

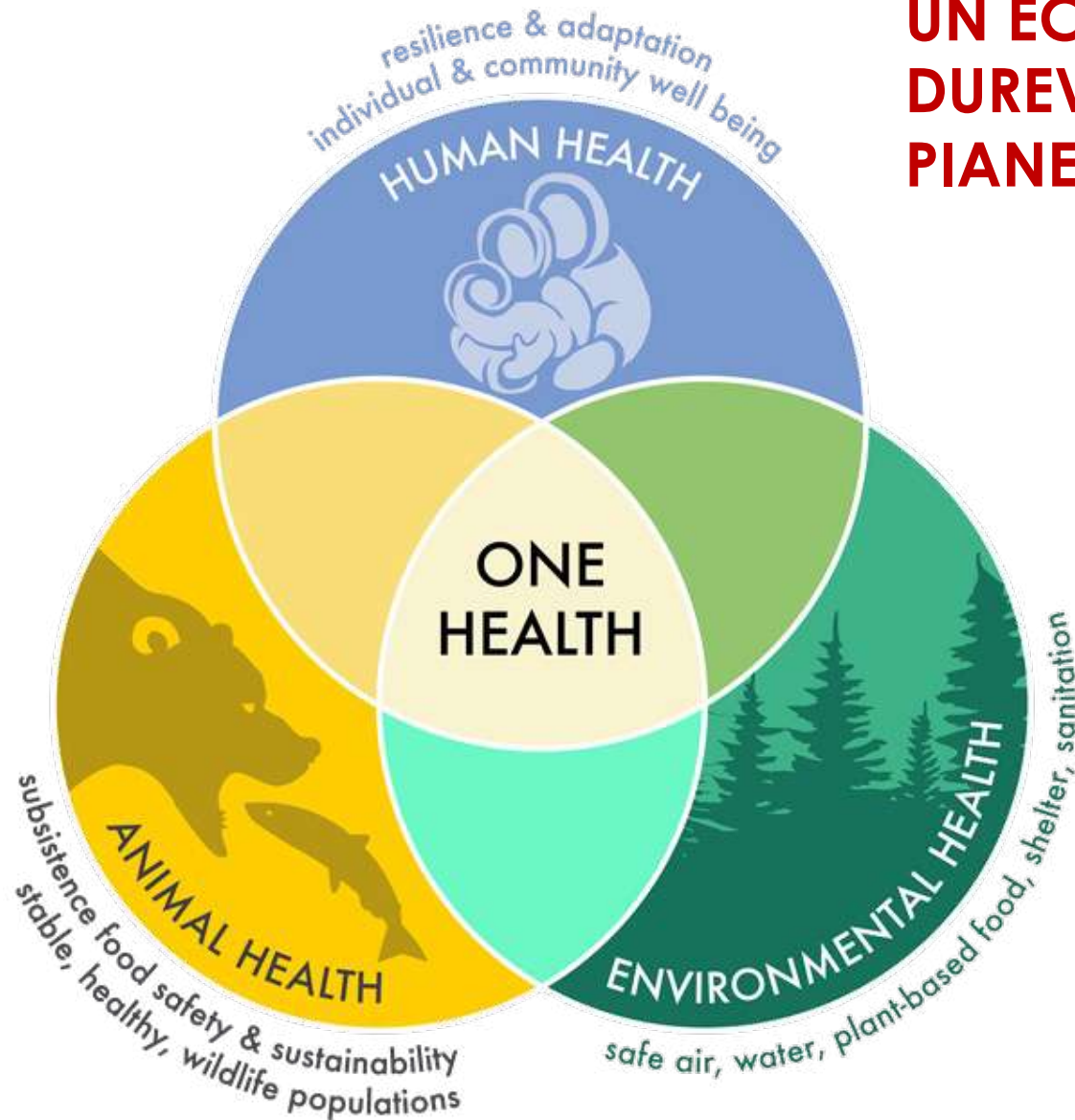
Annalisa Santucci



Industry 4.0 Competence Center on
Advanced Robotics and
enabling digital TEchnologies
& Systems

La ricerca universitaria sulla
bioeconomia diventa impresa:
la spin off Unisi **SienabioACTIVE**

UN ECOSISTEMA SOSTENIBILE, RESILIENTE E DUREVOLE PER TUTTI GLI ABITANTI DEL PIANETA TERRA



UN SISTEMA CIRCOLARE E INTEGRATO

OMS: sei prescrizioni per la ripresa 'sana e verde' post-Covid-19



1. salvaguardare la natura

2. garantire l'accesso all'acqua pulita

3. garantire una transizione energetica rapida e sana

4. promuovere sistemi alimentari sani e sostenibili

5. costruire città sane e vivibili

6. azzerare gli incentivi per i combustibili fossili



Food and Agriculture Organization of the United Nations



World Organisation for Animal Health



BIETTIVI PER LO SVILUPPO SOSTENIBILE

Linee guida per supportare la lotta contro malattie infettive emergenti secondo l'approccio ONE-HEALTH



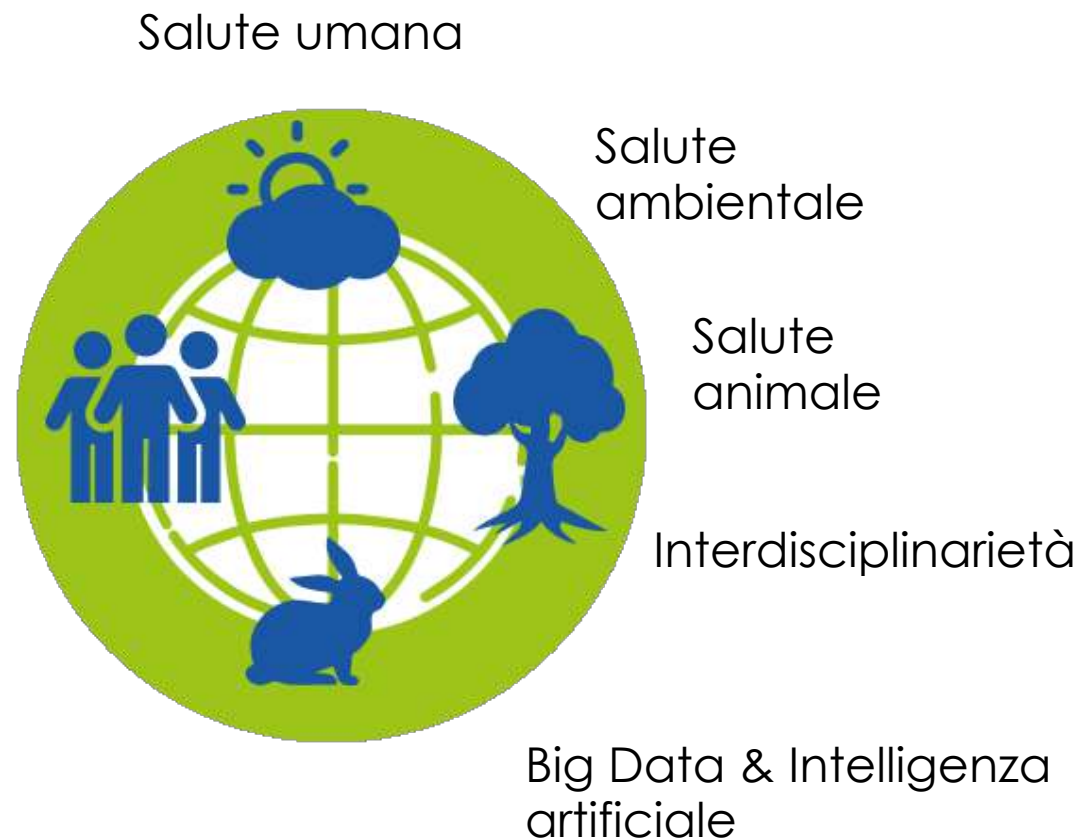
La **transizione ecologica** è fondamentale per costruire la **resilienza** ai futuri focolai e offrire opportunità di investimento, salvaguardando l'ambiente che ci circonda

Covid-19

- ✓ **relief**
- ✓ **recovery**
- ✓ **reform**

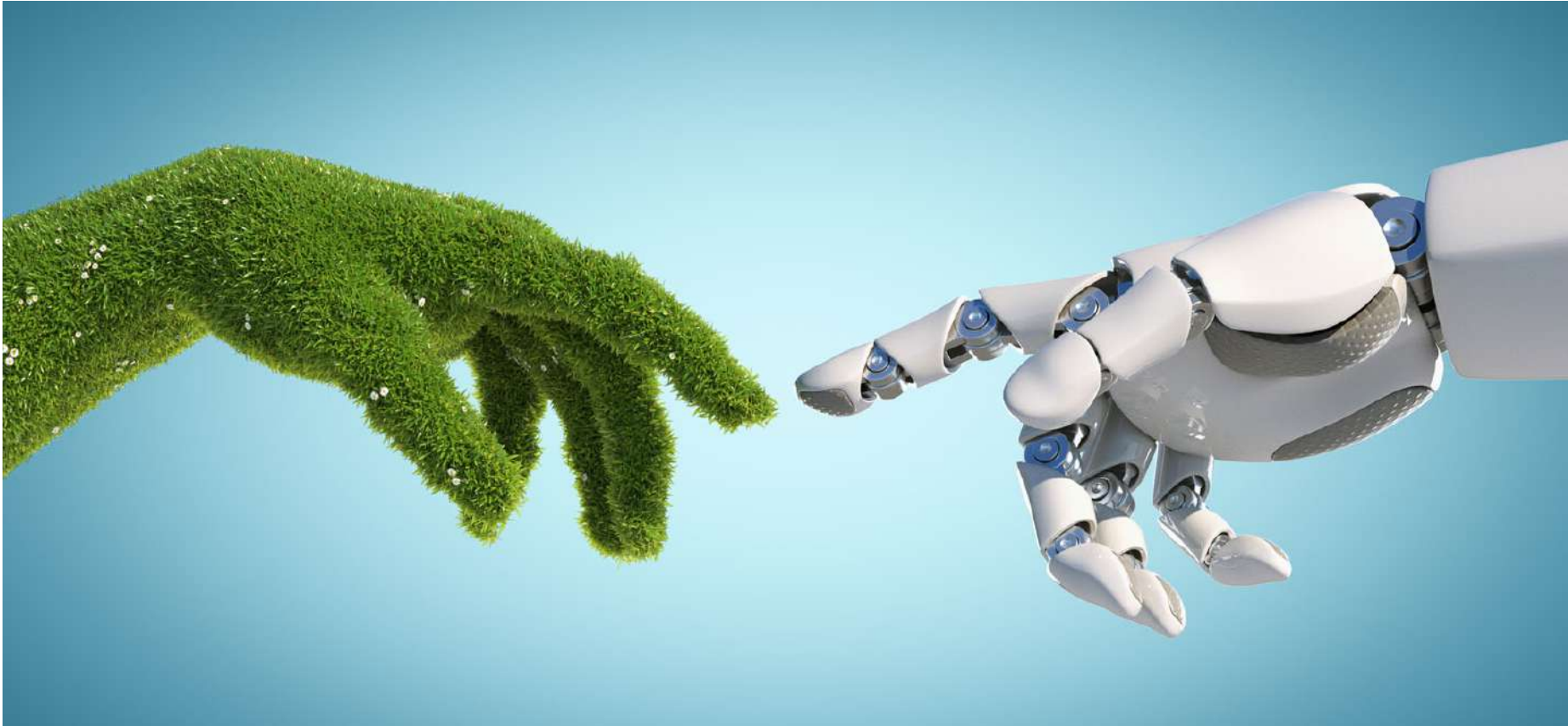
ONE-HEALTH : una nuova visione ed un nuovo paradigma della salute

PREVENZIONE
PROTEZIONE
PROMOZIONE
SERVIZI SANITARI
CURA
RIABILITAZIONE



Una salute circolare

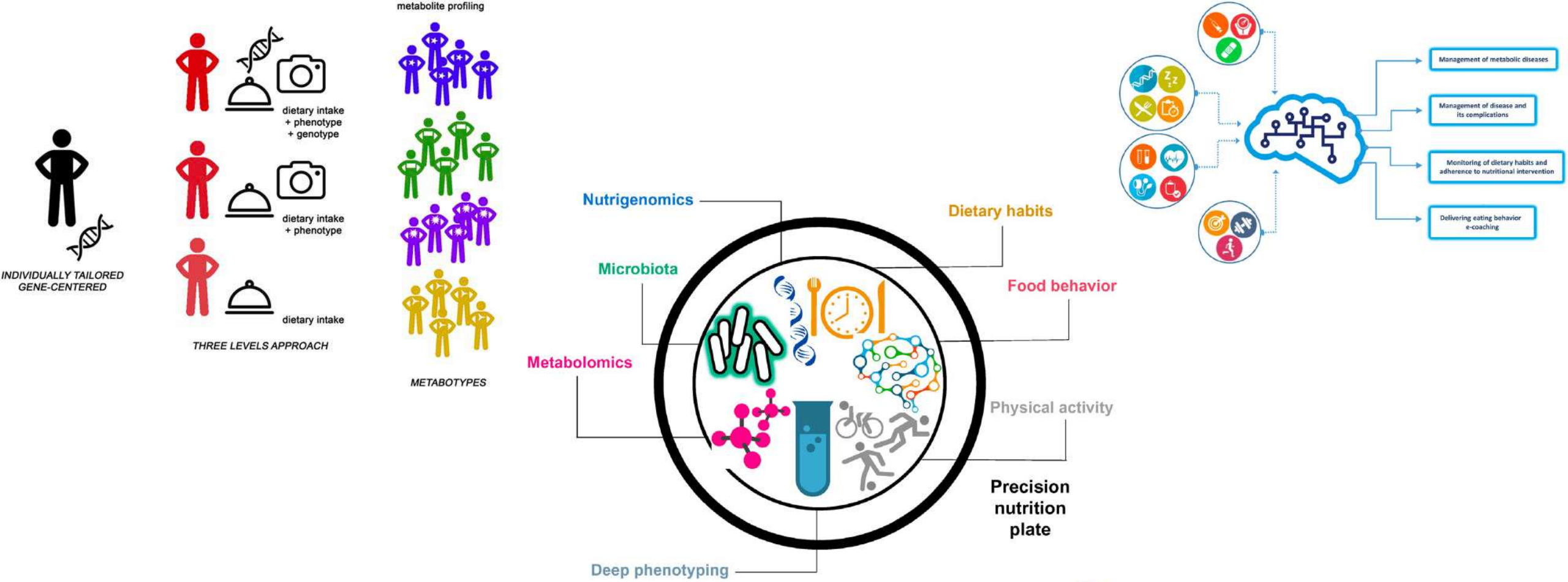
Transizione ecologica & transizione digitale





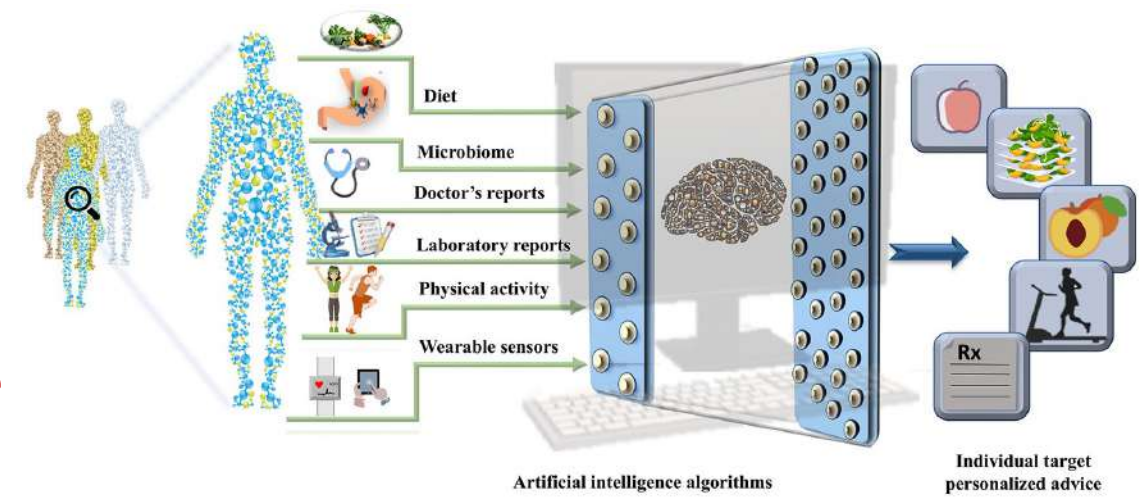
sienabio
ACTIVE

bioeconomy  UNIVERSITÀ
DI SIENA 1240 spin-off



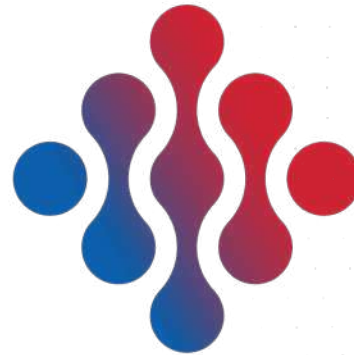
Personalized MEDICINE Personalized nutrition

Medicina di precisione + nutrizione di precisione





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enabling digital Technologies
& Systems



ARTES ISAAC
Life Sciences & Healthcare Tech

ApreciseKUre

**Ecosistema digitale integrato per un approccio di medicina di precisione per
l'alkaptonuria e sua evoluzione mediante AI**

Centro Regionale di Medicina di Precisione



Medicina di Precisione

Dati clinici

Dati genetici

Dati demografici

Dati sperimentali

La ricerca preclinica

Una rete internazionale

Ricerca e sviluppo di nuovi farmaci

Ricerca e sviluppo di nuovi diagnostici

Un approccio multidisciplinare

Big Data

Big Data & AI analysis

Pazienti

Registro dei pazienti

PDTA

Terapie

Alcaptonuria

- La prima malattia genetica scoperta
- Prototipo di tutte le malattie genetiche
- Ultra-rara (malattia orfana)

THE LANCET, JULY 11, 1908.

The Croonian Lectures

ON

INBORN ERRORS OF METABOLISM.

*Delivered before the Royal College of Physicians of London
on June 18th, 23rd, 25th, and 30th, 1908.*

By ARCHIBALD E. GARROD, M.A., M.D.
OXON., F.R.C.P. LOND.,

ASSISTANT PHYSICIAN TO, AND LECTURER ON CHEMICAL PATHOLOGY
AT, ST. BARTHOLOMEW'S HOSPITAL; SENIOR PHYSICIAN, HOSPITAL
FOR SICK CHILDREN, GREAT ORMOND STREET.

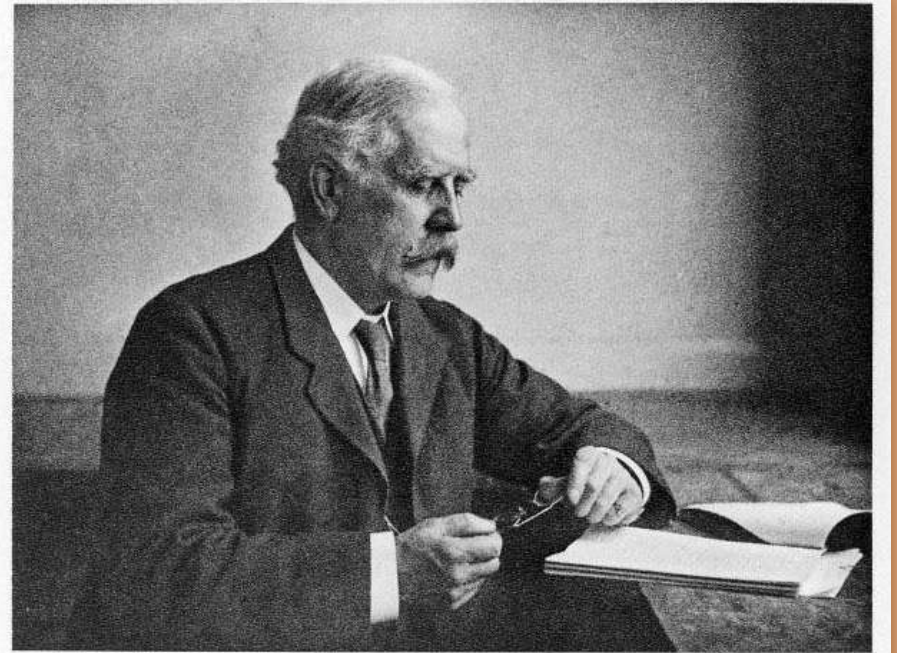
LECTURE II.¹

Delivered on June 23rd.

ALKAPTONURIA.

MR. PRESIDENT AND FELLOWS,—Of inborn errors of metabolism, alcaptonuria is that of which we know most, and from the study of which most has been learnt. In itself it is a trifling matter, inconvenient rather than harmful, which only attracts attention because an infant stains its clothing, or because an adult fails to effect an insurance of his life. The medical man merely needs to be aware of its existence and to be acquainted with the methods for its recognition in order that he may not mistake it for troubles of graver kinds; but for the chemical physiologist and pathologist it is one of the most interesting of metabolic

the early years of the nineteenth century was drawn in medical writings; black when passed and such as but it is difficult to suggest an alcaptonuria for some cases; sixteenth and seventeenth century G. A. Scribonius⁴ (in 1584) of enjoyed good health, continuous that cited by Schenck⁵ (in 1600) similar peculiarity and stated life. The most interesting record in the work of Zacutus Lusitanus patient was a boy who passed age of 14 years, was submitted to treatment which had for its aim the his viscera, which was supposed in question by charring and the measures prescribed were cold and watery diet, and drug any obvious effect, and eventually the futile and superfluous their natural course. None of married, begat a large family, life, always passing urine black That alcaptonuria is a very question, and many medical men never met with it. Of its occurrence a family and of its mode spoken at sufficient length in the majority of instances it is present throughout life but has been seen



A. E. Garrod.

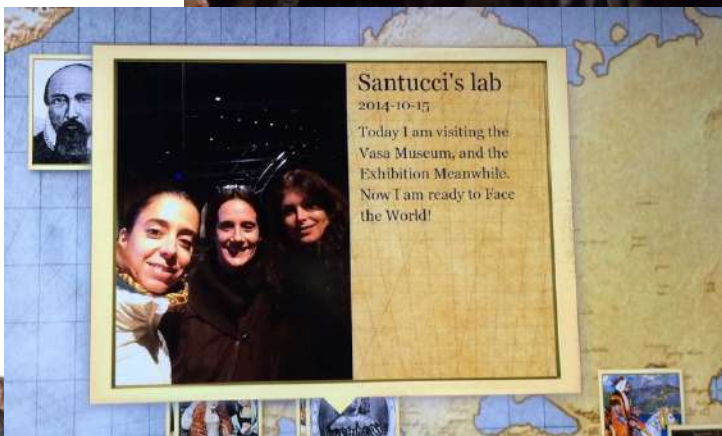
1902 - Sir Archibald Garrod

DevelopAKUre

Clinical Development of Nitisinone for Alkaptonuria



5TH INTERNATIONAL WORKSHOP ON AKU



DevelopAKUre AKU Alkaptonuria Society

8th International Workshop on AKU

Hotel Ariadne, Stockholm, Sweden
Thursday 16 October 2014
09.00 – 17.00

PROVISIONAL AGENDA

(Speakers, times and talks are subject to change)

"The use of nitisinone in hereditary tyrosinemia 1"
Prof Elisabete Hafme, University of Gothenburg, Sweden

"Alkaptonuria and the tyrosine pathway"
Prof Lakshminarayan Rangarath, Royal Liverpool University Hospital, UK

"Dietary management of alkaptonuria"
Dr Jean-Baptiste Arnoux, Hospital Necker, France

"Salt analysis in patients with alkaptonuria"
Dr Gabor Barten, Liverpool John Moores University, UK

"Rare insight from rare microscopes in the study of rare bone diseases, especially AKU"
Prof Alan Boyde, Queen Mary's University London, UK

"Amyloid in alkaptonuria: the biochemical perspective"
Prof Annalisa Santucci, University of Siena, Italy

"Osteoarthritis Biomarker Qualification – a work in progress"
Prof Virginia Kraus, Duke University, USA

"An update on alkaptonuria research in the USA"
Dr Wendy Inrone, National Institutes of Health, USA

findAKUre
FINDING A CURE
OR ALKAPTONURIA



Coorte internazionale di pazienti AKU

Dati clinici
Dati sperimentali
Dati demografici



PDTA

Coorte di pazienti AKU **italiani**

Dati clinici
 Dati sperimentali
 Dati demografici



Associazione Italiana Malati di Alcaptonuria - aimaku

Pagina Attività Insights Impostazioni Centro assistenza

QUESTA SETTIMANA
 1 "Mi piace" sulla Pagina
 34 Copertura del post
 NON LETTI
 0 Notifiche
 0 Messaggi

Associazione Italiana Malati di Alcaptonuria - aimaku
 Comunità

+ Segui Condividi

Associazione Italiana Malati di Alcaptonuria - aimaku ha condiviso la foto di Orphanet-Italia.

UN FARMACO, TANTE MALATTIE: GLI STUDI CLINICI SUI MECCANISMI COMUNI POTREBBERO MIGLIORARE L'ACCESSO AL TRATTAMENTO PER LE MR

Con il progredire della ricerca e l'aumentare delle conoscenze sulle malattie rare, sono aumentate anche le aspet... Altro...

Mi piace Commenta Condividi

Associazione Italiana Malati di Alcaptonuria - aimaku

<http://www.toscanaifsciences.org/.../malattie-rare-e-ricer-.../>

RARE DISEASE DAY 2016
29 FEBRUARY
 JOIN US IN MAKING THE VOICE OF RARE DISEASES HEARD

Malattie rare e ricerca scientifica: un incontro sull'alcaptonuria per gli studenti del Liceo...

In occasione della Giornata mondiale delle malattie rare, il Dipartimento di Biotecnologie, Chimica e Farmacia dell'Università di Siena promuove un incontro...

TOSCANALIFSCIENCES.ORG

Condividi

Recenti
 2015
 2014

Visualizza la tua inserzi...

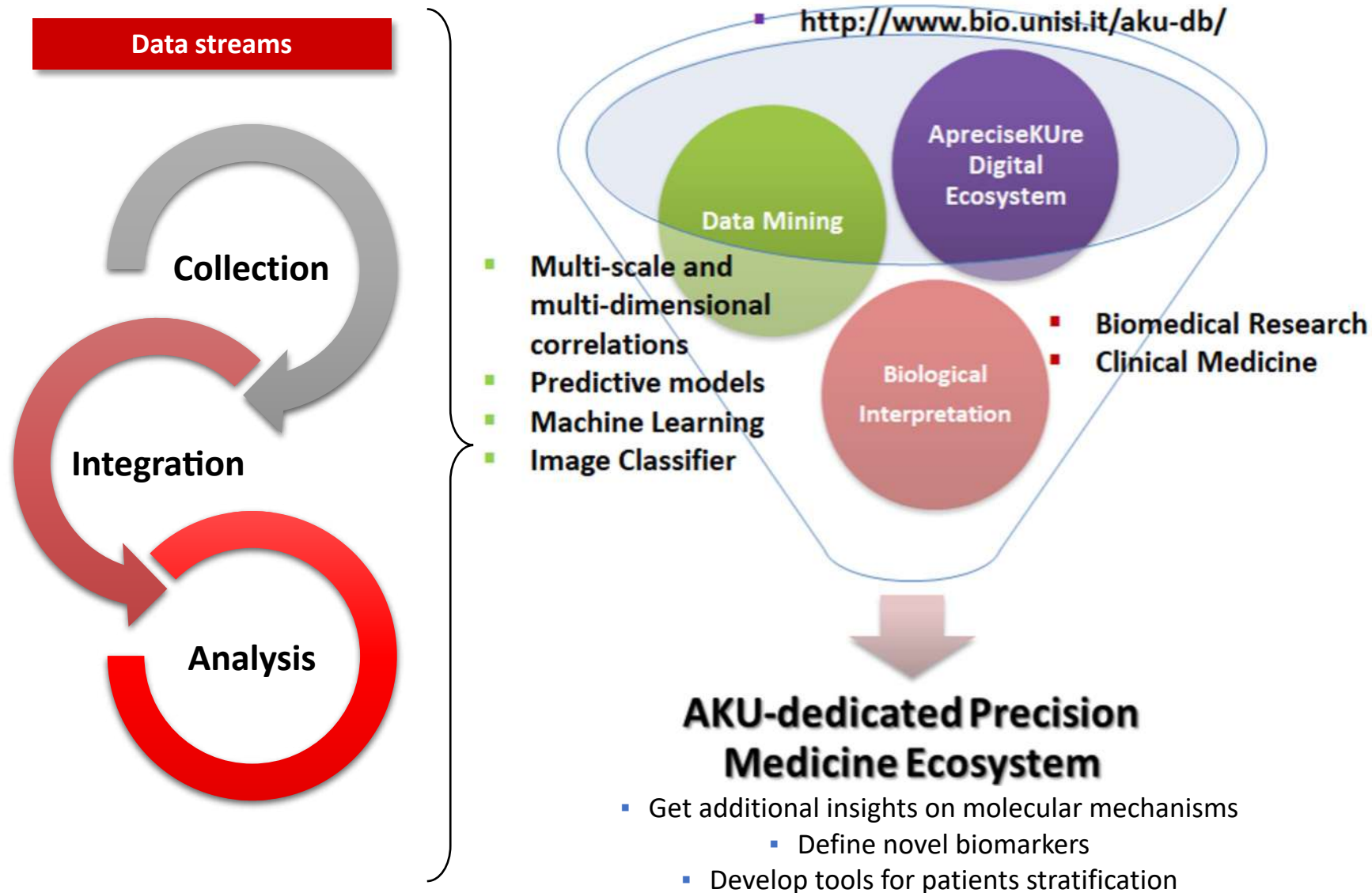
Associazione Italiana Mal...
 Piano Nazionale Malattie Rare: la posizione di MIR
<http://www.movimentorari.it/mir/piano-n-...>

Metti in evidenza il post



associazione italiana malati alcaptonuria

PM approach to Alkaptonuria (AKU)



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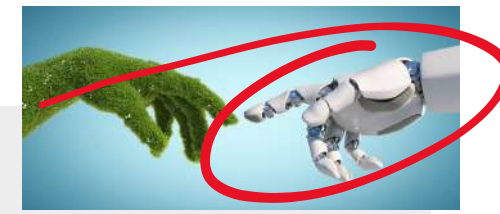
ApreciseKUre digital ecosystem

Electronic Health Records



- Spiga O, et al., Santucci A, *Machine learning application for patient stratification and phenotype/genotype investigation in a rare disease*, Bref Bioinformatics, 2021
- Spiga O, et al., Santucci A, *Towards a Precision Medicine Approach Based on Machine Learning for Tailoring Medical Treatment in Alkaptonuria*, I J Mol Sci, 2021
- Spiga O, et al., Santucci A, *Machine learning application for development of a data-driven predictive model able to investigate quality of life scores in a rare disease*, Orph J Rare Dis, 2020
- Spiga O, Cicaloni V et al., Santucci A, *Interactive alkaptonuria database: investigating clinical data to improve patient care in a rare disease*, FASEB J, 2019
- Spiga O, et al., Santucci A, *A new integrated and interactive tool applicable to inborn errors of metabolism: Application to alkaptonuria*. Computers in Biology and Medicine, 2018.
- Spiga O, et al., Santucci A, *ApreciseKUre: an approach of Precision Medicine in a Rare Disease*. BMC Medical Informatics and Decision Making, 2017.

The screenshot shows the BIO@DBCF website interface. The header includes the logo 'BIO@DBCF' and the text 'Biochemistry @ Dept. Biotechnology, Chemistry and Pharmacy'. Navigation links for 'Home', 'People', 'ApreciseKUre', and 'AKU DB' are visible. The main content area is titled 'AKU DB' and features a section 'Data analysis with correlation matrix'. This section explains that data in the ApreciseKUre Database is analyzed using classical statistical methods to build a dynamic model. It describes how Pearson's correlation coefficient and p-value are used to determine statistical significance between variables. A 'correlation matrix' is defined as a table of coefficients between variables. The text mentions that the system provides a general picture of variable associations and allows for monitoring of relationships as new data is added. A small image shows hands pointing at a document with a correlation matrix. Below this, there is a section 'Overview Reports and Rankings' with a dropdown menu set to 'Statistical description of numeric fields' and a 'Go' button. The 'Correlation matrix explorer' section includes a note to 'click on the matrix element to examine data pair statistics' and shows a specific correlation: $\rho = -0.21$ for h10 vs glucose, followed by a grid of small matrix elements.



AprecisekurE-*Like* ONE-HEALTH approach

- **GAIA** - Sistema di Gestione e condivisione della conoscenza clinica e sperimentale per un Approccio Integrato all'AKU (con Dedalus, SAIHub, Regione Toscana)
- **SHASI** - Realizzazione di un vaccino multivalente contro le infezioni tifoide, paratifoide e non tifoide da Salmonella (con AchilleS Vaccines, SAIHub, SienabioACTIVE)
- **MISE LAB 4.0** – Lab 4.0 per la produzione di biofarmaci (con AchilleS Vaccines, Imola Informatica, SAIHub, Regione Emilia Romagna, Regione Toscana)
- **MISE MISS THAI** - Molecular Interaction Studies Through AI (con AchilleS Vaccines, Imola Informatica, SAIHub, Regione Toscana)
- **CANNABIS 4.0** - Standardization of therapeutic application of medical cannabis and creation of a patients digital ecosystem (con Regione Toscana, Farmacie Ospedaliere)
- **PNRR THE Tuscany Health Ecosystem** - A precision medicine ecosystem for Alkaptonuria: new regional and national reference center through Clinical and Experimental Knowledge management and sharing system for an integrated approach
- **PNRR II UNISI SAILS** - Siena infrastructure for Artificial Intelligence and Life Science
- **PNRR PE6 Medicina Precisione**



Industry 4.0 Competence Center on
**Advanced Robotics and
enabling digital TEchnologies
& Systems 4.0**

Attività in programmazione e sviluppo

**Piattaforma prototipale multiprodotto
eco-disegnata in ottica ONE-HEALTH**



sienabio
ACTIVE

bioeconomy  UNIVERSITÀ
DI SIENA 1240 spin-off

Chi siamo

Spin Off dell'Università di Siena

Benefit company di bioeconomia

Start Up innovativa

Azienda R&D scienze della vita

Azienda a leadership femminile



bioeconomy  UNIVERSITÀ DI SIENA 1240 spin-off

La nostra visione

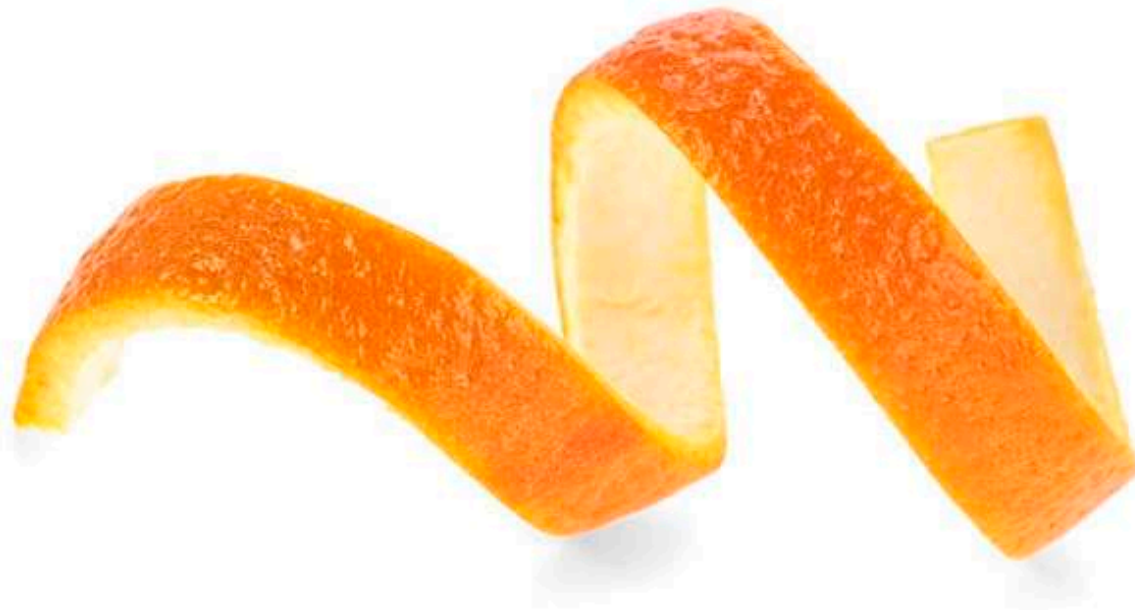


**BIETTIVI
PER LO SVILUPPO
SOSTENIBILE**



La nostra missione

Trasformare scarti in risorse



Scarti biologici? No, biofabbriche naturali

La nostra proposta



Bioeconomia

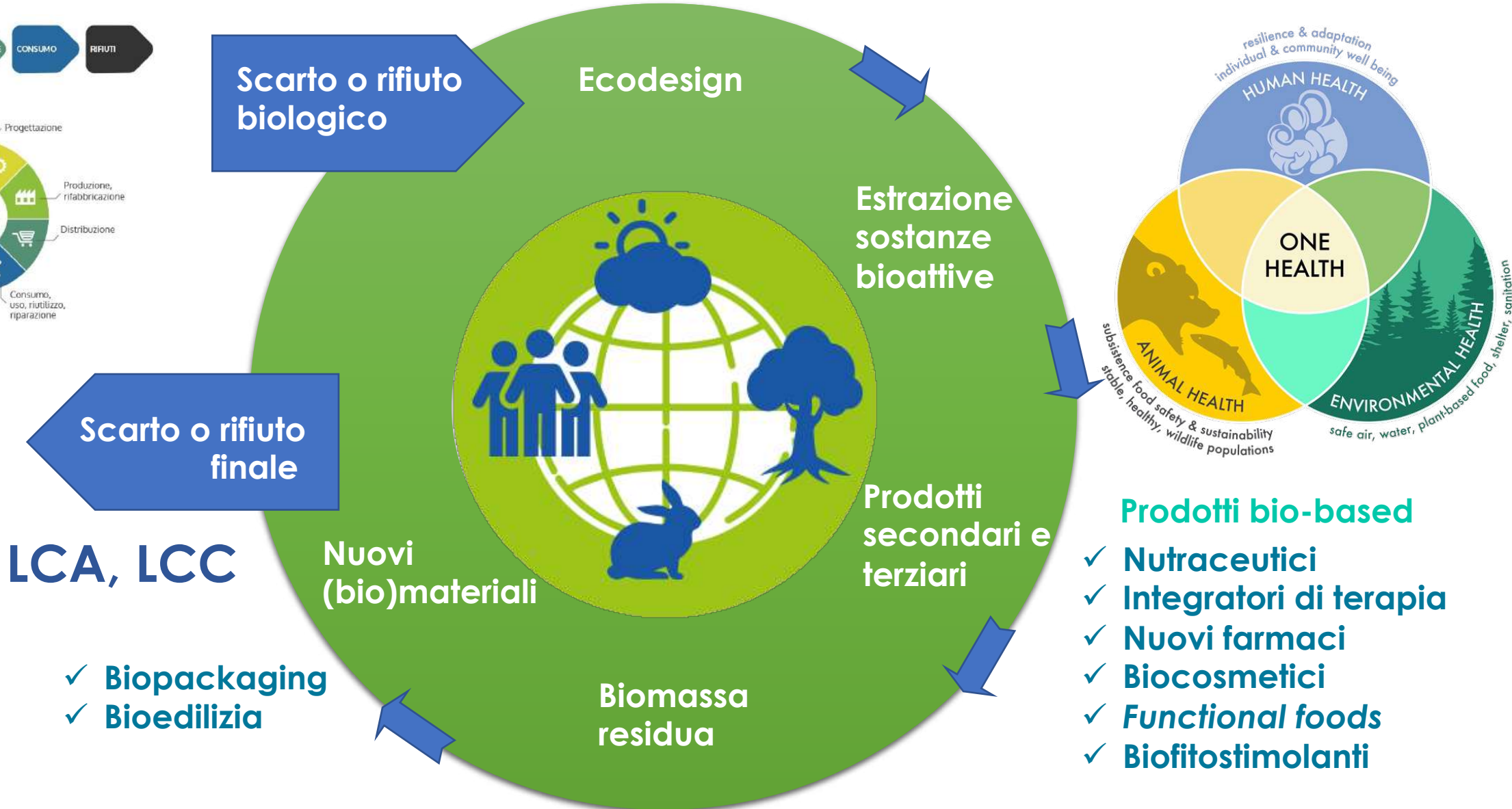
Il cuore biologico dell'economia circolare



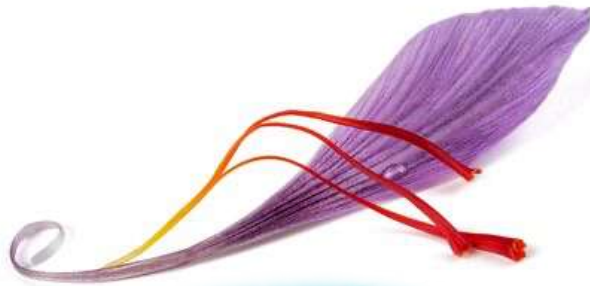
ECONOMIA LINEARE



- ✓ Reuse
- ✓ Reduce
- ✓ Recycle



Le nostre biofabbriche





biocostone
cosmetics for a better life

Prodotti a partire da un estratto green con potente potere antiossidante, ottenuto da uno scarto iconico, il riccio di castagna

Biocosmeceutici dermofunzionali

Gender-less

Age-less

Packaging ecosostenibile

100% Made in Tuscany

Certificazione bio

Hair-care 100% vegana



La nuova vita del riccio di castagna

Da **riccio** di castagna a
biocosmetico

La trasformazione di uno
scarto in **risorsa**

Da **circolo vizioso**
in **circolo virtuoso**

Legato al nostro **territorio**

Ecologico, sicuro, sostenibile

La ricerca si fa impresa

**Bio-cosmeceutici
dermofunzionali
ecosostenibili**



**Bio-packaging
ecosostenibile**





Brevetto per invenzione industriale



Ministero
dello sviluppo economico

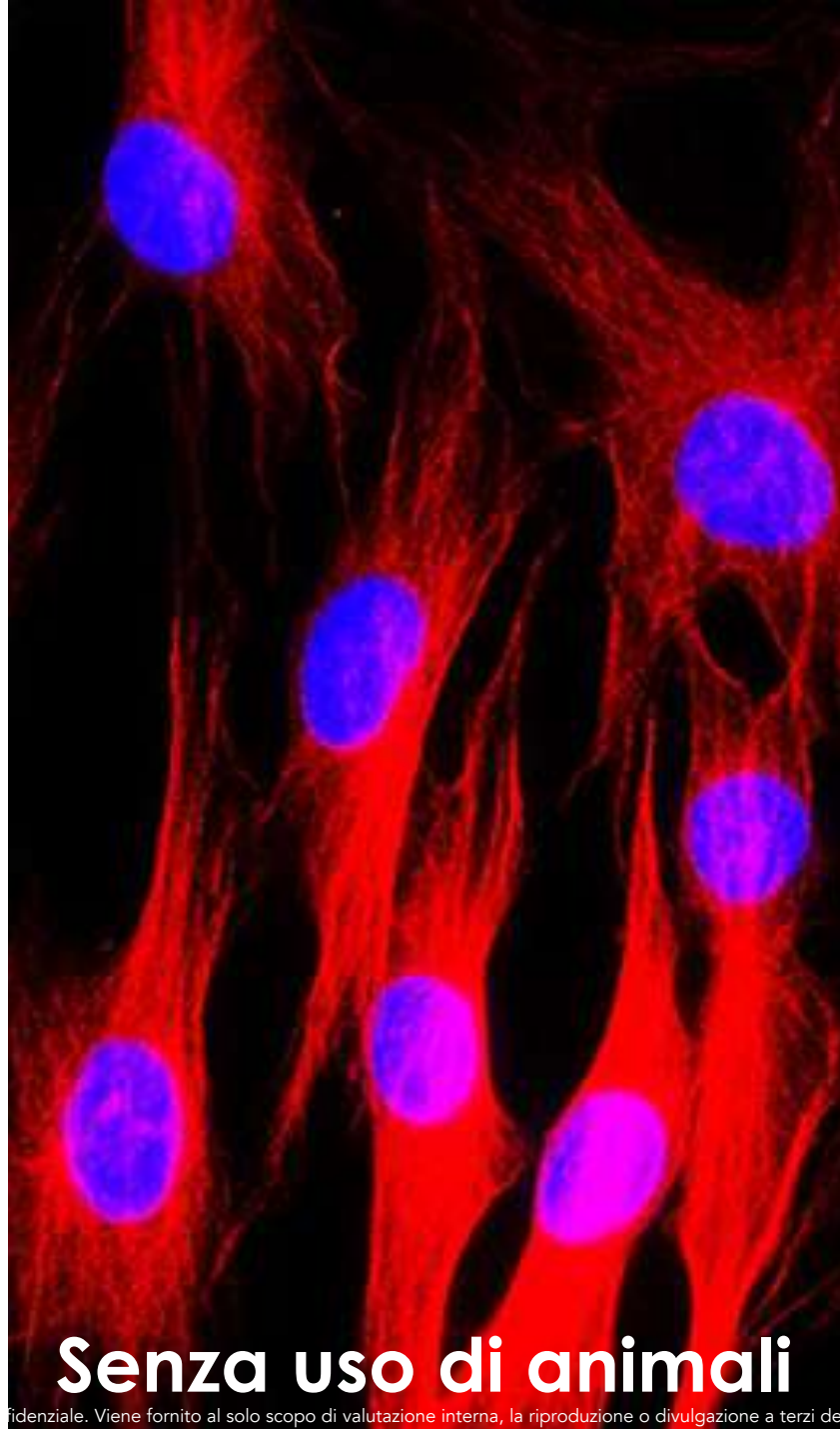
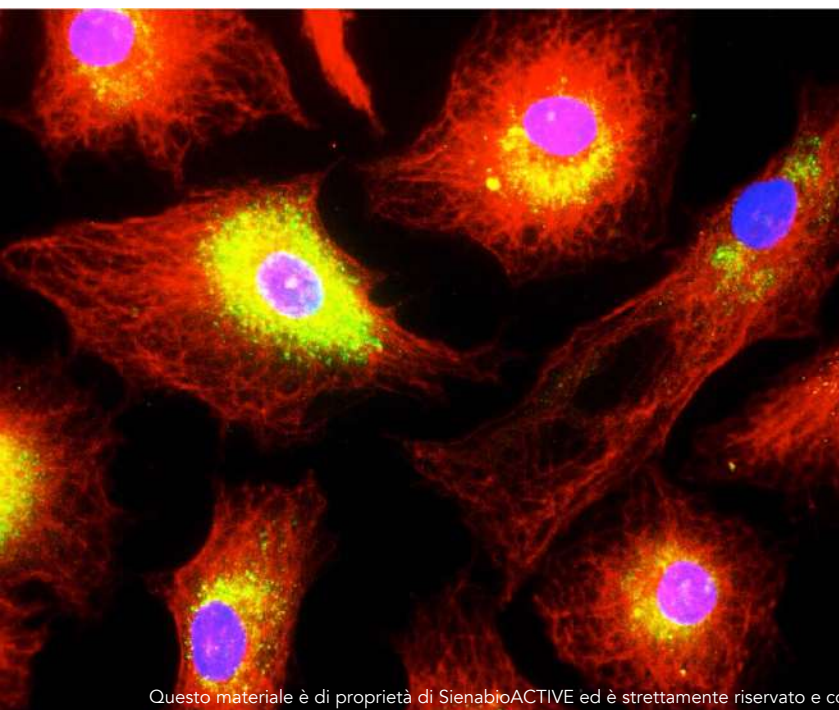
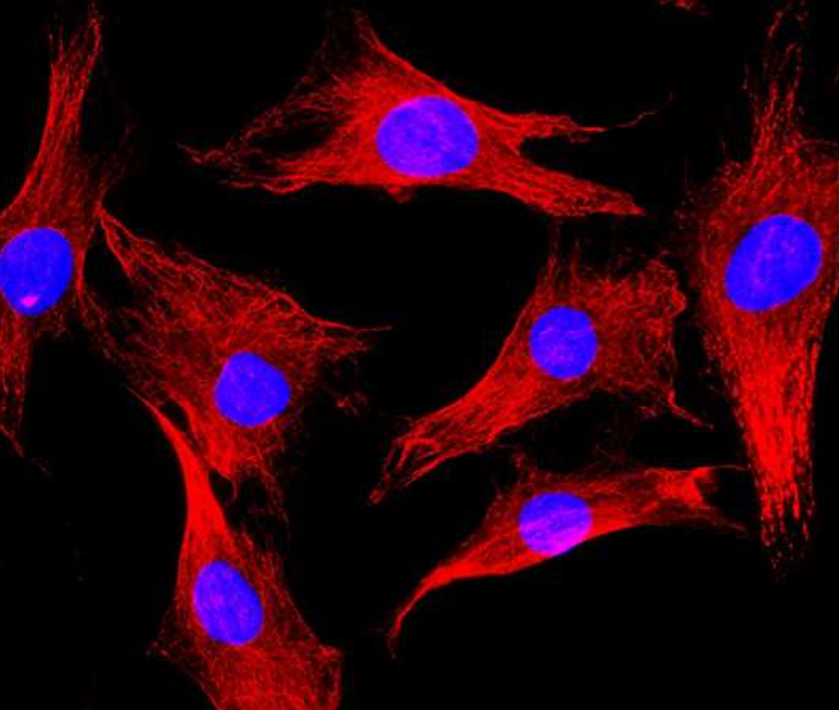
Domanda numero: 102020000018592

Data di presentazione: 30/07/2020

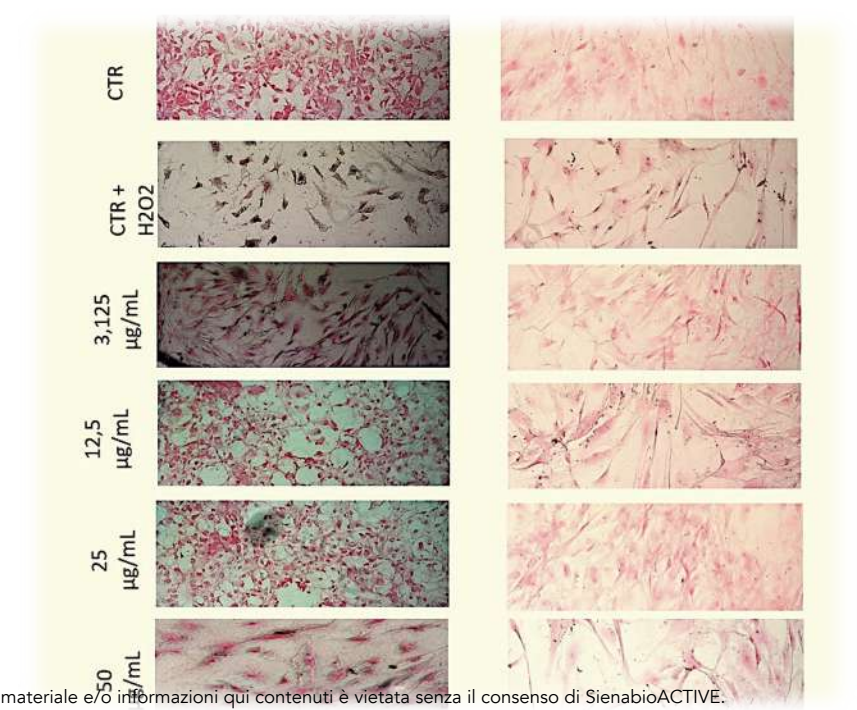
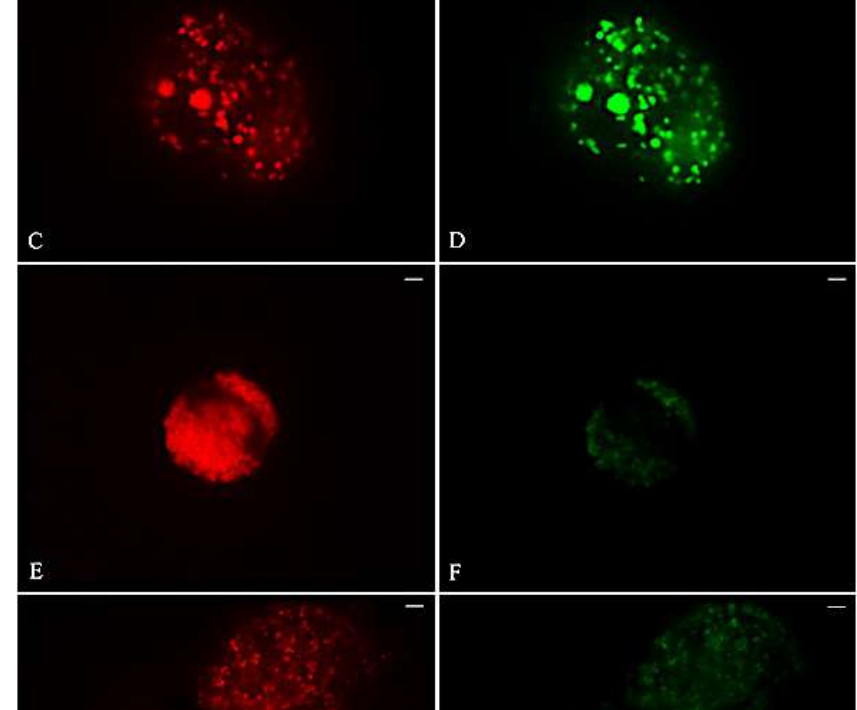
Estratto di riccio di castagna per uso come antibatterico

La ricerca si fa impresa





Senza uso di animali



Premi

*Quando la ricerca
si fa impresa*

✓  **festAmbiente** Finalisti 2019 e 2020

✓  **Premio innovazione amica dell'ambiente** Finalisti 2019

✓  **PMI**  **START Cup**  **Regione Toscana** Finalisti 2019

PREMIO NAZIONALE INNOVAZIONE
TOSCANA
PREMIO ALLE IDEE INNOVATIVE

✓  **MIP MURATE IDEA PARK**  **Scuola di Scienze Aziendali e Tecnologiche**  **MERCAFIR** **Vincitori 2019**
Idee in Evazione • PIERO DALL'EST • TIVOLI • FIRENZE
IL MERCATO AGROALIMENTARE A FIRENZE
AGRI-FOOD INNOVATION 2019

✓  **EcoCircUS**  **EcoCircus**  **Interreg**  **Vincitori 2020**
Economia Circolare per le Start Up **MARITTIMO-IT FR-MARITIME**
Fondo Europeo di Sviluppo Regionale
Bando Progetti IMPATTI NO

✓  **Premio INNOVAZIONE TOSCANA** **Vincitori 2021**



Sienabioactive-like ONE-HEALTH approach



- **CHEBAPACK - CHESTNUT SHELL BIO BASED PACKAGING** (Regione Toscana)
- **OMNIALGAE - PRODOTTI BIOATTIVI DA ALGHE INFESTANTI** (MAATM)
- **POSIDONIA - Bioeconomia circolare di Posidonia oceanica depositata su spiagge** (MITE)
- **ERICA Ecosistema di trasferimento tecnologico per Risorse naturali Integrate con Circular Economy e Agricoltura** (con CNR-IIA, Alce Nero, Amatrice Terra Viva, Agenzia per la Coesione Territoriale)
- **SUSPAGRO - NEW STATISTICAL AND EXPERIMENTAL APPROCHES TO THE DESIGN AND PREPARATION OF SUSTAINABLE PAPERS FROM AGROFORESTAL WASTE MATERIALS** (CRP)
- **BONTA' Buone pratiche per lo sviluppo della produttività, sostenibilità e redditività della filiera biologica La Cesenatica – Alce Nero** (MIPAAF)
- **Intercept – Motivating mobilizing supporting needs green career pathway** (PUG, Malta, Lituania, Slovacchia, Lussemburgo)
- **Life Skills for Employment in COVID-19 Era through VR Innovation** (Erasmus +)
- **ITS**



UNIVERSITÀ DI SIENA 1240

Sustainable
Industrial
Pharmaceutical
Biotechnology



DIPARTIMENTO DI BIOTECNOLOGIE, CHIMICA E FARMACIA
Dipartimento di Eccellenza 2018-2022



1

FROM SAFFRON WASTE TO A NOVEL
MULTIPURPOSE ANTI-MICROBIAL PROTOTYPE
PRODUCT: AN EXPERIMENTAL AND
COMPUTATIONAL STUDY

SUSTAINABLE BIOECONOMY OF CANNABIS BY-
PRODUCTS: A BIOCHEMICAL APPROACH
TOWARDS THE PRODUCTION OF A NOVEL BIO-
BASED ANTI-INFLAMMATORY MEDICAL DEVICE



**La
bioeconomia
è un
connettore
di valore
e
di valori**