«Η ΔΥΝΑΜΙΚΗ ΤΩΝ ΕΠΙΠΤΩΣΕΩΝ ΤΟΥ ΠΕΡΙΒΑΛΛΟΝΤΟΣ ΣΤΟ ΠΑΙΔΙ: ΕΞΕΛΙΞΕΙΣ, ΑΝΑΔΥΟΜΕΝΟΙ ΚΙΝΔΥΝΟΙ ΚΑΙ ΠΡΟΛΗΨΗ»

1/11/2018

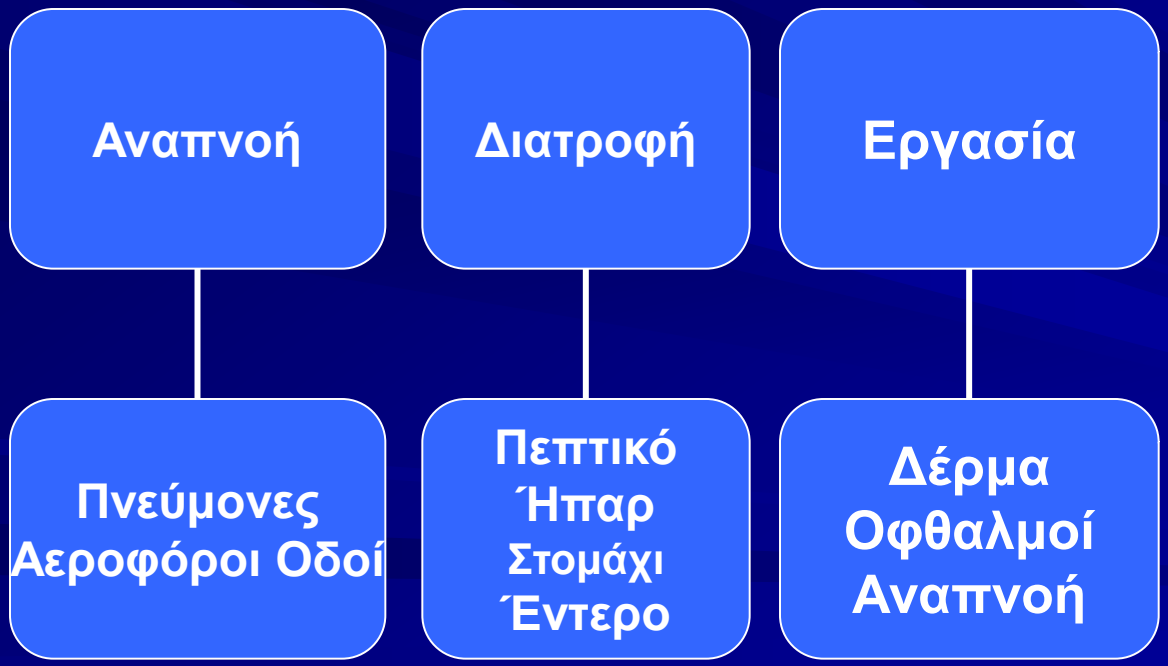
Ινστιτούτο Νευρολογίας και Γενετικής Κύπρου

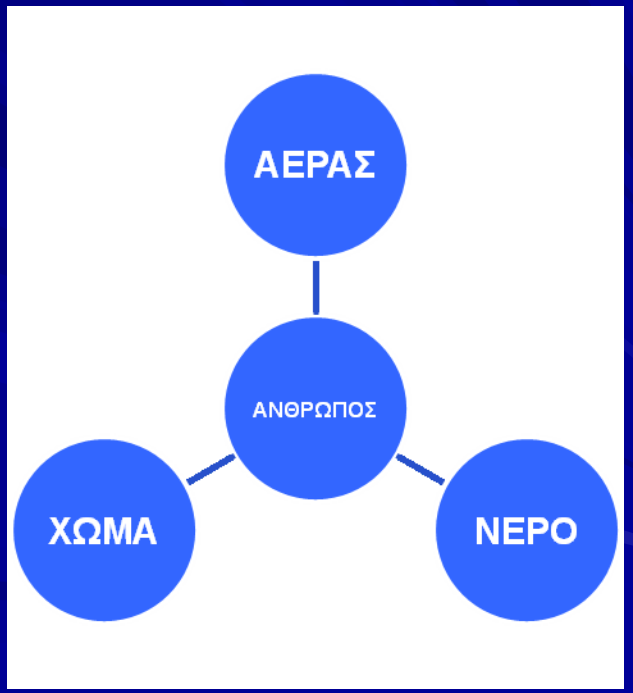
Η συνέργεια των επιπτώσεων του Περιβάλλοντος στην Υγεία του Παιδιού Ένα μεγάλο αδιευκρίνιστο πρόβλημα

Πολυξένη Νικολοπούλου – Σταμάτη
Καθηγήτρια Περιβαλλοντικής Παθολογικής Ανατομίας
Εθνικό και Καποδιστριακό Πανεπιστήμιο Αθηνών Ιατρική Σχολή

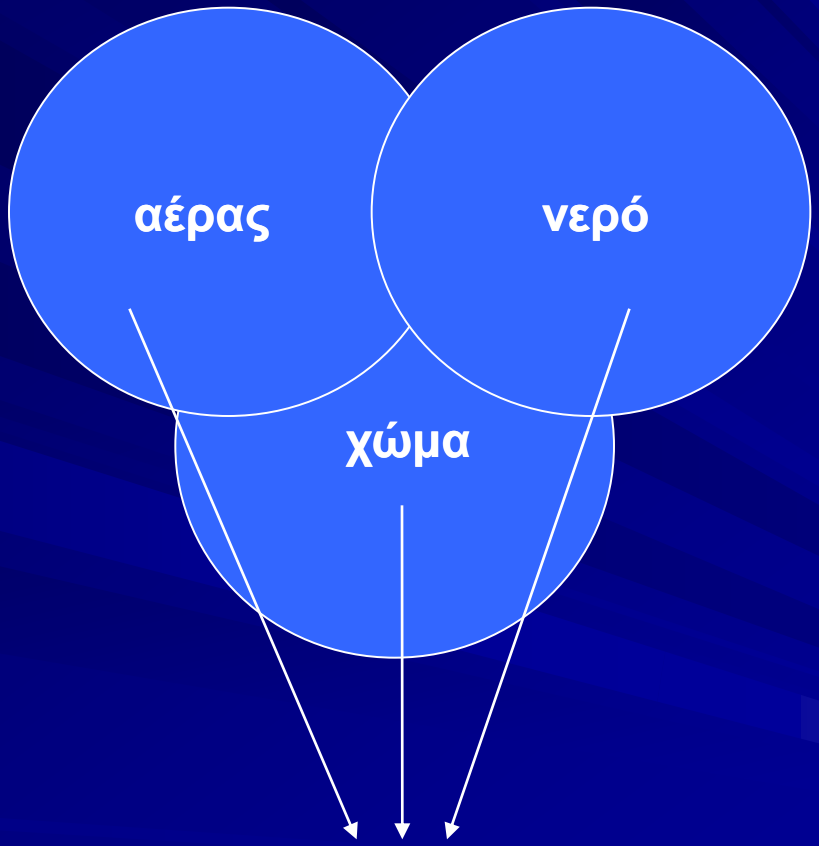
Άνθρωπος και περιβάλλον

Ο άνθρωπος: ένας κρίκος στο οικοσύστημα απόλυτα συνδεδεμένος με τον αέρα, το χώμα και το νερό.

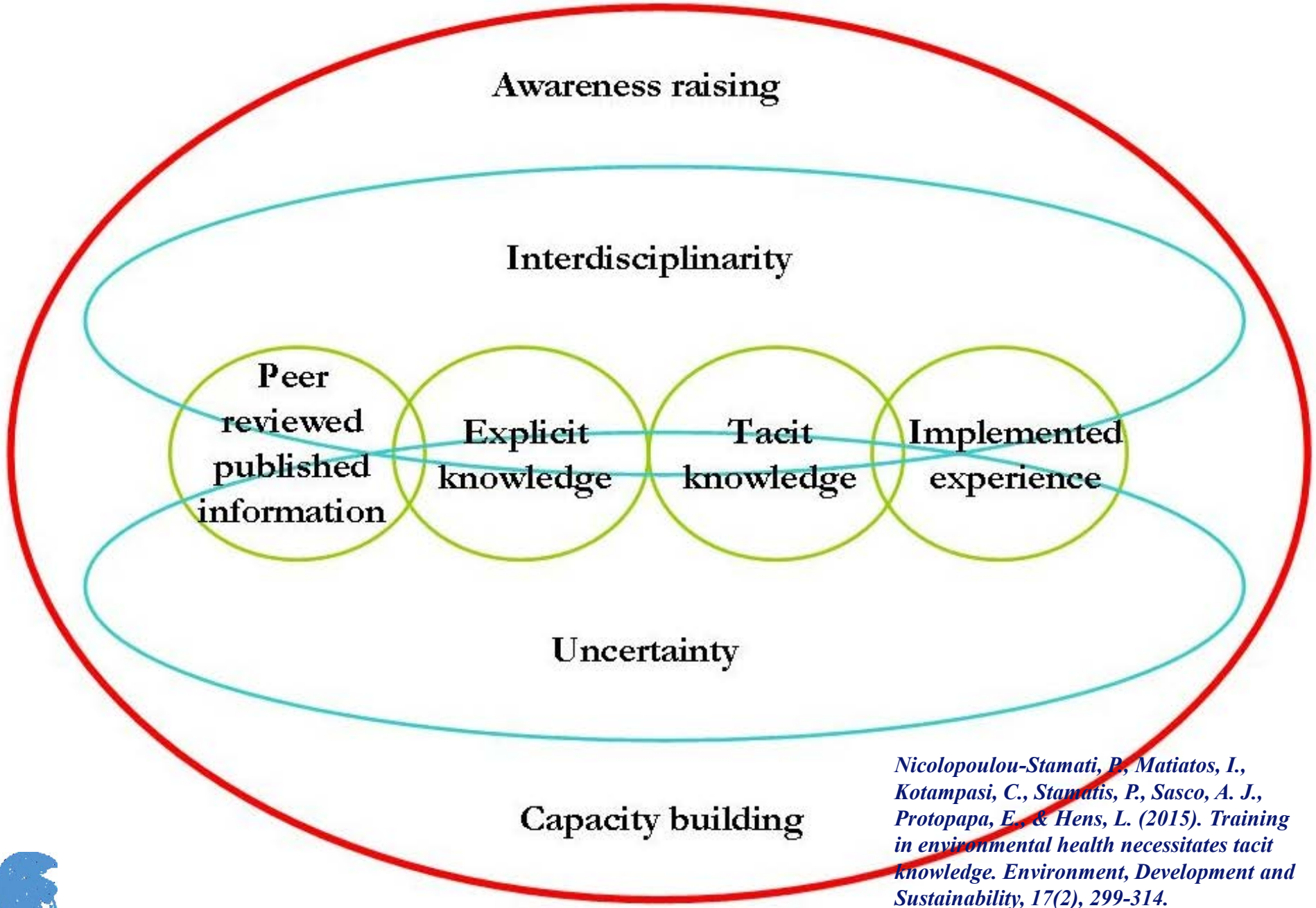




ΠΕΡΙΒΑΛΛΟΝΤΙΚΗ ΕΚΘΕΣΗ



ΥΓΕΙΑ



Nicolopoulou-Stamati, P., Matiatos, I., Kotampasi, C., Stamatis, P., Sasco, A. J., Protopapa, E., & Hens, L. (2015). Training in environmental health necessitates tacit knowledge. Environment, Development and Sustainability, 17(2), 299-314.

Ποιοι είναι οι οδοί από όπου εισέρχονται οι ρύποι στον οργανισμό;

- **Αναπνευστικό σύστημα: Αέρας**
- **Πεπτικό σύστημα: Τροφή**
- **Δέρμα: Έκθεση σε αέρα και νερό**

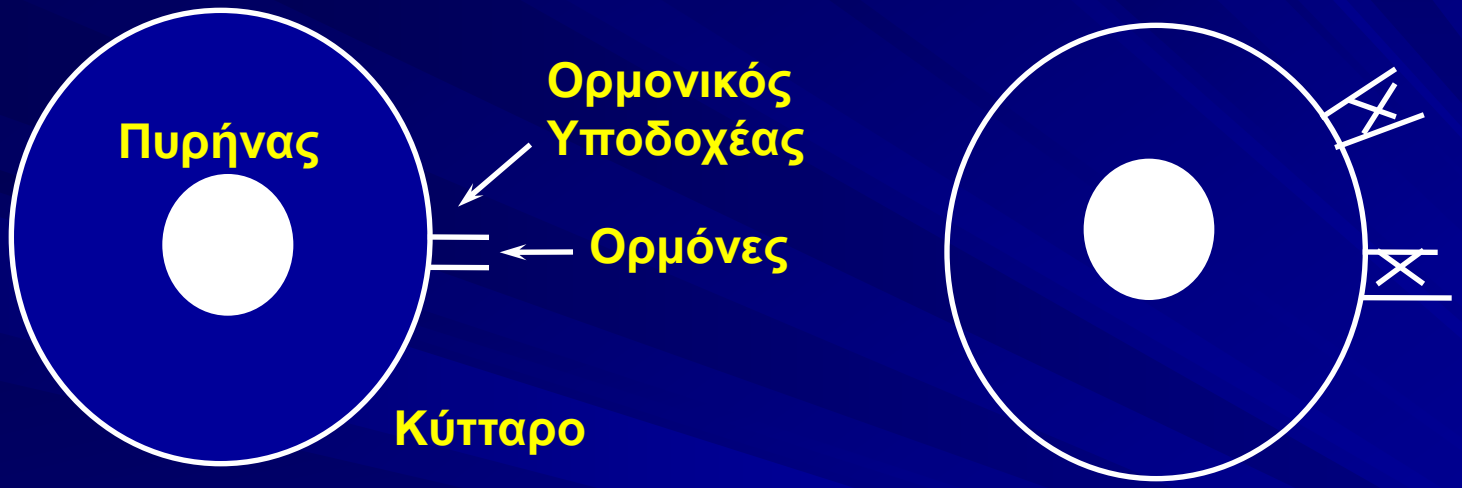
Αναπνευστικό σύστημα	Φλεγμονή	Αλλεργίες	Καρκίνος
Πεπτικό σύστημα	Φλεγμονή	Αλλεργίες	Καρκίνος
Δέρμα	Φλεγμονή	Αλλεργίες	Καρκίνος

Τι γίνονται οι τοξικές ουσίες που εισέρχονται στον οργανισμό

Χημικές ουσίες → Παρεμβαίνουν στο ορμονικό σύστημα

↓

Ενδοκρινικοί Διαταράκτες

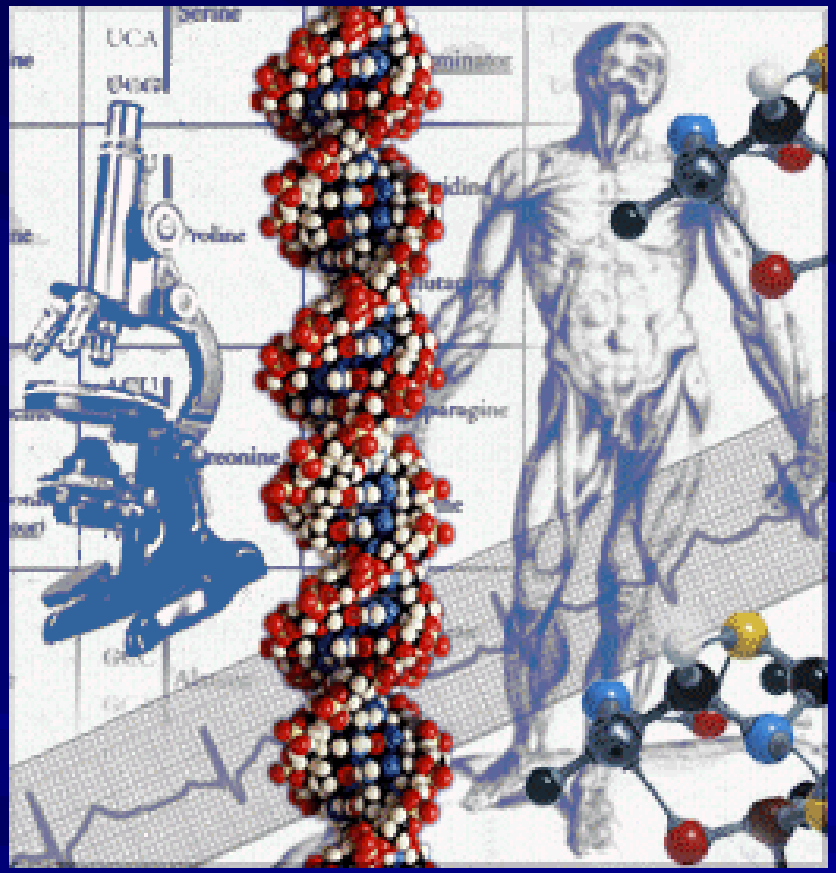


Μιμούνται την ορμονική δράση και έτσι επιφέρουν διαταραχές στον ανθρώπινο οργανισμό.

Πού βρίσκονται:

Καλλυντικά, Πρόσθετα τροφίμων, Απορρυπαντικά, Εντομοκτόνα

Τελικά σημεία δράσης (end points) Ενδοκρινικών Διαταρακτών



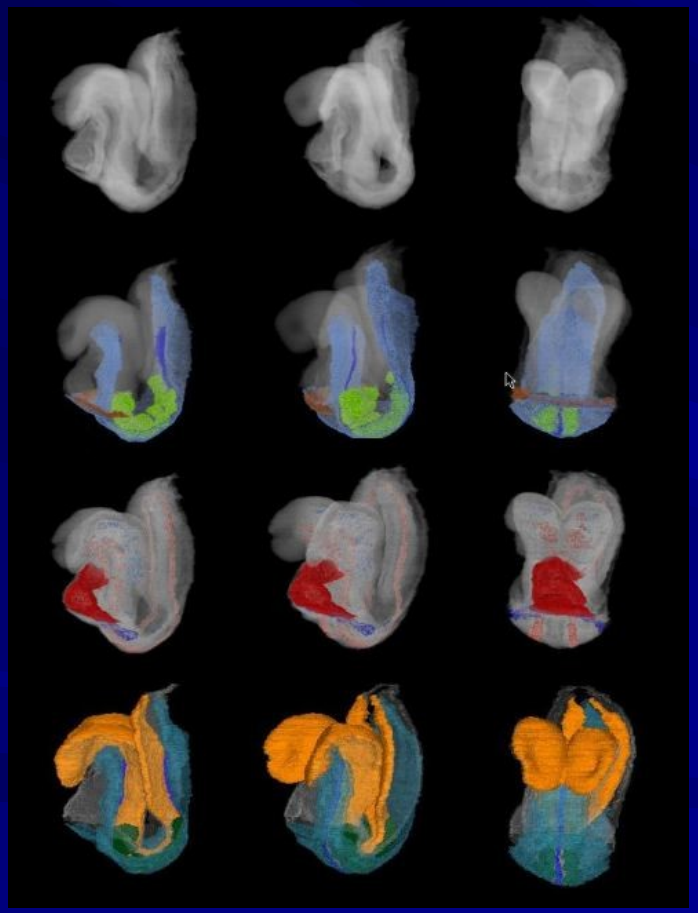
- Αναπαραγωγή
- Καρκίνος
- Νευρολογικά προβλήματα
- Ανοσοβιολογικά προβλήματα
- Επίδραση στο έμβρυο

Το ανθρώπινο σώμα, ακόμα και του εμβρύου, είναι αναπόσπαστα συνδεδεμένο με τον ατμοσφαιρικό αέρα, τη γη και το νερό και τις συνήθειες των γονιών του

Η ακούσια έκθεση σε ενδοκρινικούς διαταράκτες στην ενδομήτριο ζωή και στην πρώιμη παιδική ηλικία φαίνεται ότι σχετίζεται με την ανθρώπινη γονιμότητα αλλά και με την νεοπλασία στην μετέπειτα ζωή.

Όλες οι ηλικίες κινδυνεύουν από τους ύπουλους εισβολείς μέσα από την διατροφή;

Ανοιχτά Παράθυρα Έκθεσης



- **ΕΝΔΟΜΗΤΡΙΑ**
- **ΝΕΟΓΝΙΚΗ**
- **ΕΦΗΒΙΚΗ**
- **……**

Περίπλοκη Περιβαλλοντική έκθεση ...

- Άνθρωποι και ιδιαίτερα παιδιά αλλά και ολόκληρα οικοσυστήματα διαρκώς εκτίθενται σε μίγματα χημικών ουσιών αλλά και πλήθος ακτινοβολιών αγνοώντας τις πιθανές αθροιστικές/συνεργιστικές δράσεις

- Έχει παρατηρηθεί συνέργεια φυτοφαρμάκων με ηλιακή αλλά και ηλεκτρομαγνητική ενέργεια και όχι μόνο

- Εισερχόμενα φυτοφάρμακα στον οργανισμό αλλά διαχεόμενα και στο περιβάλλον μετατρέπονται/μεταβολίζονται σε διαφορετικές χημικές δομές με άγνωστες και μη μελετημένες ιδιότητες.

- Η αποικοδόμηση των αρχικών ουσιών σε θυγατρικά προϊόντα είναι δυνατόν να ενεργοποιήσουν μηχανισμούς κυτταροτοξικότητας και γενοτοξικότητας σε ανθρώπους και περιβάλλον

- Έκθεση σε περιβαλλοντικούς παράγοντες σπάνια είναι σε μεμονωμένα ερεθίσματα Παράδειγμα ο Ήλιος η Ηλεκτρομαγνητικά πεδία και φυτοφάρμακα

Koppe, J. G., Bartonova, A., Bolte, G., Bistrup, M. L., Busby, C., Butter, M., & Howard, V. Nicolopoulou P. (2006). Exposure to multiple environmental agents and their effect. Acta Paediatrica, 95, 106-113.

Exposome or "life-course environmental exposures"

- A general external environment including the urban environment, education, climate factors, social capital, stress.
- A specific external environment with specific contaminants, radiation, infections, lifestyle fact ors (e.g. tobacco, alcohol), diet, physical activity, etc.
- An internal environment to include internal biological factors such as metabolic factors, hormones, gut microflora, inflammation, oxidative stress.

Wild, C. P. (2005). Complementing the genome with an "exposome": the outstanding challenge of environmental exposure measurement in molecular epidemiology.

Body burden

- The air we breathe, water we drink, food we eat, and even the homes we live in

  -- all have some level of toxic contamination.

- It's just the unavoidable nature of our industrialized world

there's no safe threshold.

Extremely low frequency-magnetic fields (ELF-EMF)

- Extremely Low Frequency-Magnetic Fields (ELF-MF) are possible carcinogens to humans and some data suggest that they can act as promoters or progressors.

- Since NK cells play a major role in the control of cancer development, an adverse effect on ELF-MF on NK function has been hypothesized

Gobba, F., Bargellini, A., Scaringi, M., Bravo, G., & Borella, P. (2009). Extremely low frequency-magnetic fields (ELF-EMF) occupational exposure and natural killer activity in peripheral blood lymphocytes. Science of the total environment, 407(3), 1218-1223.

Radiation chemistry comes before radiation biology.

- Radiation chemistry is central of specific aspects.
- Historically, the main application of radiation chemistry of relevance to radiation biology has been investigations of the free-radical processes leading to radiation-induced DNA damage and its chemical characterization,

O'Neill, P., & Wardman, P. (2009). Radiation chemistry comes before radiation biology. International journal of radiation biology, 85(1), 9-25.

Synergistic health effects between chemical pollutants and electromagnetic fields 1/4

- Humans and ecosystems are exposed to highly variable and unknown cocktail of chemicals and radiations.
- Although individual chemicals are typically present at low concentrations, they can interact with each other resulting in additive or potentially synergistic mixture effects.
- This was also observed with products obtained by radiation actions such as sunlight or electromagnetic fields that can change the effects of chemicals, such as pesticides, and metal trace elements on health.

Synergistic health effects between chemical pollutants and electromagnetic fields 2/4

- Humans and ecosystems are exposed to highly variable and unknown cocktail of chemicals and radiations.
- Although individual chemicals are typically present at low concentrations, they can interact with each other resulting in additive or potentially synergistic mixture effects.
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Synergistic health effects between chemical pollutants and electromagnetic fields 3/4

- Concomitant presence of various pesticides and their transformation products adds further complexity to chemical risk assessment since chronic inflammation is a key step for cancer promotion.
- Degradation of a parent molecule can produce several by-products which can trigger various toxic effects with different impacts on health and environment.
- For instance, the cocktail of sunlight irradiated sulcotrione pesticide has a greater cytotoxicity and genotoxicity than parent molecule, sulcotrione, and questions about the impact of photochemical process on environment.

Synergistic health effects between chemical pollutants and electromagnetic fields 4/4

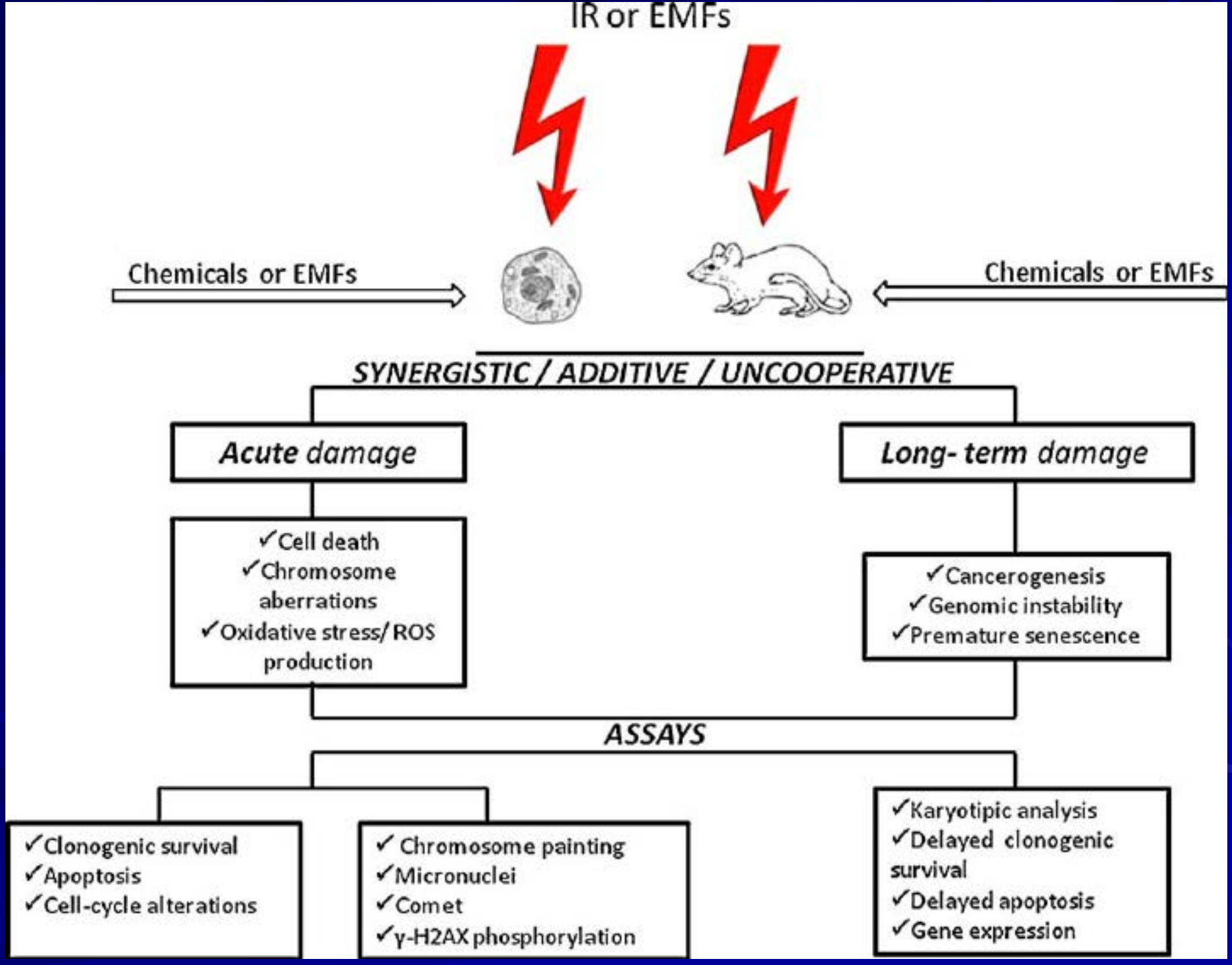
- Adjuvants were shown to modify the biological features of pesticides.
- Addition of other elements, metals or biological products, can differently enhance cell toxicity of pesticides or electromagnetic radiations suggesting a synergy in living organisms.
- Electromagnetic fields spreading, pesticide by-products and mixtures monitoring become greater for environmental contamination evaluations.

Ledoigt, G., Sta, C., Goujon, E., Souguir, D., & El Ferjani, E. (2015). Synergistic health effects between chemical pollutants and electromagnetic fields. Reviews on environmental health, 30(4), 305-309.

Ionizing and non-ionizing electromagnetic field (EMF) radiation, either stand-alone or in combination with other agents,

exert health effects on biological systems.

Kostoff, R. N., & Lau, C. G. (2017). Modified health effects of non-ionizing electromagnetic radiation combined with other agents reported in the biomedical literature. In Microwave Effects on DNA and Proteins (pp. 97-157). Springer, Cham.


IR or EMFs
Chemicals or EMFs
Chemicals or EMFs
SYNERGISTIC / ADDITIVE / UNCOOPERATIVE
Acute damage
Long- term damage
✓Cell death
✓Chromosome aberrations
✓Oxidative stress/ ROS production
✓Cancerogenesis
✓Genomic instability
✓Premature senescence
ASSAYS
✓Clonogenic survival
✓Apoptosis
✓Cell-cycle alterations
✓ Chromosome painting
✓Micronuclei
✓Comet
✓γ-H2AX phosphorylation
✓Karyotipic analysis
✓Delayed clonogenic survival
✓Delayed apoptosis
✓Gene expression

In daily living, the body is exposed to multiple external agents simultaneously

- myriad non-ionizing EMF radiations,
- pesticides,
- food additives,
- heavy metal,
- legal and illegal drugs,
- ionizing radiation, and
- air pollution.

Kostoff, R. N., & Lau, C. G. (2017). Modified health effects of non-ionizing electromagnetic radiation combined with other agents reported in the biomedical literature. In Microwave Effects on DNA and Proteins (pp. 97-157). Springer, Cham.

The number of combinations of potential external agents is large

Each combination could potentially have synergistic or antagonistic, and beneficial or adverse, effects.

Kostoff, R. N., & Lau, C. G. (2017). Modified health effects of non-ionizing electromagnetic radiation combined with other agents reported in the biomedical literature. In Microwave Effects on DNA and Proteins (pp. 97-157). Springer, Cham.

However…

- Non-ionizing EMF radiation exposure safety standards are based primarily on stand-alone radiation exposures.
- When combined with other agents, the adverse effects of non-ionizing EMF radiation on biological systems may be more severe.
- Much work remains to be done before definitive statements about non-ionizing EMF radiation exposure safety can be made.

Kostoff, R. N., & Lau, C. G. (2017). Modified health effects of non-ionizing electromagnetic radiation combined with other agents reported in the biomedical literature. In Microwave Effects on DNA and Proteins (pp. 97-157). Springer, Cham.

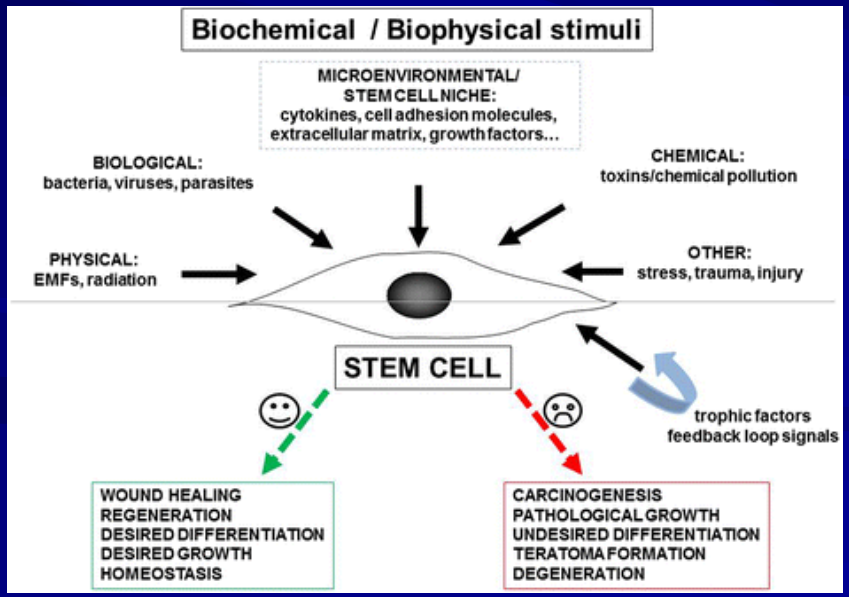
Health concerns have been raised about non-ionizing EMF radiation from

- mobile communication devices,
- occupational exposure,
- residential exposure,
- wireless networks in homes, businesses, and schools, and
- other non-ionizing EMF radiation sources such as ‘smart meters’ and ‘Internet of Things’

Kostoff, R. N., & Lau, C. G. (2017). Modified health effects of non-ionizing electromagnetic radiation combined with other agents reported in the biomedical literature. In Microwave Effects on DNA and Proteins (pp. 97-157). Springer, Cham.

Harmful Effects

- "Extremely Low Frequency-Magnetic Fields (ELF-MF) are possible carcinogens to humans and some data suggest that they can act as promoters or progressors".

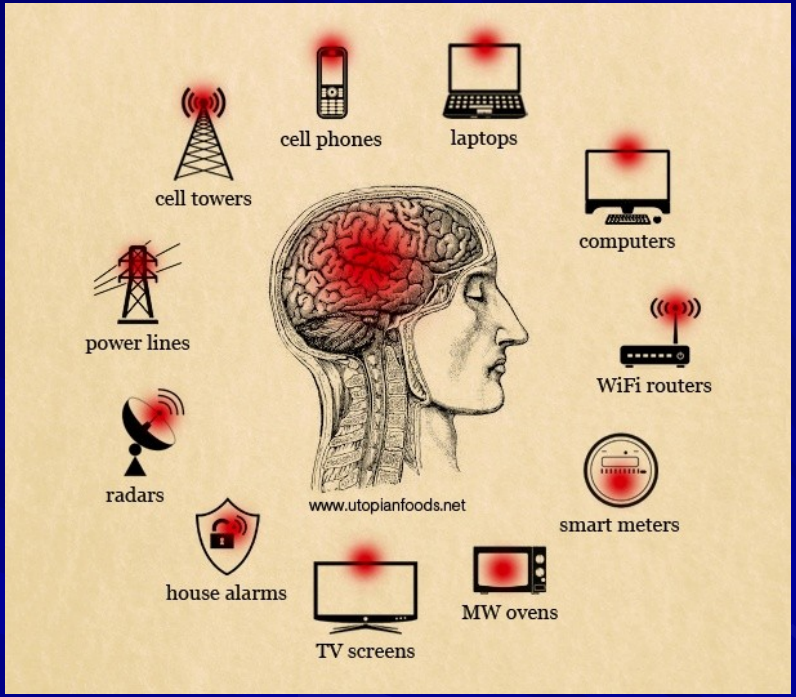


Gobba F, Bargellini A, Scaringi M, Bravo G, Borella P (2009) extremely low frequency-magnetic fields (ELF-EMF) occupational exposure and natural killer activity in peripheral blood lymphocytes. Sci Total Environ 407(3):1218–1223

- "These additional data support previous findings concerning a possible association between heavy mobile phone use and brain tumours"

Coureau G, Bouvier G, Lebailly P, Fabbro-Peray P, Gruber A, Leffondre K, Guillamo J-S, Loiseau H, Mathoulin-Pelissier S, Salamon R, Baldi I (2014) mobile phone use and brain tumours in the CERENAT case-control study. Occup Environ Med 71(7):514–522

- Headaches, skin rashes, sleep disturbances, depression, decreased libido, increased rates of suicide, concentration problems, dizziness, memory changes, increased risk of cancer, tremors, and other neurophysiological effects in populations near base stations



Levitt BB, Lai H (2010) Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. Environ Rev 18:369–395

- “The risk of childhood leukemia was higher than expected for the distance up to 6 km from the radio station.....and there was a significant decline in risk with increasing distance both for male mortality.....and for childhood leukemia”

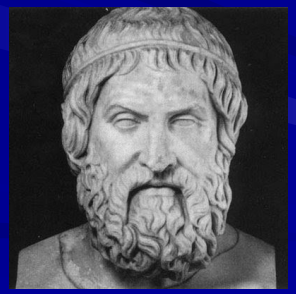
Michelozzi P, Capon A, Kirchmayer U, Forastiere F, Biggeri A, Barca A, Perucci CA (2002) Adult and childhood leukemia near a high-power radio station in Rome. Ital Am J Epidemiol 155(12):1096–1103

Το ερώτημα είναι τι δυνατότητες υπάρχουν

Αρχή της προφύλαξης

- Όταν τα επιστημονικά τεκμήρια είναι ανεπαρκή, μη καταληκτικά ή αβέβαια και όπου υπάρχουν ενδείξεις, χάρη σε μια προκαταρτική αντικειμενική επιστημονική αξιολόγηση, ότι τα δυνάμει επικίνδυνα αποτελέσματα για το περιβάλλον και την υγεία των ανθρώπων, των ζώων και των φυτών είναι ασυνεπή με το επιδιωκόμενο επίπεδο προστασίας τότε…

«κάλλιον το προλαμβάνειν ή το θεραπεύειν»



Ιπποκράτης (Κως 460 π.Χ. - Λάρισα 377 π.Χ.)


Πληροφορία
Γνώση
Επίγνωση
Ευαισθητοποίηση
Λήψη Αποφάσεων

Θέλω να ευχαριστήσω

Theodore Scorato, *Environmental Health Trust*

Devra Davis, *Environmental Health Trust*

Chrysanthi Kotampasi, *Medical School of Athens*

Σας Ευχαριστώ

1985 NOBEL PEACE PRIZE