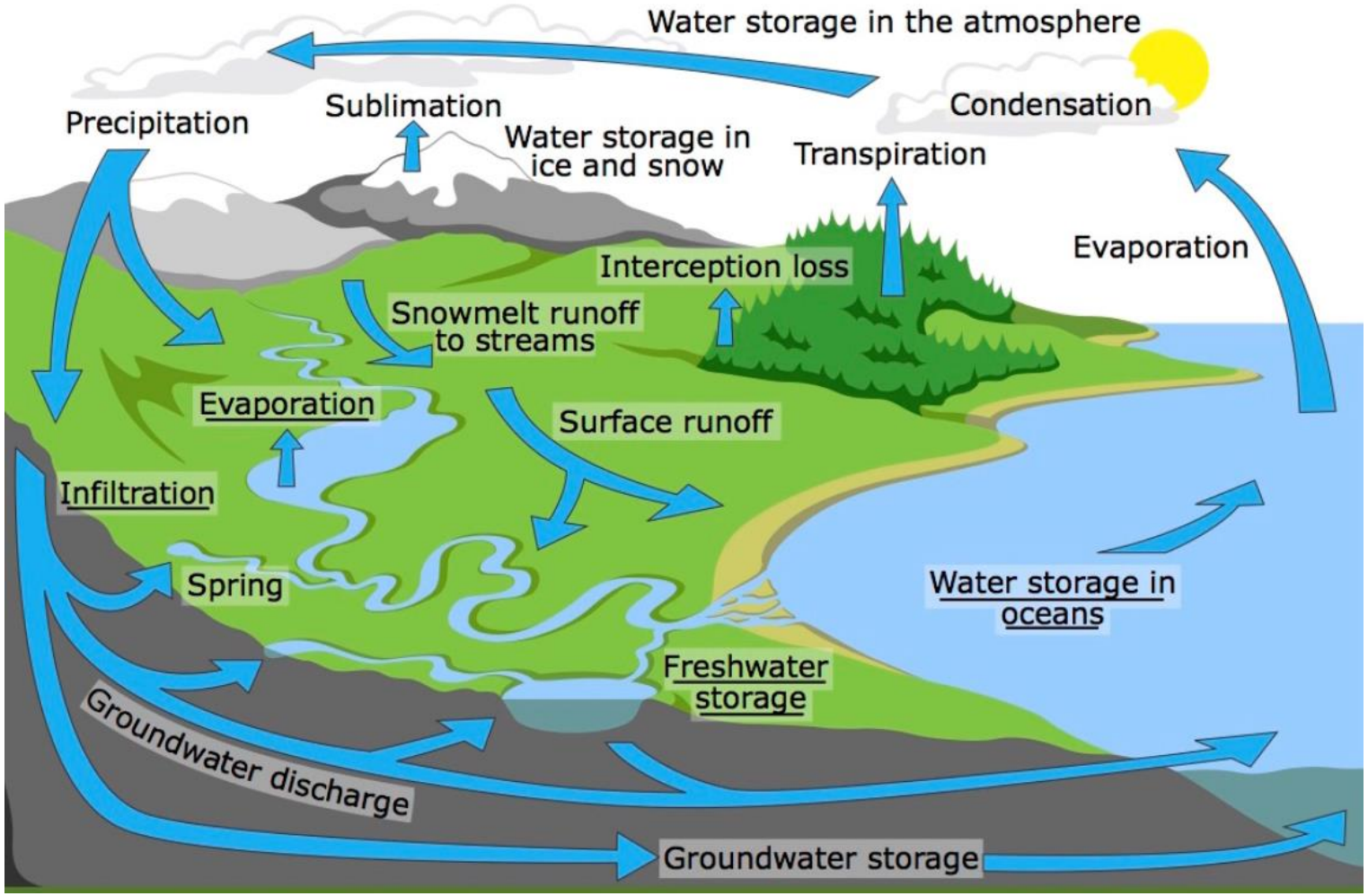
-Geno

-Pico

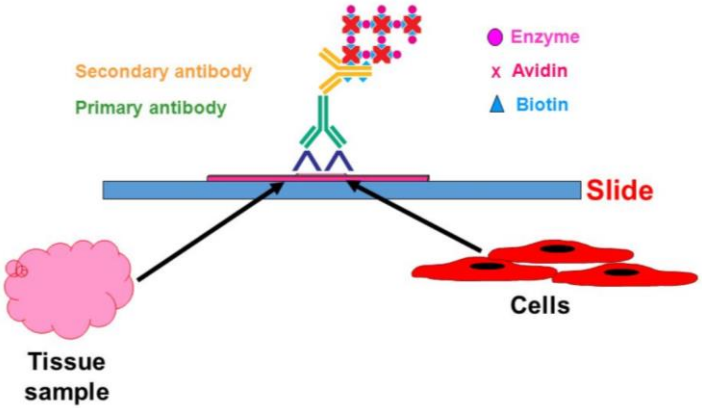
-Alto

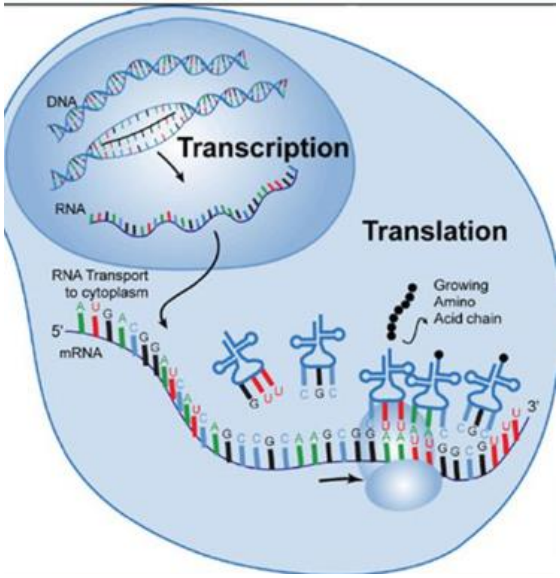
-Duo

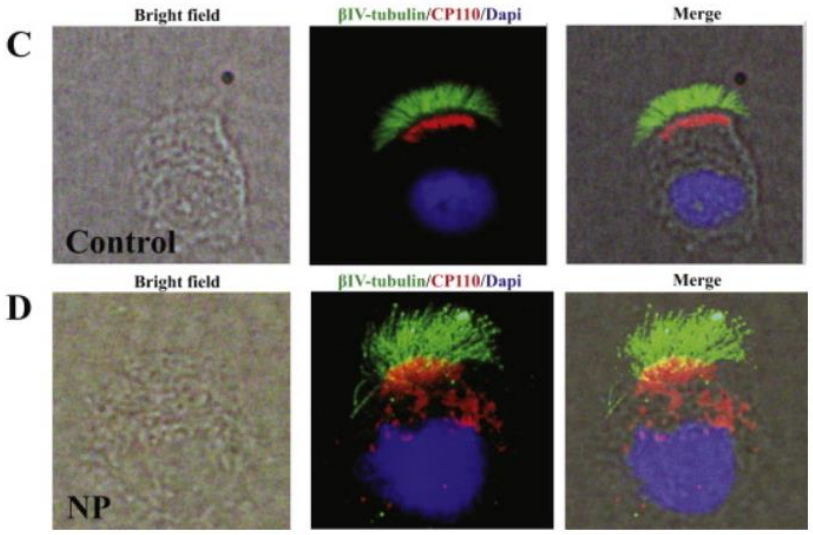
Global Water Cycle



Effect of contaminated water on Scientific Applications







Contaminants

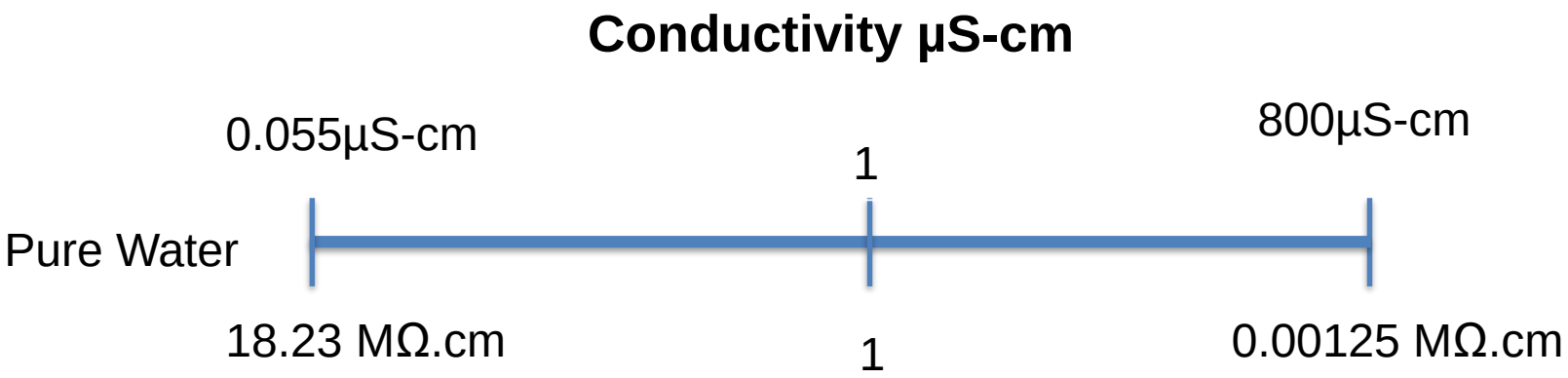
1. Inorganics
2. Organics
3. Particulates\ suspended solids
4. Colloids
5. Bacteria\Viruses
6. Endotoxin
7. Dissolved gases

1. Inorganics

- Major impurity in water- simple molecules
- Mainly from water being in contact with rock salts/minerals (metals)
- Any compound that lacks a Carbon atom (CO-CO_2)
- Cations (+ve) and anions (-ve)

H^+ Na^+ K^+ Ca^{2+} O^{-2} Cl^- Br^- SO_4^{2-}

Inorganic water quality measurement



- Meg Ohms (MΩ-cm) relate to the resistivity of the water (ability to resist passage of electrical current)
- Pure water has a very high resistivity of 18.2MΩ-cm
- µS and MΩ have an inversely proportional relationship to each other
  1/18.2 MΩ = 0.055 µS 1/100 µS = 0.01 MΩ

Examples of U.K water quality

	µS/cm
Cambridge	715
Leeds	285
Birmingham	115
Nottingham	540
Manchester	115
London	715
Oxford	645
Glasgow	200

2. Organics

- Typically of biological origins- Decay of vegetal material
- Carbon containing compounds
- Total Oxidizable Organic Carbon TOOC\ TOC (PPM-PPB-PPT)
- Dissolved organics can support the growth of a wide range of microorganisms therefore disrupting several biological applications

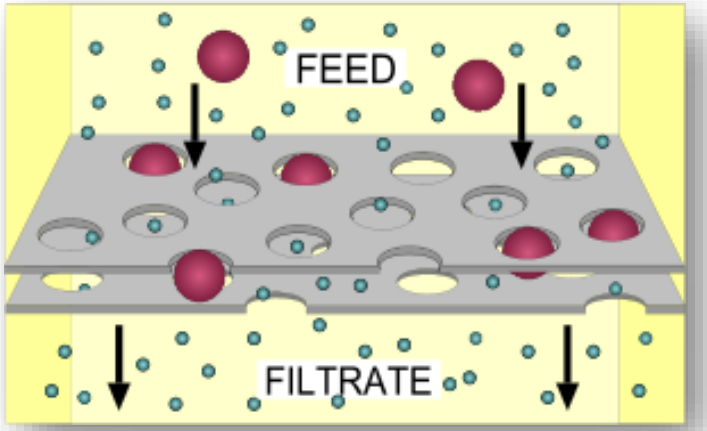
Examples of U.K water quality

	µS/cm	Organics
Cambridge	715	Low
Leeds	285	High
Birmingham	115	High
Nottingham	540	High
Manchester	115	High
London	715	Low
Oxford	645	High
Glasgow	200	Very high

3. Particulates\ suspended solids/ 4. Colloids

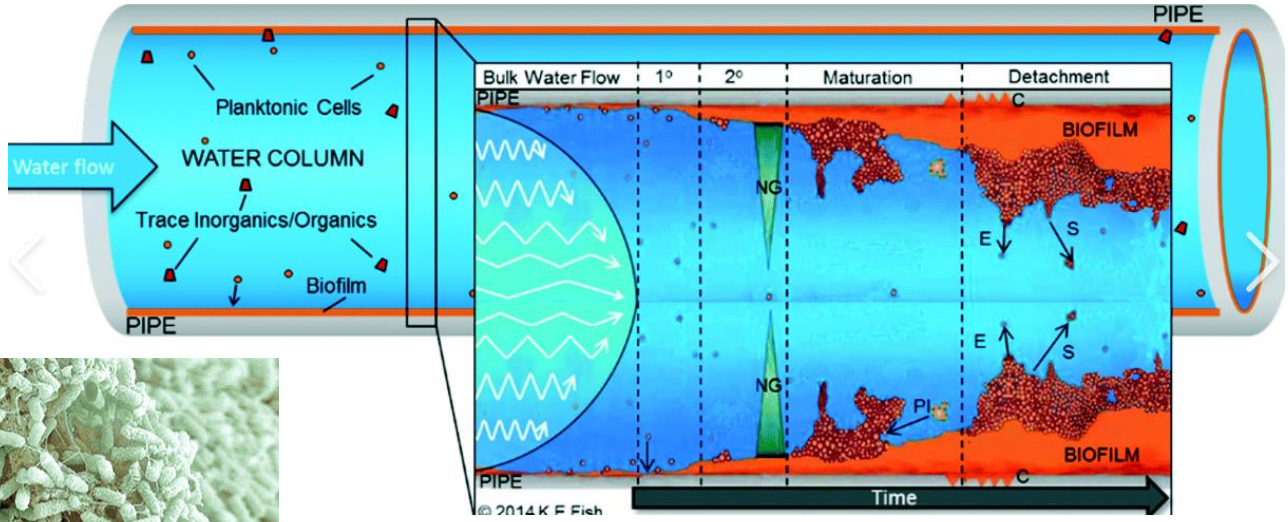
- Suspended matter including hard particles (sand, rock, slit), soft particles (vegetal debris) and colloids (organic or inorganic).
- SDI: Slit Density Index

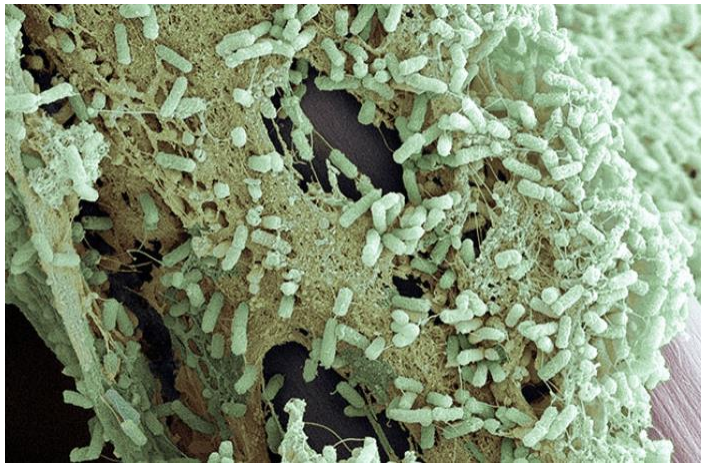
- Impact on system: Foul RO membranes interfere with valves. Analytical columns can be blocked- water turbidity



5. Bacteria\Viruses

- Chlorination does remove harmful bacteria from drinking water but it will still contain live microorganisms.

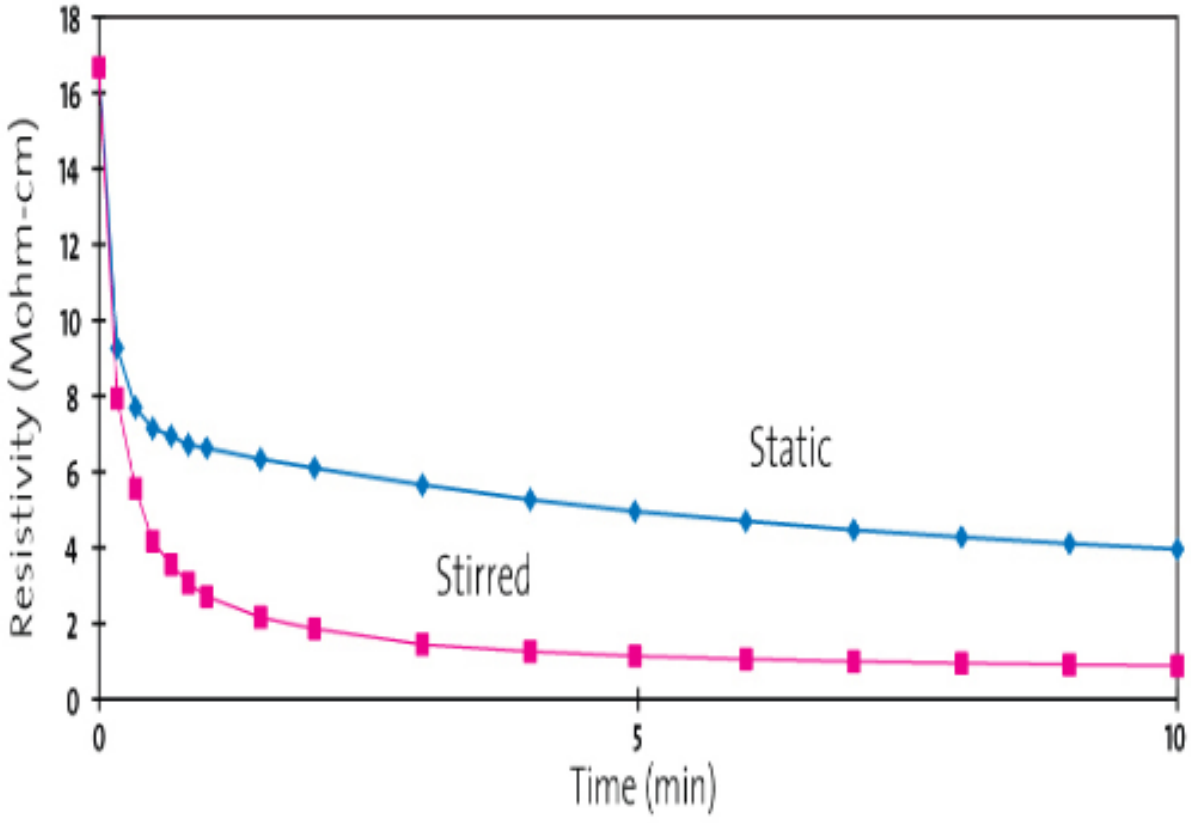




7. Dissolved gasses

- Oxygen and Nitrogen in feed water <10ppm and traces of noble gases
- CO_2 behaves differently and when it dissolves in water, it reacts to set up a series of equilibria
- $CO_2 + H_2O \leftrightarrow H_2CO_3 \leftrightarrow H+ + HCO_3^- \leftrightarrow 2H^+ + CO_3^{2-}$
- CO_2 will pass unaltered through filters and UV treatment
- CO_2 is removed from water that has been purified by ion-exchange
- As soon as this water is dispensed into a vessel in the laboratory it comes into contact with air and CO_2 absorbed. hydrogen, bicarbonate and carbonate ions will be produced and the resistivity will fall to about 1.3 MΩ.cm

7. Dissolved gasses



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LABORATORY WATER – CLASSIFICATION

LAB EQUIPMENT & SUPPLIES | WATER SYSTEMS | CONTROL & MONITORING | SERVICE

Laboratory Water - Classification

- Classified into types – I, II and III
  - Type I: Ultra-pure
  - Type II: General Lab Grade
  - Type III:Primary Grade

Laboratory Water – Type I (ASTM)

- Inorganics: 18.2 Meg Ohm-cm Resistivity
- Organics: <50ppb Total Organic Carbon
- Bacterial: <10CFU/1000ml Heterotrophic Count
- Endotoxins: <0.03 EU/ml

Laboratory Water – Type II (ASTM)*

- Inorganics: >1 Meg Ohm-cm Resistivity
- Organics: <50ppb Total Organic Carbon
- Bacterial: <10CFU/1000ml Heterotrophic Count
- Endotoxins: <0.25 EU/ml

Laboratory Water – Type III

- General product offering based on Reverse Osmosis
- Inorganics: Up to 98% rejection
- Organics: >99% rejection
- Bacterial: >99% rejection
- Particles: >99% rejection

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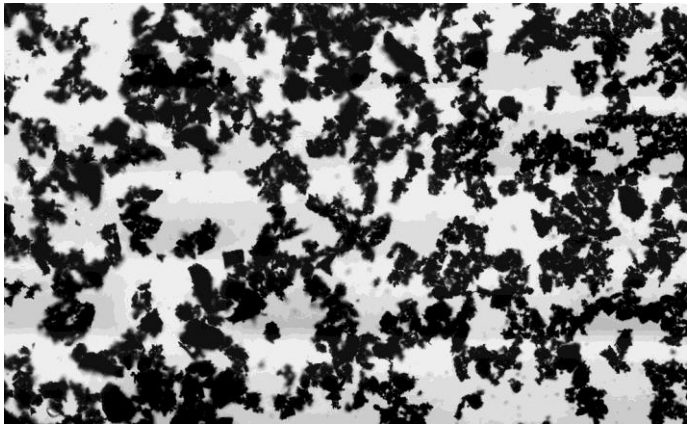
WATER PURIFICATION TECHNIQUES

LAB EQUIPMENT & SUPPLIES | WATER SYSTEMS | CONTROL & MONITORING | SERVICE

Water Purification Techniques

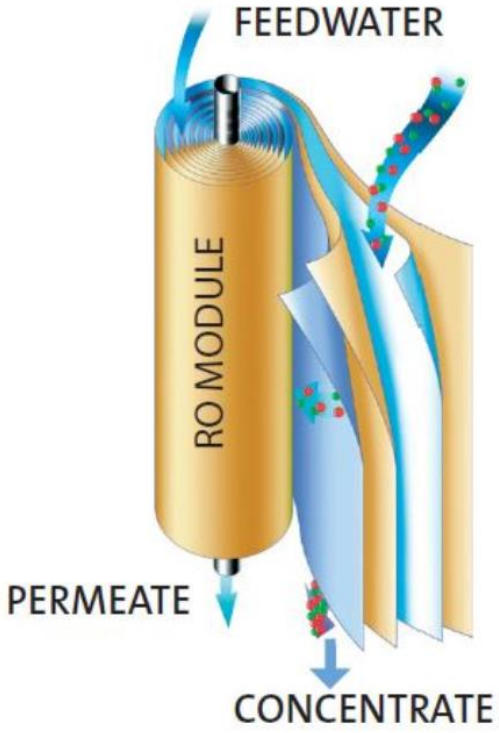
- Pre-treatment
- Reverse Osmosis (RO)
- Deionisation (DI)
- Ultra-Violet (UV)
- Ultrafiltration (UF)

Pre-treatment



Removes organics and Cl_2 by Adsorbtion
High Surface area

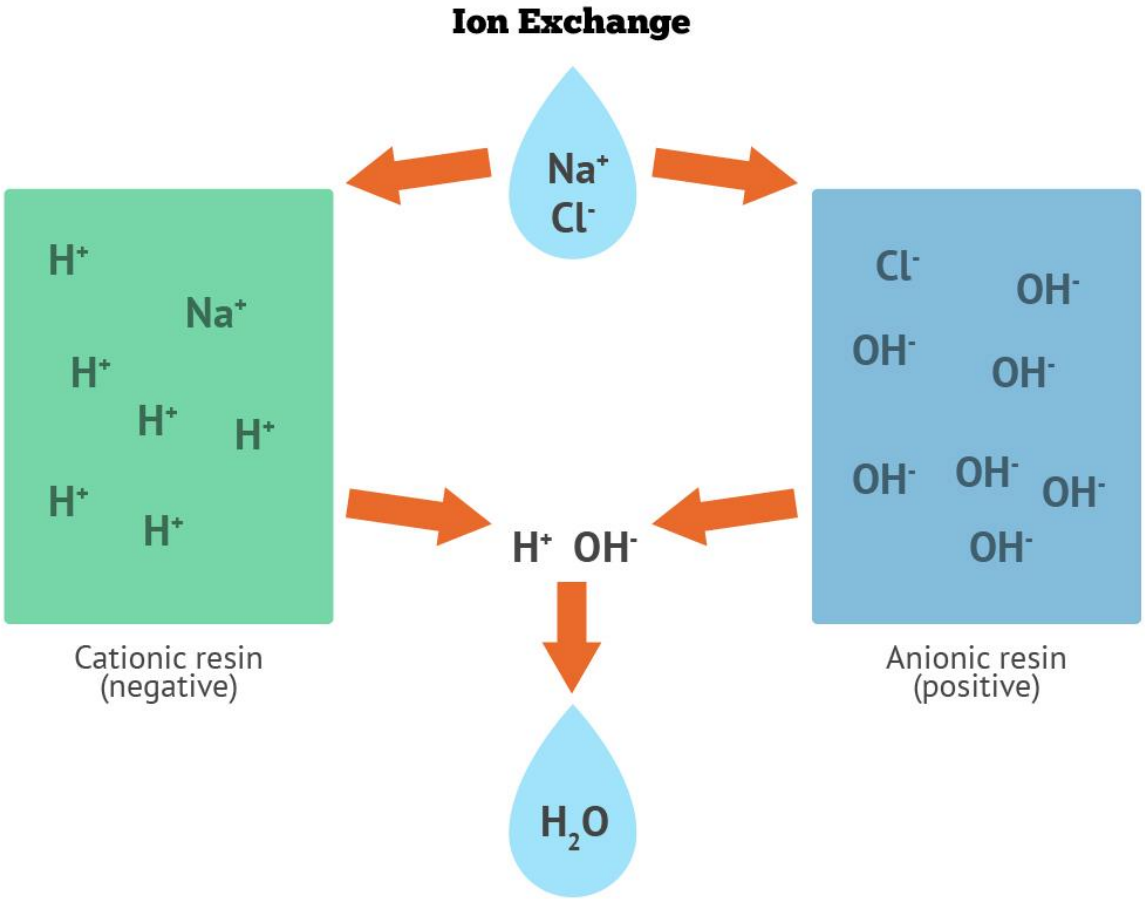
Reverse Osmosis



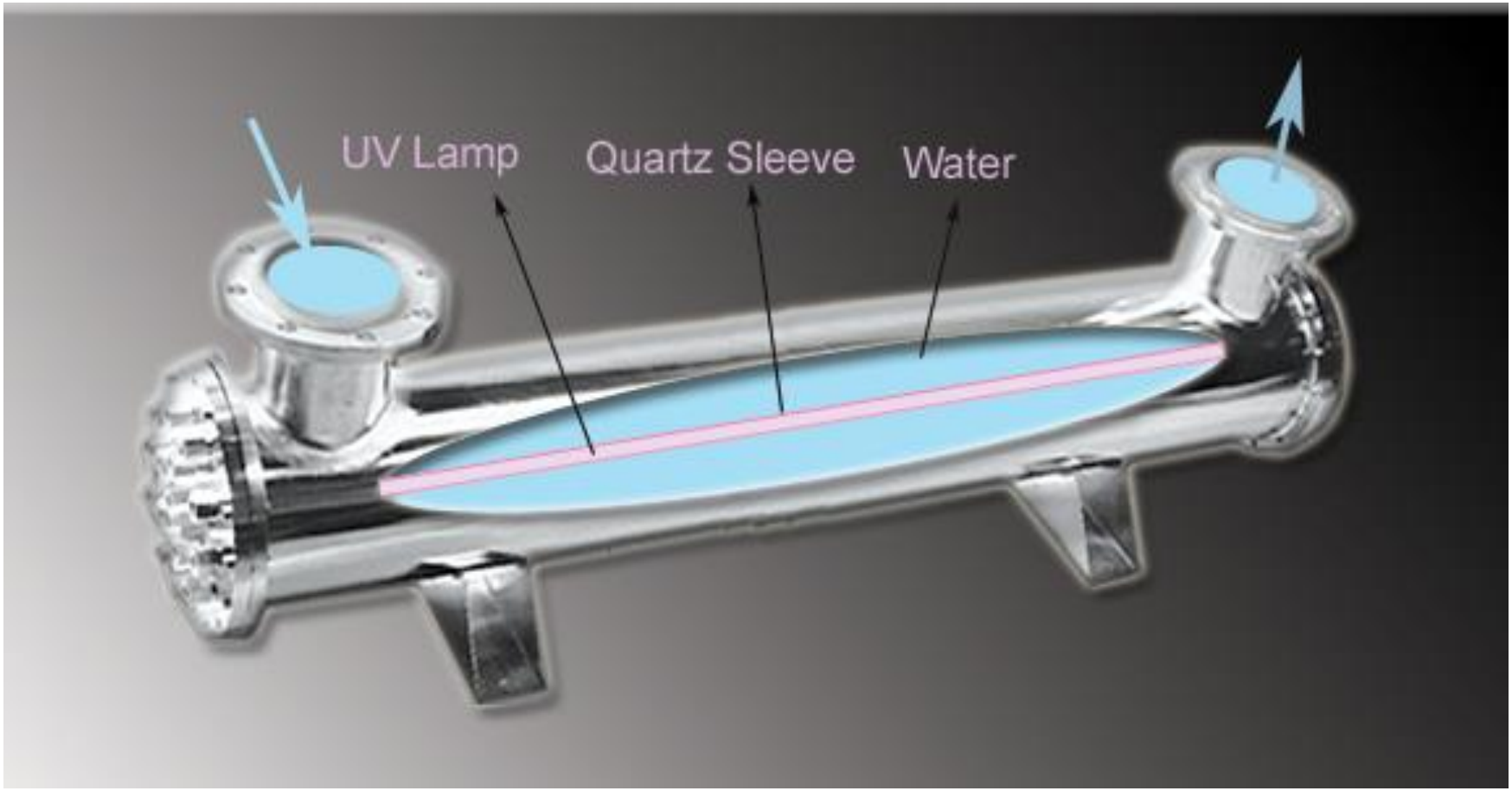
Very efficient and cost-effective technology for the removal of majority of impurities

The result is that concentrate is retained on the pressurised side of the membrane and pure permeate passes through to reservoir

Mixed bed deionisation



Ultra-violet (UV) irradiation

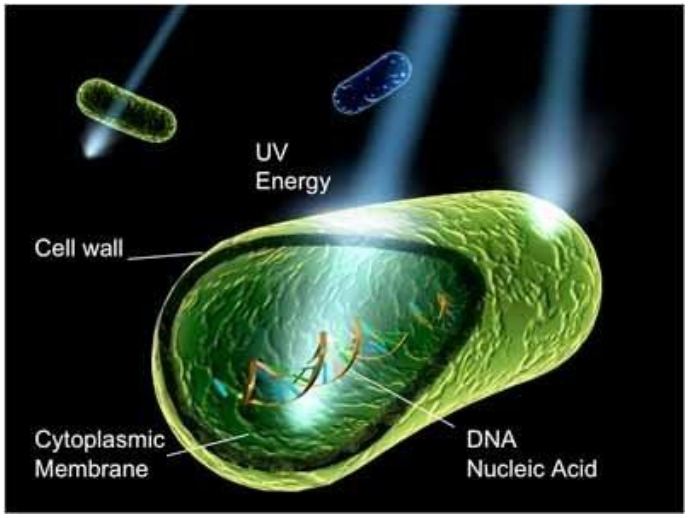


UV penetrating the cell wall of a microorganism

- Dual wavelength 185/254nm

- 254nm has bactericidal action, damaging DNA and RNA polymerase and preventing replication

- 185nm is most effective at oxidising organics, breaking large organic molecules into smaller ionised components



Ultrafiltration/Microfiltration

- An ultrafiltration (UF) filter functions as a molecular sieve
- Separates dissolved molecules according to size, size by passing the water through a very fine filter, typically with pore sizes 1-10nm
- An excellent technology for ensuring consistent ultra pure water quality with respect to particles, bacteria, pyrogens and nucleases

Avidity Science Solution

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REVERSE OSMOSIS	DEIONIZED	ULTRAPURE
PRIMARY GRADE WATER	GENERAL LAB GRADE WATER	18.2 MΩ-cm

Puro

Production Rate:
10, 20, 50 or 80L/hr.

Reservoir Required

Geno

Production Rate:
10, 20 or 50L/hr.

Reservoir Required

Alto

Dispensing Rate: 2L/min.
Volumetric Dispense

UF Options Available

Pico

RO or DI Water
35L Integrated Tank

Production Rate:
10 or 20L/hr.

Duo

Dual Water System

Production Rate: 10 or 20L/hr.
Dispensing Rate: 2L/min.
Volumetric Dispense

UF Options Available

RESERVOIRS

CONSUMABLES

SERVICE

Puro- It speaks volumes

- Type 3 Primary Grade RO Water
- 10, 20, 50 or 80 litres per hour
- Choice of storage reservoir
- One easy change pre-filter
- Very low running costs
- Integral boost pump - simplifies installation and avoids unexpected cost of reduced flow rates
- Integrated leak detector
- Icon driven touchscreen – all parameters displayed

Puro

Type 3 water applications

Reservoirs

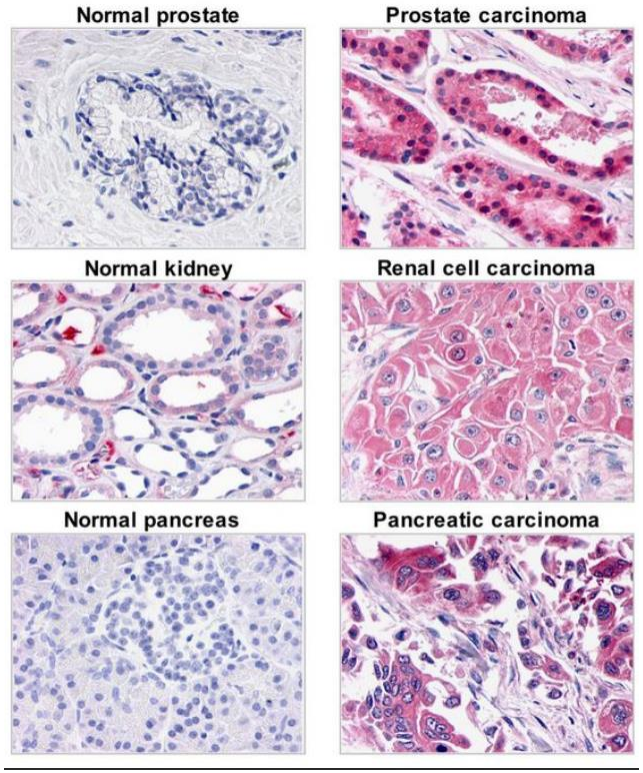
- 30, 60 and 100 litre reservoirs
- Made from Polyethylene
- 100 litre with optional pump
- Easy sanitisation – crevice free and full draining
- Wall mounting brackets for 30 and 60 litre
- Hydrophobic 0.2µm filter or CO_2 option

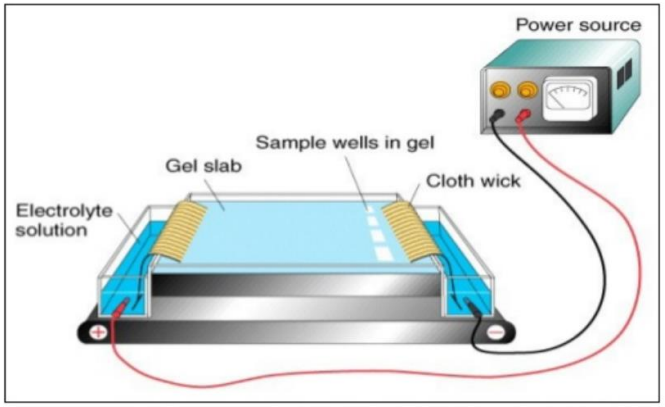
Geno. Beyond expectation

- Type 2 General Laboratory Grade Water
- 10, 20 or 50 litres per hour
- RO and DI technology (same RO as Puro)
- Cartridge life extended by water recirculation
- Wall, bench or reservoir mounted
- Choice of storage reservoir
- Integrated leak detector

Geno

Type 2 water applications



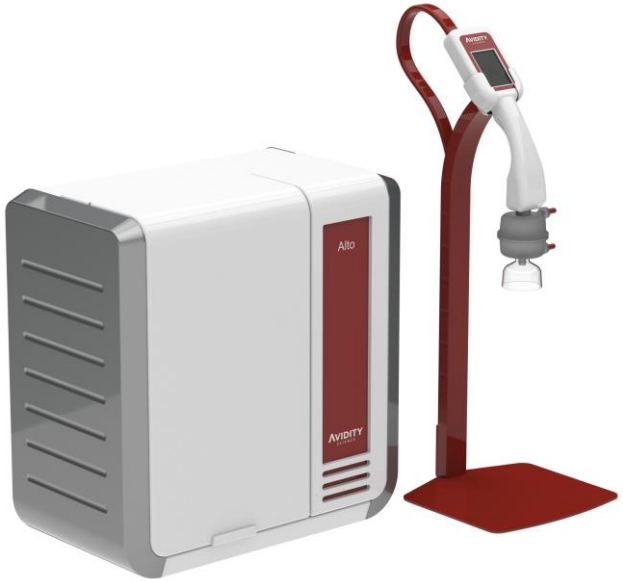


Pico. Small in size. Big in benefits

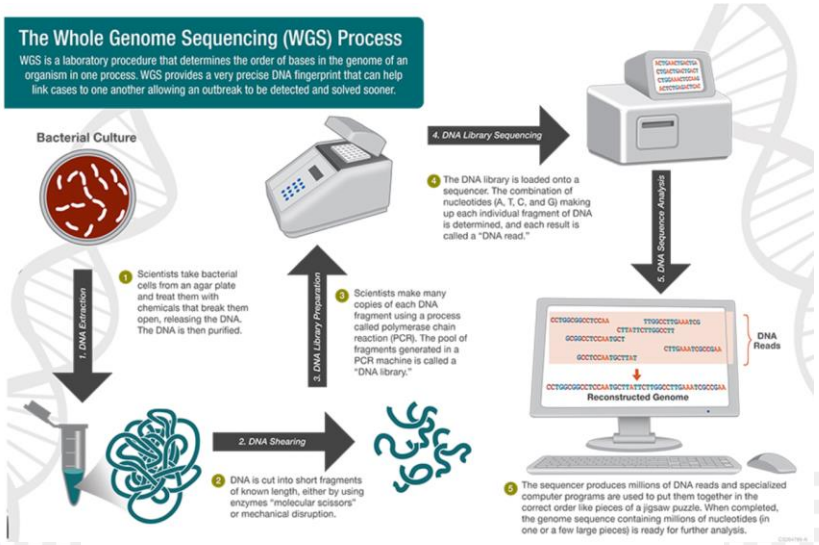
- No other system on the market like PICO
- Type 3 or Type 2 water
- Wall, bench or reservoir mounted
- Integrated reservoir
- Very simple to install and service
- Very low running costs
- Energy consumption of <40w when processing water
- Quite, internal boost pump and patented anti-vibration mountings

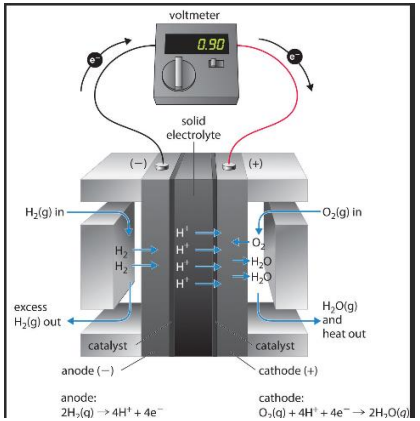
Alto - It will work around you

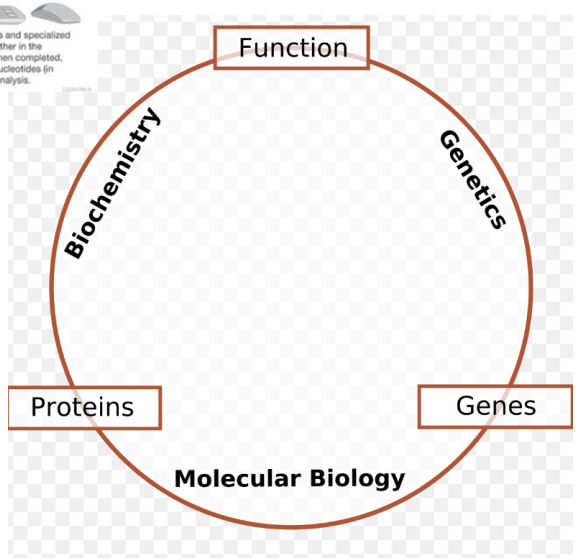
- Type 1 Ultrapure Water polisher
- Pre-purified water feed (tank or ring)
- On system dispense, remote dispense or both (2m tubing length)
- Wall, bench or under bench mounted
- No reservoir required
- Fast volumetric and variable dispense of Type 1 water on demand (up to 2l/min)
- Endotoxin and nuclease free (UF model)
- Dual wavelength 185/254 nm UV



Type 1 water applications







Duo- The best of both worlds

- Unique design:
  - Type 1 ultrapure water from dispenser
  - Type 2 water from the reservoir
- 10 or 20 l/hr Type 2 make up rates
- Space saving
- Novel tap to Type 1 water
- Fast variable dispense up to 2 l/min Type 1
- Wall, bench, under bench or reservoir mounted
- Choice of dispense – remote/system mounted
- Choice of storage reservoir

Duo

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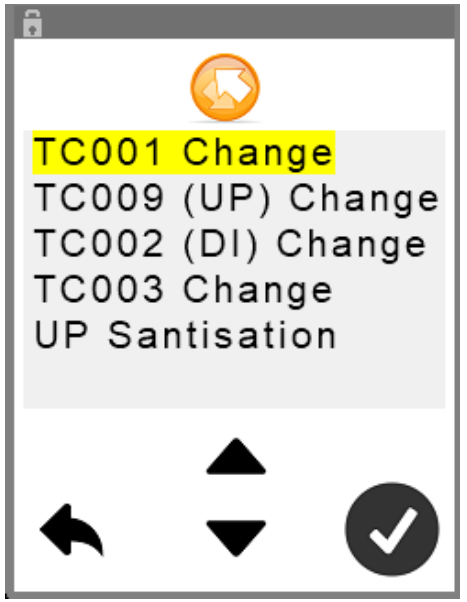
Software



Consumables

Annual low cost Endure consumable packs
Incentivise service contract with enhanced discount on consumable pack

ENVIRONMENTALLY FRIENDLY

Consumable life in Puro, Geno, Duo and Alto is optimised by utilising the latest microprocessor controls, ensuring every last drop of water is produced before they require changing. This saves the environment and makes maximum use of your budget.

Avidity Science Global Reference Sites (EMEA & Asia)

Key Life Science Accounts (LS)	
UK	Phamaron UK ltd
University of Cambridge	Syngenta Ltd
University College London (UCL)	Tecniplast UK ltd
Kings College London	Immunocore Ltd
University of Birmingham	MRC Clinical Sciences Centre
Trinity College Dublin	ALS Food & Pharmaceutical
University of Oxford	Coca-Cola European Partners GB LTD
University of Southampton	Charles River Laboratories Edinburgh Ltd
University of St Andrews	Astex Therapeutics Ltd
Imperial College London	Anglian Water Services Ltd
AstraZeneca UK Ltd	Ireland
University of Manchester	France
University of Edinburgh	Italy
Cancer Research UK	Switzerland
Imperial College London	Germany
University of Hertfordshire	South Korea
Nuffield Healthcare Ltd	China