I SIMPOSIO NACIONAL
de ONCOLOGÍA de PRECISIÓN

Vigo, del 28 de febrero al 1 de marzo de 2019

Radioterapia de precisión: de la física a la biología

Dr. Antonio J. Conde Moreno
Servicio de Oncología Radioterápica
Hospital Universitari i Politécnic La Fe, Valencia

ACCURAY®

Precise, innovative tumor treatments™

ACCURAY

Precision®

Industry News: Precision Radiotherapy with the Elekta Unity Cancer Treatment System

Elekta Unity combines advanced diagnostic standard MR imaging and precision radiotherapy technologies, giving doctors the "vision" to zero in on tumors and avoid healthy tissues

30 Jul 2018

JOHNS HOPKINS
NATIONAL PROTON THERAPY
at SIBLEY MEMORIAL HOSPITAL

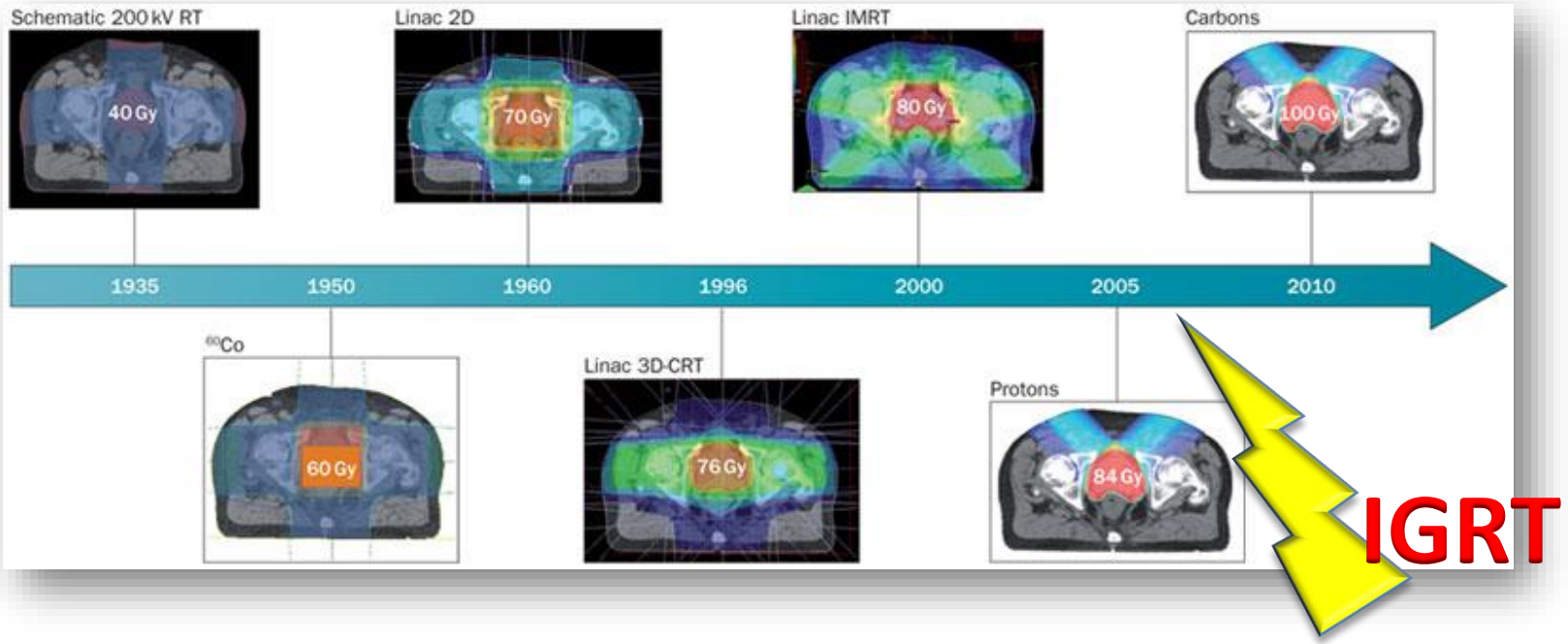
PROTON THERAPY is
PRECISION Radiation Therapy

PRECISION RADIATION THERAPY EDGE

PRECISION
RADIOTHERAPY CENTER

Kirk E. Kanady, MD
Ted Yang, MD
Jonathan Cheng, MD

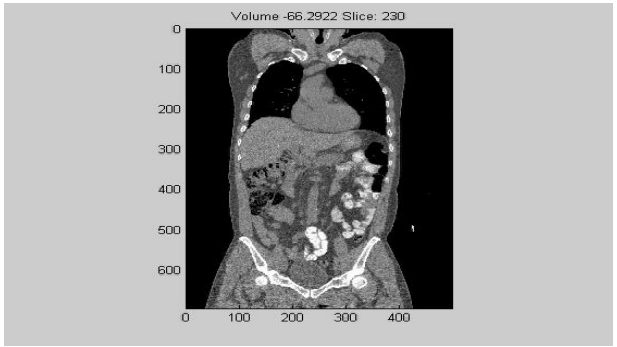
EVOLUTION OF RADIOTHERAPY

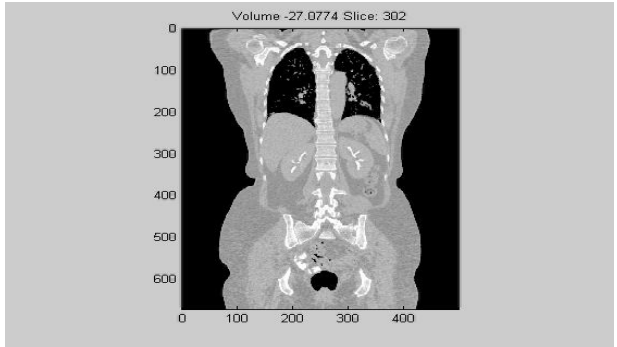


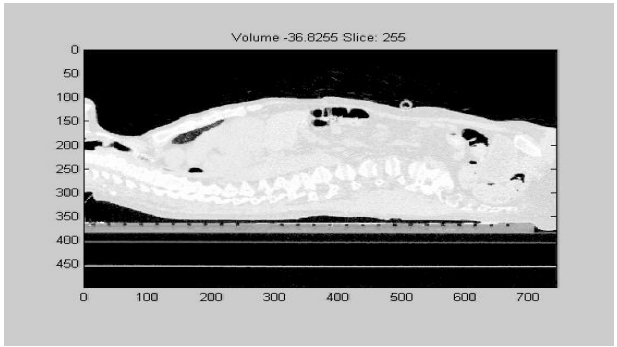
Thariat, J. *et al.* (2012) Past, present, and future of radiotherapy for the benefit of patients. *Nat. Rev. Clin. Oncol.* doi:10.1038/nrclinonc.2012.203

Radioterapia Guiada por la Imagen
IGRT

CADA SER HUMANO ES ÚNICO Y VARIABLE







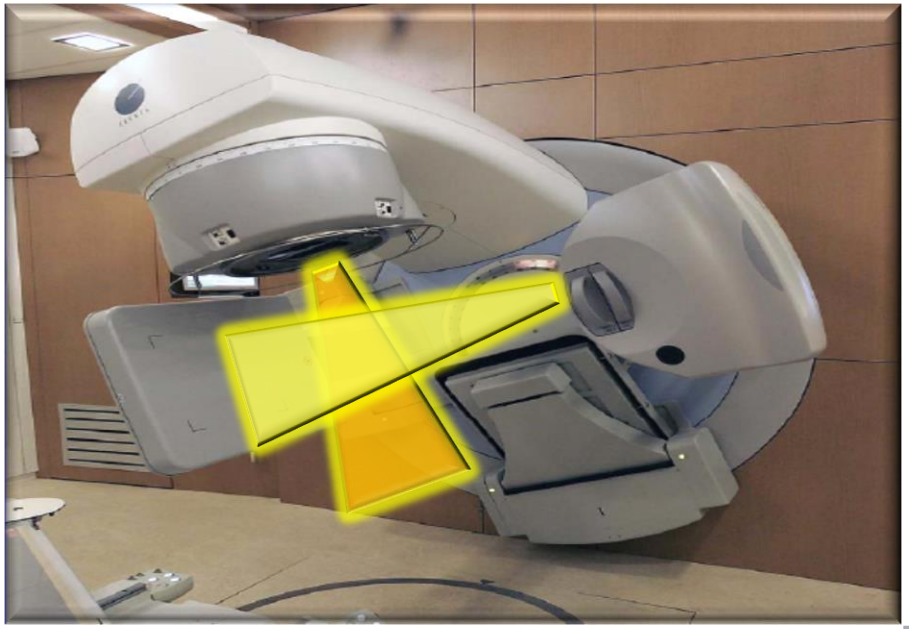
- Movimiento intrafracción: continuo, desde base de lengua hasta el final de la pelvis.

QA

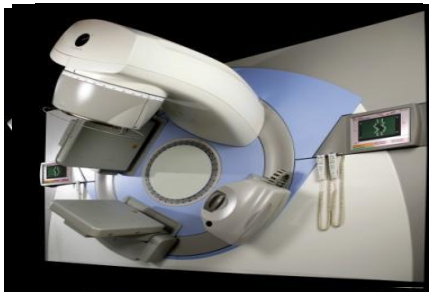
DOSIS PLANIFICADA= DOSIS ADMINISTRADA

IGRT: Image Guided Radiation Therapy

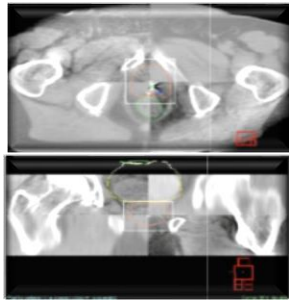
CBKvCT

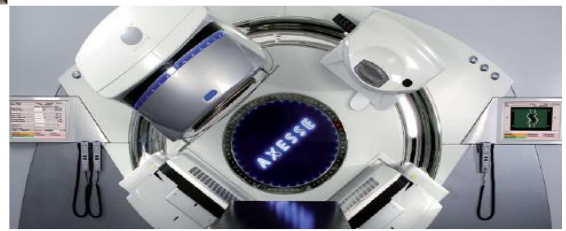


- EQUIPMENT:
  - -Elekta Synergy
  - -Elekta Axesse
  - -Varian Trilogy (OBI)
  - -Varian True Beam
  - *(TD 2400 UM/min)*



- NO indirect references (surrogates) ➔soft tissue visualization.
- CT-CT registration with similar information.





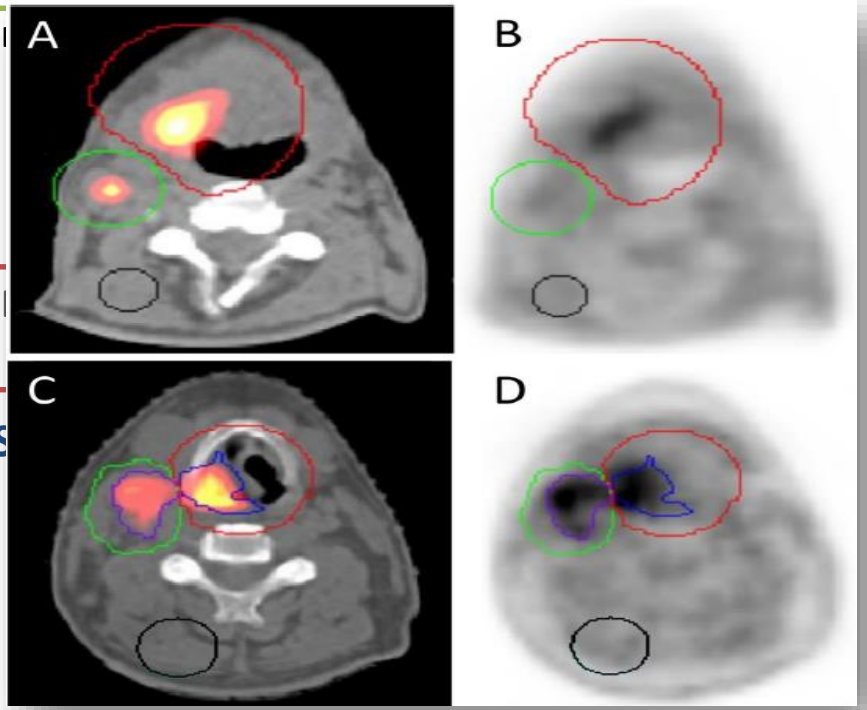
DETERMINACIÓN DEL VOLUMEN BLANCO EN RADIOTERAPIA

EN RADIOTERAPIA ASUMIMOS QUE SABEMOS DÓNDE ESTA EL VOLUMEN BLANCO Y LAS CÉLULAS TUMORALES…

- **BLANCO ANATÓMICO (delineado usando anatomía**
  - **Volumen Blanco Tumoral GTV.**
  - **Volumen Blanco Clínico Tumoral CTV.**
  - **Volumen Blanco De Planificación PTV.**

NO SIEMPRE SABEMOS CON EXACTITUD DÓNDE ESTÁ
TUMORALES Y SUS LÍMITES.

- **BLANCO BASADO EN VOLÚMENES BIOLÓGICOS**
  como MRI, MRS, SPECT o PET):
  Volumen Hipóxico del Tumor.
  Volumen Apoptótico del Tumor.
  Fracción celular en proliferación.



NEXT IS ADAPTATION

IGRT: PERMITE VER LO QUE HACEMOS

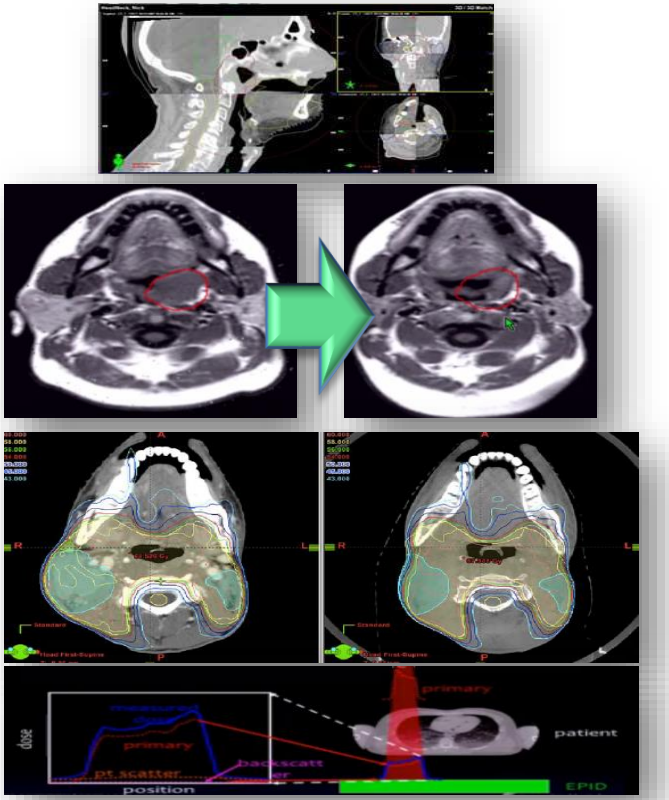
NOS DAMOS CUENTA DE QUE LAS COSAS CAMBIAN

HEMOS DE RECONOCER ESOS CAMBIOS: REGISTRO DEFORMABLE (**DIR**)

HEMOS DE ADAPTAR NUESTRO TRATAMIENTO A ESOS CAMBIOS:
IGART

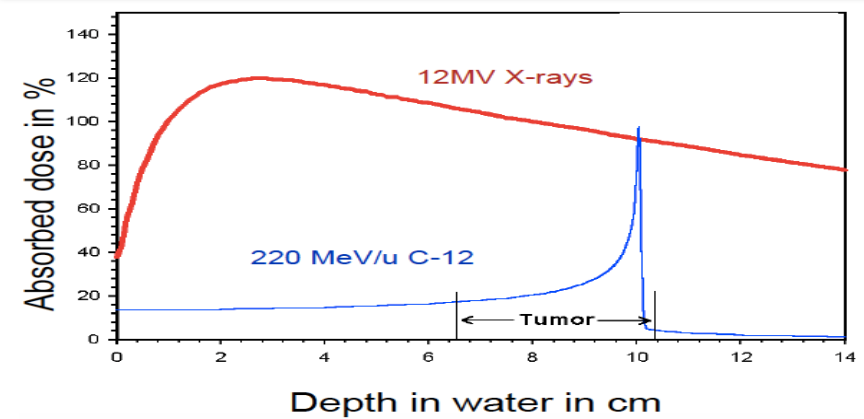
REPLANIFICACION

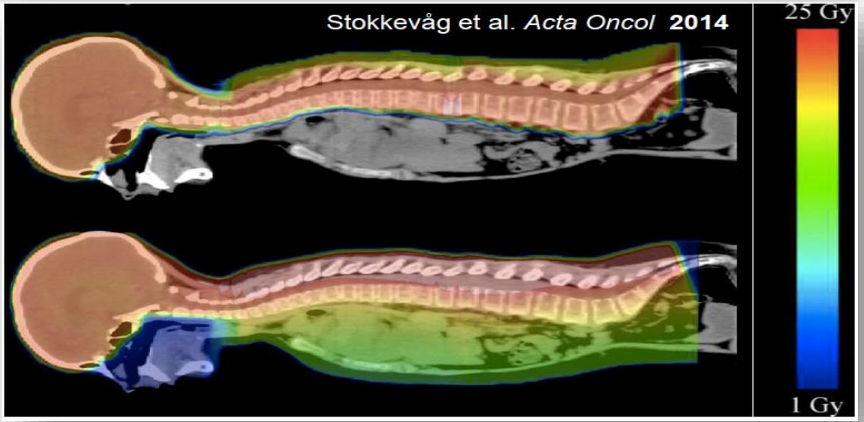
MEDIMOS IN VIVO LA DOSIS QUE DAMOS

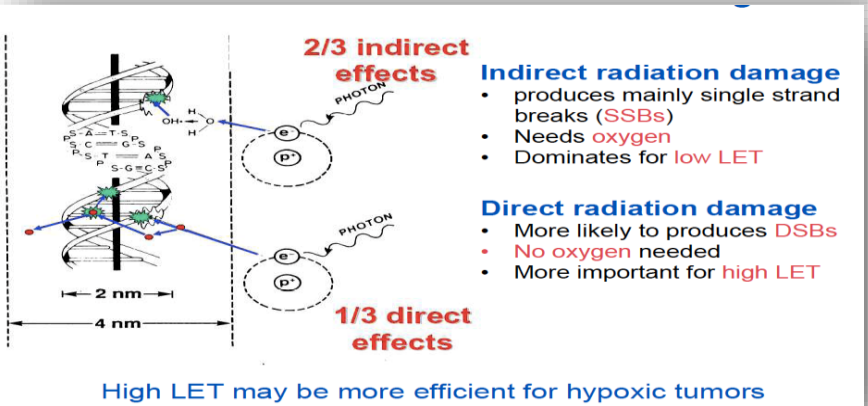


SEA CON LA MAQUINA QUE SEA: TODO CAMBIA. SIEMPRE QUE HAY TIEMPO, HAY CAMBIO

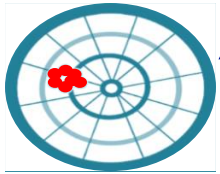
PROTONES - IONES CARBONO

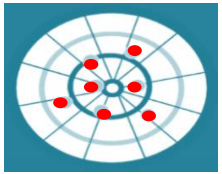






(50% U. Heidelberg & 50% Germany Gov)





Beneficio dosimétrico

IMPT

Protonterapia

MRI Realtime

IGADRT

Tomoterapia

VMAT

IMRT

Intraoperatoria

RT4D

Cyberknife

IGRT

Radiocirugía

RT3D

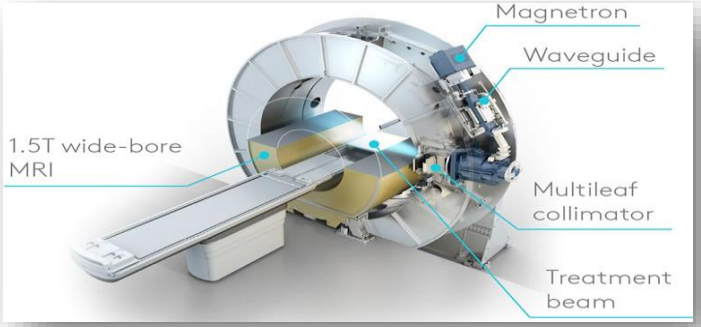
Braquiterapia

Beneficio geométrico

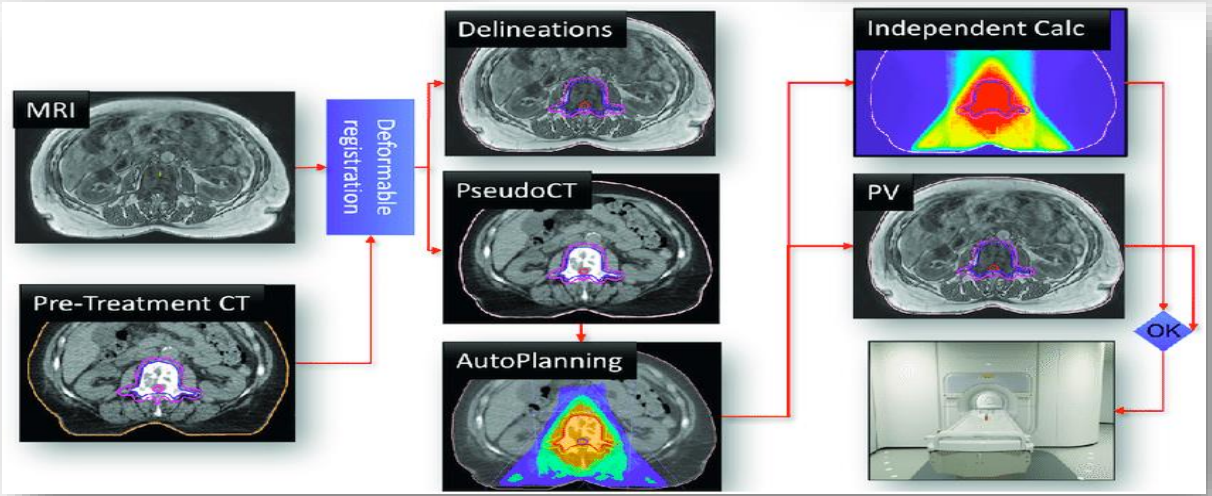
TAC ----------PET/CT----------RMN----------

--PET/RMN

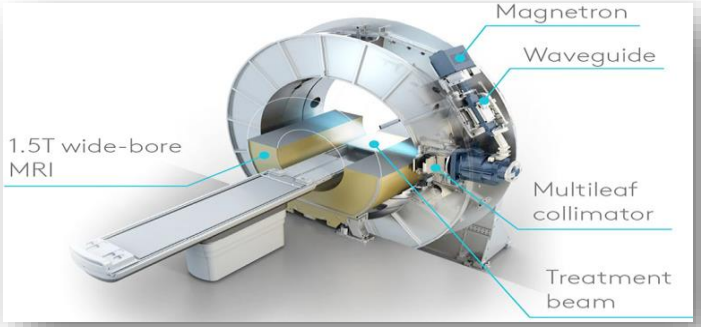
LINAC MRI


Magnetron
Waveguide
1.5T wide-bore MRI
Multileaf collimator
Treatment beam


PHILIPS


MRI
Pre-Treatment CT
Deformable registration
Delineations
PseudoCT
AutoPlanning
Independent Calc
PV
OK

LINAC MRI



Functional imaging as biomarker

- Tumor exhibits complex and heterogeneous microenvironment
- Biological changes may occur before detectable morphological changes
- Functional MRI imaging as a biomarker to assess radiation treatment response:

Biological Processes	Modalities
Metabolism	1H -13C- MR Spectroscopic imaging (MRSI)
Hypoxia	Blood Oxygenation Level-Dependent (BOLD) MRI
Proliferation/Apoptosis	Diffusion Weighted MRI
Angiogenesis	Dynamic Contrast Enhanced (DEC) MRI

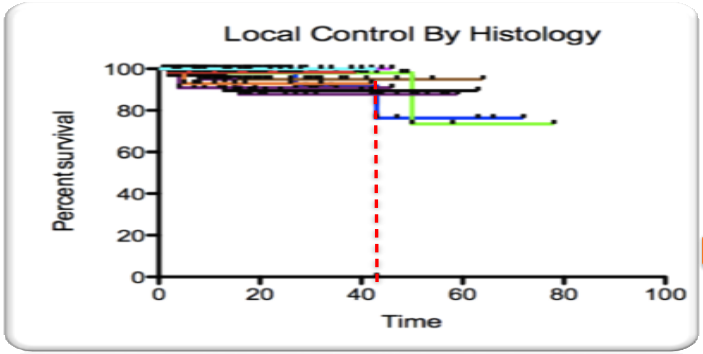
CLINICAL INVESTIGATION Metastasis

PREDICTORS OF LOCAL CONTROL AFTER SINGLE-DOSE STEREOTACTIC IMAGE-GUIDED INTENSITY-MODULATED RADIOTHERAPY FOR EXTRACRANIAL METASTASES

Carlo Greco, M.D.,* Michael J. Zelefsky, M.D.,* Michael Lovelock, Ph.D.,† Zvi Fuks, M.D.,* Margie Hunt, M.S.,† Kenneth Rosenzweig, M.D.,* Joan Zatcky, B.S., N.P.,* Balem Kim, B.A.,* and Yoshiya Yamada, M.D.*

Departments of *Radiation Oncology and †Medical Physics, Memorial Sloan-Kettering Cancer Center, New York, NY

- Dosis única de **21-24Gy**…90% Control local.
- Fraccionamiento de 800 a 950 cGy x 3.



Histology	3 Yr Local Control
Breast	98%
GI	98%
H&N	93%
Lung	98%
Melanoma	90%
Unknown	91%
Prostate	98%
Renal	89%
Sarcoma	96%
Thyroid	92%

413 patients

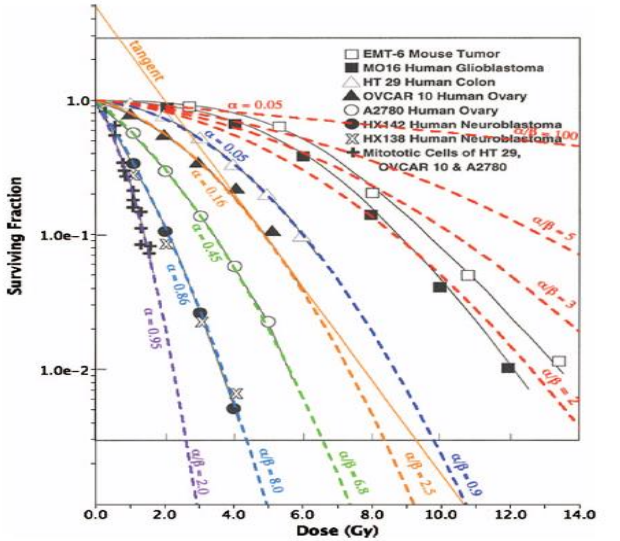
IGRT-IMRT

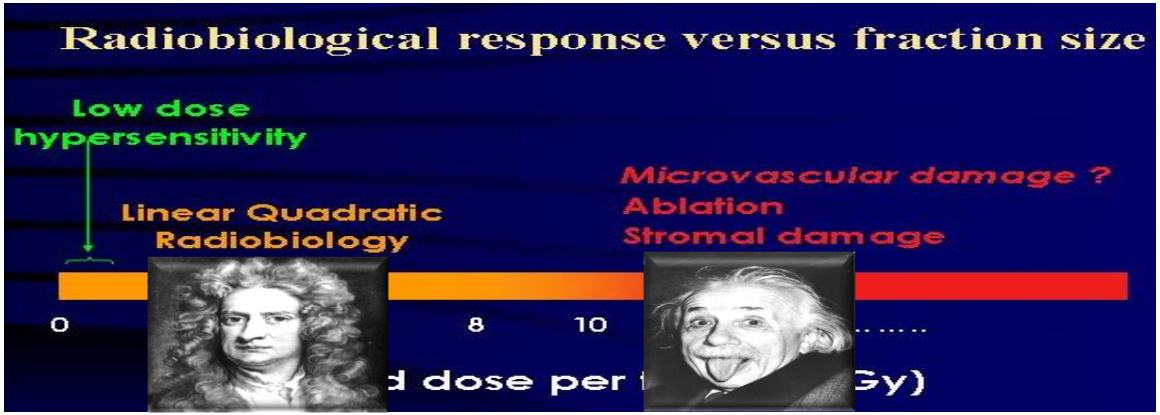
Los avances en tecnología deben traducirse en avances e innovaciones en biología.

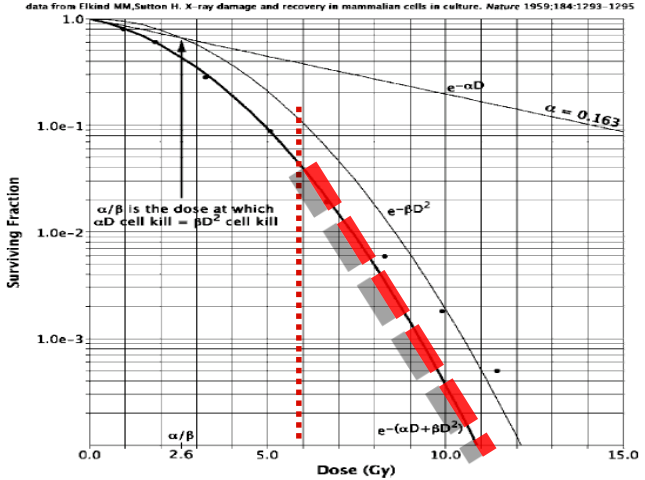
Int. J. Radiation Oncology Biol. Phys., Vol. 79, No. 4, pp. 1151–1157, 2011

Linear Quadratic Modeling and High Dose > 6Gy

- The LQ model starts to break down after 6 Gy per fraction:
  - *In experimental modes, the cell kill after 6 Gy starts to become more linear rather than quadratic.*
  - *LQ model does not accurately describe cell survival at higher doses for radioresistant cell types (broad shoulder).*
  - *α/β may vary over a range of doses*

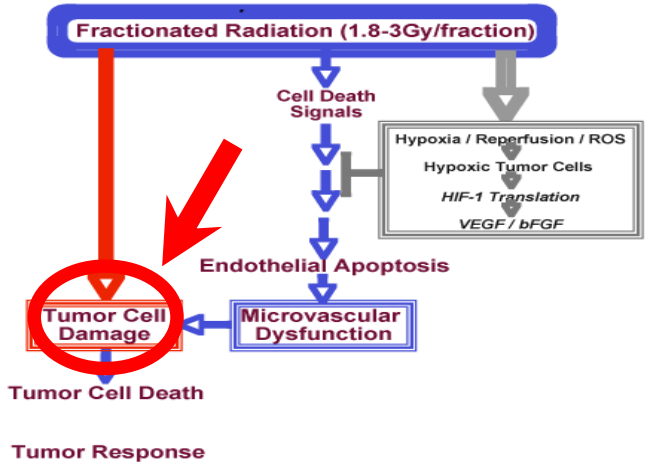




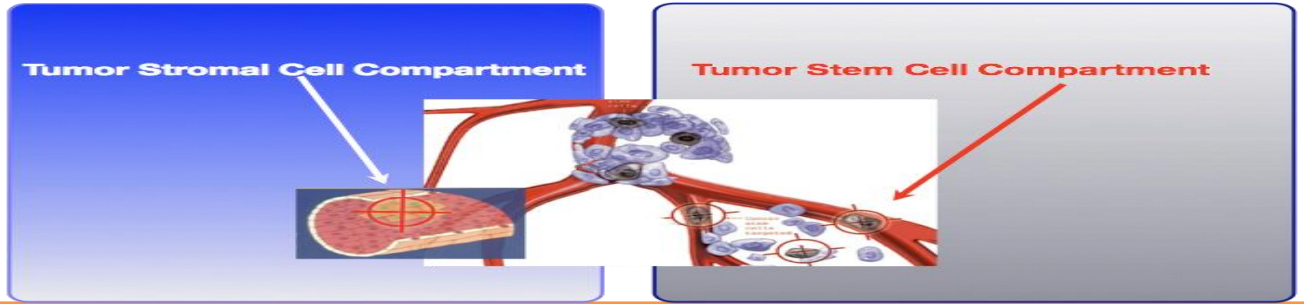


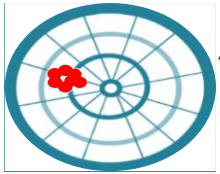
Astrahan, Med Physics 35(9): 4161-4172

EFECTO UMBRAL DE LAS ALTAS DOSIS



Moeller and Dewhirst, 2004





Desarrollo farmacológico

Inmunoterapia

Radio-Inmunoterapia

Target-Therapy

Oligoprogresión

QT-RTConcomitante

SRS-SBRT-SABR

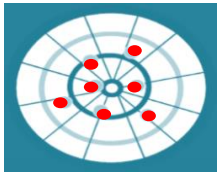
QT HT

QT-RT Secuencial

HF Extrem SD

Fx Convencional

Hipofraccionamiento

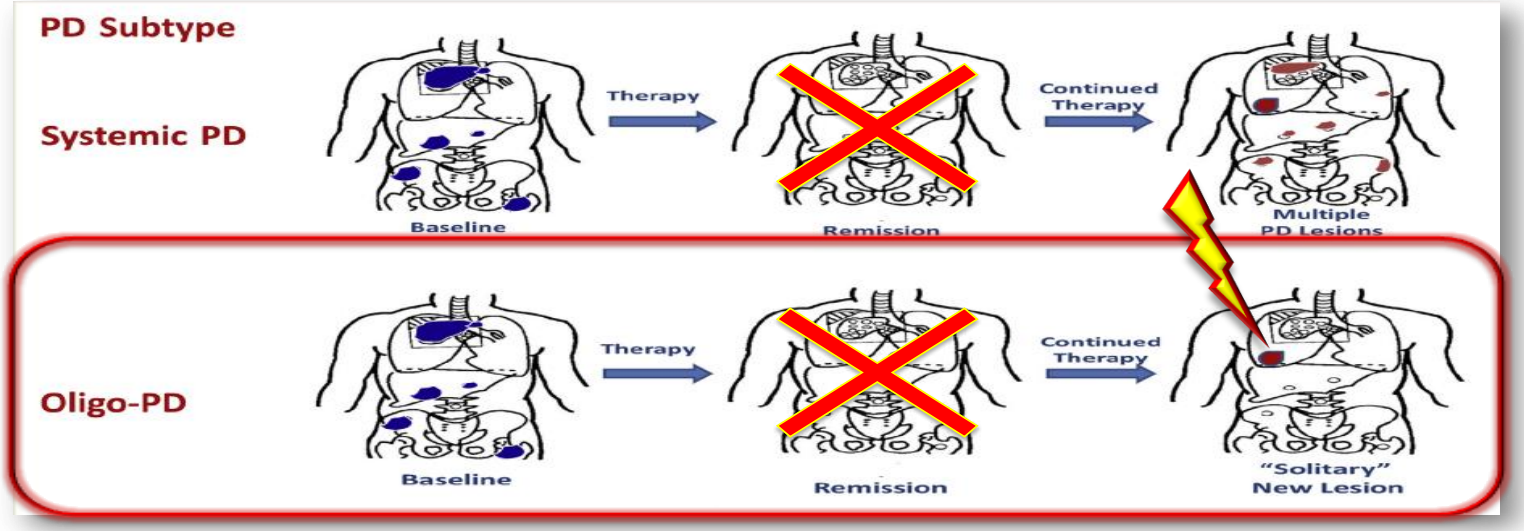


Desarrollo Radiobiológico

OLIGOPROGRESSION

Definition: Majority of metastatic disease controlled by systemic treatment, a few 'resistant' clones progress

Key question: can SBRT be considered a *treatment line?*



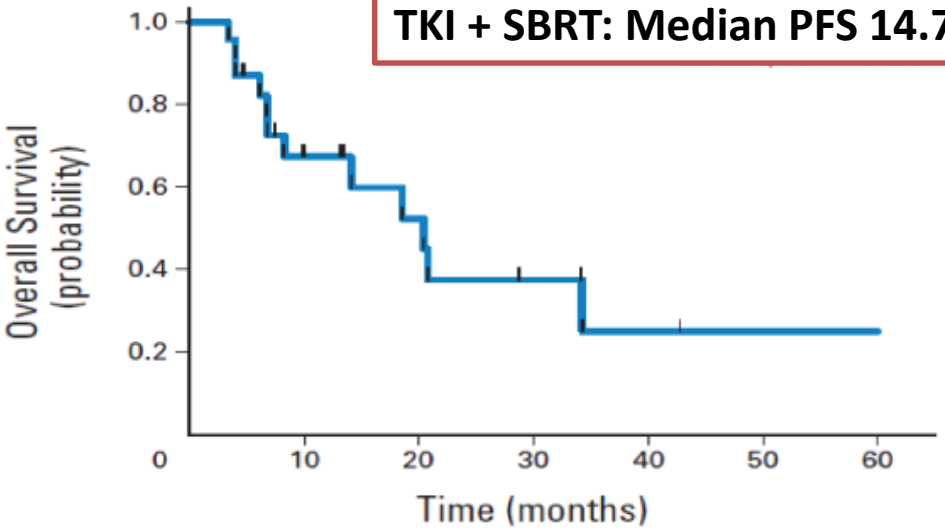
JOURNAL OF CLINICAL ONCOLOGY ORIGINAL REPORT

Phase II Trial of Stereotactic Body Radiation Therapy Combined With Erlotinib for Patients With Limited but Progressive Metastatic Non–Small-Cell Lung Cancer

Puneeth Iyengar, Brian D. Kavanagh, Zabi Wardak, Irma Smith, Chul Ahn, David E. Gerber, Jonathan Dowell, Randall Hughes, Ramzi Abdulrahman, D. Ross Camidge, Laurie E. Gaspar, Robert C. Doebele, Paul A. Bunn, Hak Choy, and Robert Timmerman

Safety of TKIs and Radiotherapy

Erlotinib after failure of at least one prior chemotherapy regimen: PFS 2.3m OS 6,7M



TKI + SBRT: Median PFS 14.7m OS was 20.4m

- Phase 2, single arm study
- n=24
- SBRT used to treat oligoprogression
- TKIs continued during SBRT
- No associated toxicity with SBRT and TKI delivered concurrently

Iyengar JCO 2014

STOP - Oligoprogression Trial

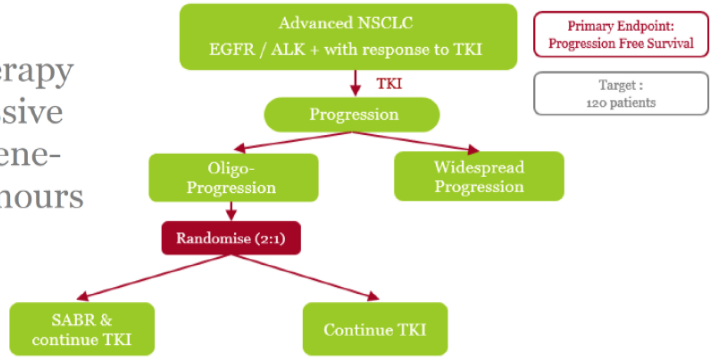
Stereotactic Radiotherapy for Oligo-Progressive Non-Small Cell Lung Cancer (STOP-NSCLC): A randomized phase II trial

Canadian Pulmonary Radiotherapy Investigators Group

www.capriclinicaltrials.com

HALT

Ablative Local Therapy for Oligo-Progressive Disease in Oncogene-Addicted Lung Tumours



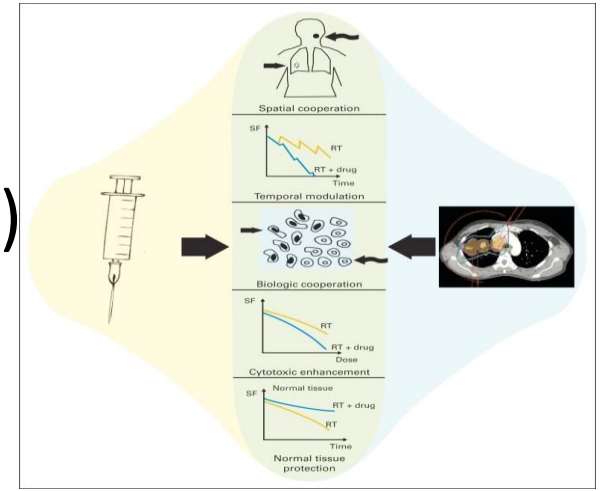
CI: Fiona McDonald

RADIOTERAPIA DE PRECISIÓN

Administrar al **paciente** adecuado, de la **forma** adecuada, acertando en el **sitio** adecuado, con la **mínima toxicidad**…

...la **dosis** adecuada (Precisión Biológica)

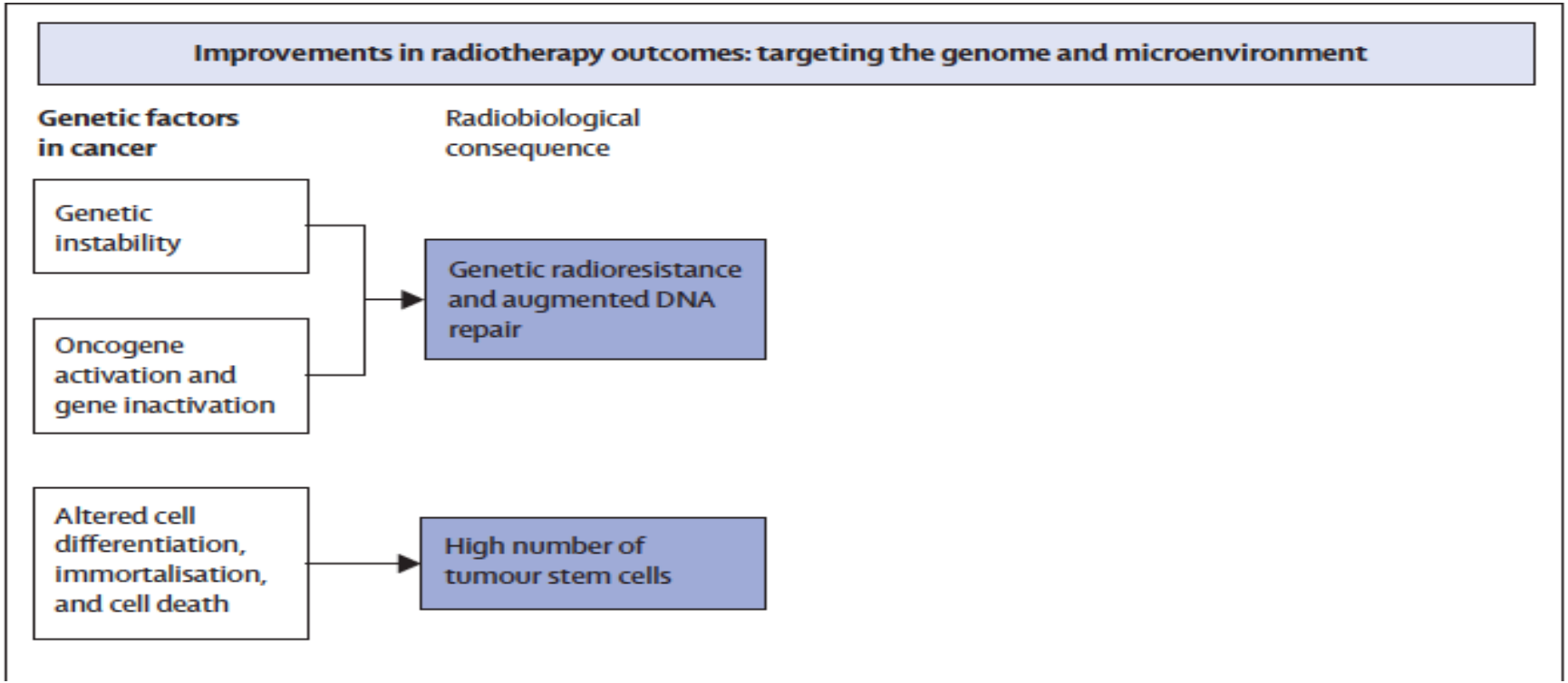
...con el **fármaco** adecuado



RADIOTERAPIA DE PRECISIÓN

What?	How?
Patient:	Now: Pathology (e.g. low grade DCIS, Gleason 6 prostate) Future: Minimal residual disease (e.g. ctDNA, molecular imaging)
Location:	Now: Cross-axial imaging (e.g. reduction In elective volumes; better GTV delin) Future: Mol & Func Imaging
Conformity/Tox:	Now: IMRT, IGRT, spacers, gating/tracking Future: Protons, MR-Linac,
Dose:	Now: MTD Future: ???
Drug:	Now: empirical Future: ???

Precisión Biológica



Specific gene mutations, gene expression patterns , or imaging biomarkers should be studied to try to identify ***radiation-sensitive*** and ***radiation-resistant tumors***

A genome-based model for adjusting radiotherapy dose (GARD): a retrospective, cohort-based study

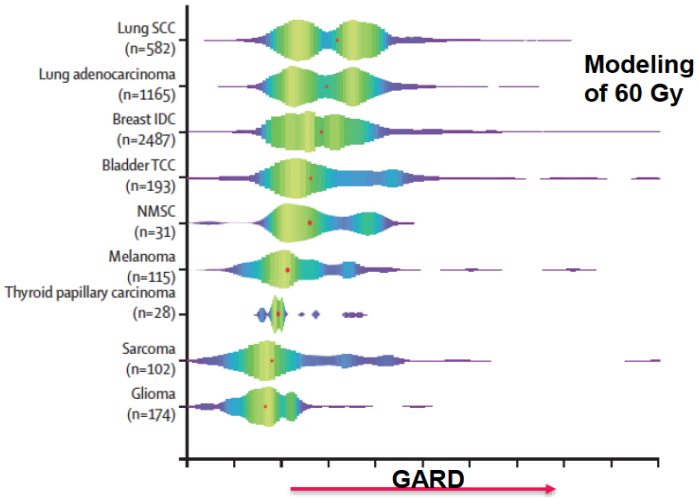
Jacob G Scott, Anders Berglund, Michael J Schell, Ivaylo Mihaylov, William J Fulp, Binglin Yue, Eric Welsh, Jimmy J Caudell, Kamran Ahmed, Tobin S Strom, Eric Mellon, Puja Venkat, Peter Johnstone, John Foekens, Jae Lee, Eduardo Moros, William S Dalton, Steven A Eschrich, Howard McLeod, Louis B Harrison, Javier F Torres-Roca

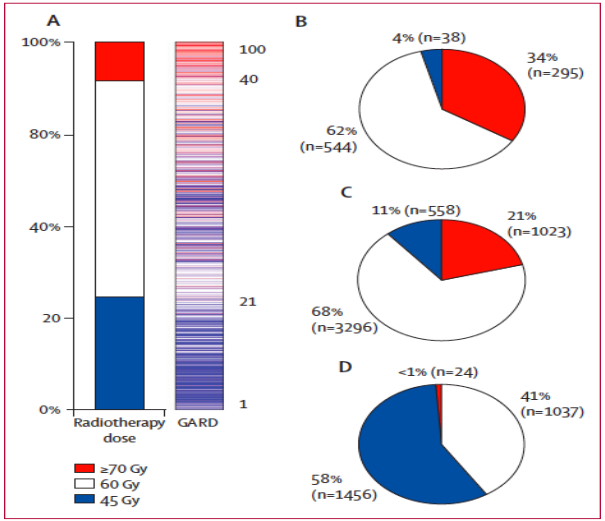
- **Genomic-adjusted radiation dose (GARD)**: individualisation of RT dose to tumour radiosensitivity and provide a framework to design genomically-guided clinical trials in radiation oncology.
- Validated in 5 independent datasets of breast, pancreatic, glioblastoma, and lung tumors
  8,200 primary tumor tissue samples from 20 disease sites

$$E = nd(\alpha + \beta d)$$

RSI = -0.0098009*AR + 0.0128283*cJun + 0.0254552*STAT1 - 0.0017589*PKC - 0.0038171*RelA + 0.1070213*cABL - 0.0002509*SUMO1 - 0.0092431*PAK2 - 0.0204469*HDAC1 -0.0441683*IRF1

GARD=nd(α + βd)





Impact of HPV-associated p16-expression on radiotherapy outcome in advanced oropharynx and non-oropharynx cancer

Pernille Lassen [a], Hanne Primdahl [b], Jørgen Johansen [c], Claus A. Kristensen [d], Elo Andersen [e], Lisbeth J. Andersen [f], Jan F. Evensen [g], Jesper G. Eriksen [a], Jens Overgaard [a], Danish Head and Neck Cancer Group (DAHANCA)

2014

De-escalation Trials in HPV-Positive OPSCC

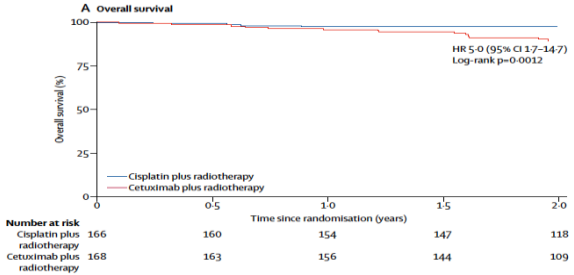
Trial	Inclusion criteria	Treatment	Outcomes
Cmelak et al, phase 2	Stage III, IVA/B, HPV-16 ISHþ /p16þ OPSCC	IC with 3 cycles of cisplatin/paclitaxel/cetuximab. Complete clinical responders received 54 Gy with weekly cetuximab	2-y PFS 2 year OS
RTOG 1016, phase 3 (clinicaltrials.gov Identifier: NCT01302834)	Stage III, IVA/B, p16þ OPSCC	Cisplatin 100 mg/m2 on days 1 and 22 with 70 Gy accelerated IMRT (6 wk) vs weekly cetuximab with 70 Gy accelerated IMRT (6 wk)	2-Year PFS 2-Year OS
ECOG 3311, phase 2 (clinicaltrials.gov Identifier: NCT01898494)	Stage III, IVA/B, p16þ OPSCC	Initial TORS with neck dissection and risk stratification determines adjuvant treatment. Low risk: Observation Intermediate risk: randomized to RT alone, 50 Gy vs 60 Gy High risk: Weekly cisplatin/66 Gy RT	2-Year PFS 2-Year OS
Quarterback Trial, phase 3 (clinicaltrials.gov Identifier: NCT01706939)	Stage III, IVA/B, p16þ OPSCC, unknown primary tumor, nasopharynx	IC with 3 cycles of TPF and responders (CR or PR) randomized 2:1 to RT 56 Gy with weekly carboplatin vs RT 70 Gy with carboplatin	3-Year PFS 3-Year LRC 5-Year OS
ADEPT, phase 3 adjuvant trial (clinicaltrials.gov Identifier: NCT01687413)	p16þ OPSCC with postoperative pathological T1-4aNþ with ECS	IMRT 60 Gy vs IMRT 60 Gy with weekly cisplatin	2-Year DFS 2-Year LRC 5-Year DM rate
TROG 12.01, phase 3 (clinicaltrials.gov Identifier: NCT01855451)	Stage III, IVA/B, p16þ OPSCC, (excluding T1-2N1 and T4N3, >10 py smokers with N2b or N2c)	RT 70 Gy with weekly cetuximab vs RT 70 Gy with weekly 40 mg/m2 cisplatin	Compare treatment adverse effects using MDASI-HN
De-ESCALaTE, phase 3 (clinicaltrials.gov Identifier: NCT01874171)	Stage III, IVA/B, p16þ OPSCC (T3N0-T4N0, T1N1- T4N3)	RT 70 Gy with weekly cetuximab vs RT 70 Gy with cisplatin 100 mg/m2 on days 1, 22, and 43	Compare treatment adverse effects

Combinación de fármacos

	Drug examples	Potential benefit of treatment	Trial status	Challenges
Intracellular signalling				
EGFR	Cetuximab, panitumumab, gefitinib, erlotinib	Targets tumour cell radioresistance	Phase 2–3 with radiotherapy–chemotherapy combination or radiotherapy alone	Tracking drug action on targets in situ
mTOR	Everolimus, temsirolimus	Targets tumour cell radioresistance	Phase 1/2	Defining additional benefits over combined chemotherapy–radiotherapy
AKT	Nelfinavir	Targets tumour cell radioresistance	Phase 1/2	Needs biomarker-driven trials using functional signalling assays

Radiotherapy plus cisplatin or cetuximab in low-risk human papillomavirus-positive oropharyngeal cancer (De-ESCALaTE HPV): an open-label randomised controlled phase 3 trial

*Hisham Mehanna, Max Robinson, Andrew Hartley, Anthony Kong, Bernadette Foran, Tessa Fulton-Lieuw, Matthew Dalby, Pankaj Mistry, Mehmet Sen, Lorcan O'Toole, Hoda Al Booz, Karen Dyker, Rafael Moleron, Stephen Whitaker, Sinead Brennan, Audrey Cook, Matthew Griffin, Eleanor Aynsley, Martin Rolles, Emma De Winton, Andrew Chan, Devraj Srinivasan, Ioanna Nixon, Joanne Grumett, C René Leemans, Jan Buter, Julia Henderson, Kevin Harrington, Christopher McConkey, Alastair Gray, Janet Dunn, on behalf of the De-ESCALaTE HPV Trial Group**

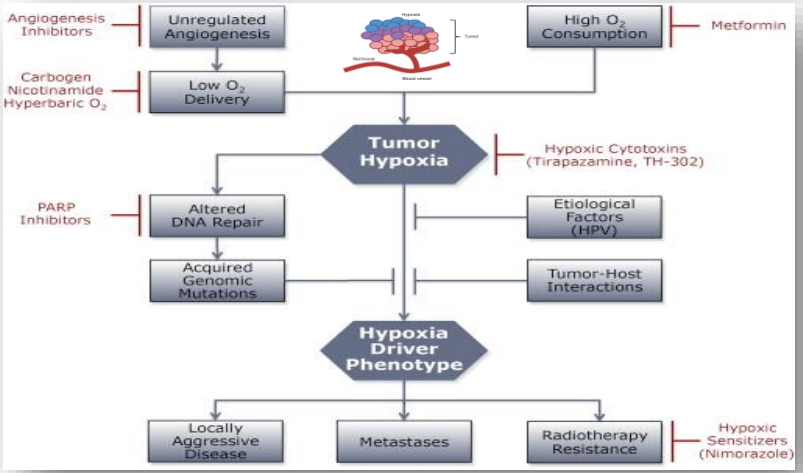


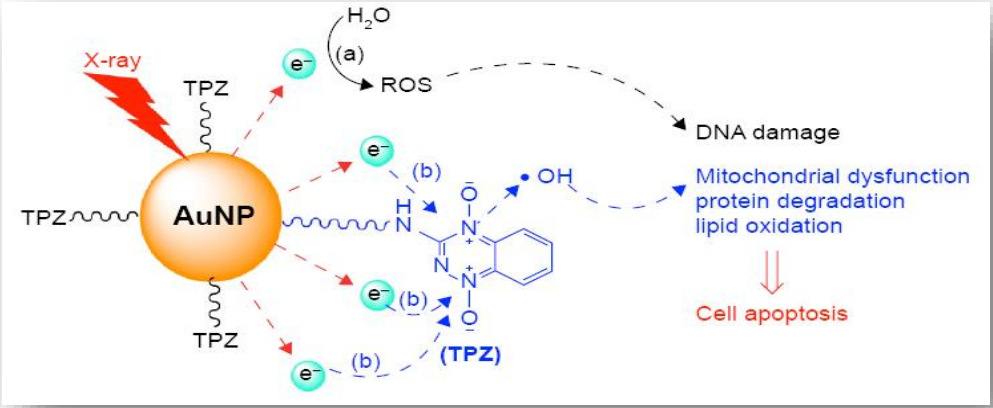
- ✓ No reduction in toxicity with cetuximab.
- ✓ Statistically and clinically significant detriment in tumour control and survival.
- ✓ The importance of doing comparative phase 3 trials in new indications, even for treatments that are already approved or have shown benefit in phase 2 trials.

Lancet 2019; 393: 51–60

Combinación de fármacos

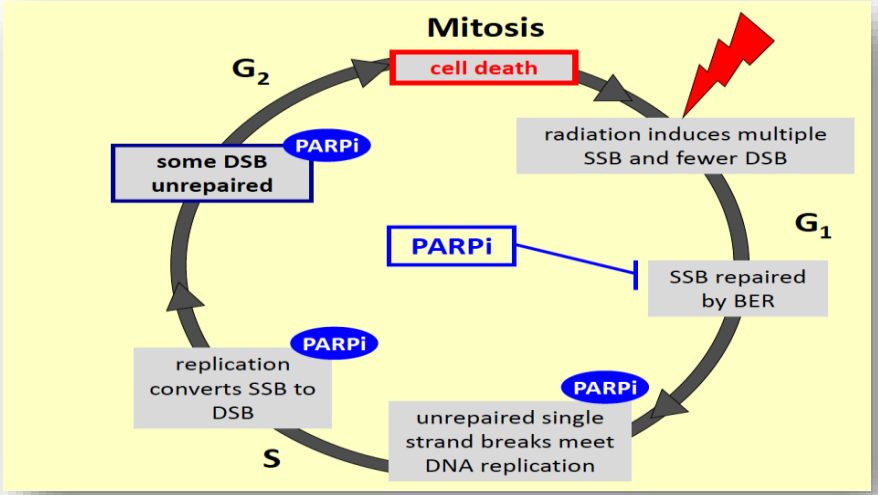
	Drug examples	Potential benefit of treatment	Trial status	Challenges
Cancer metabolism or hypoxia				
Tumour hypoxia	Tirapazamine evofosfamide	Targets tumour cell radioresistance and metastasis	Phase 3	Toxic effects with radiotherapy in head, eyes, ears, nose, and throat (tirapazamine)
Tumour hypoxia	Nimorazole	Targets tumour cell radioresistance and metastasis	Phase 3	Needs biomarker-driven trials
Tumour hypoxia	Metformin	Targets tumour cell radioresistance and metastasis	Phase 2–3	Needs standardisation of hypoxia assays (PET, in situ)

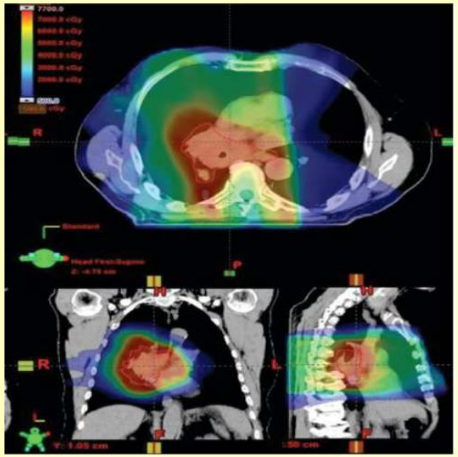




Combinación de fármacos

	Drug examples	Potential benefit of treatment	Trial status	Challenges
DNA repair and genetic instability				
PARP	Olaparib, veliparib, iniparib	Target tumour radioresistance and use of synthetic lethality	Phase 1	Toxic effects when given concurrently with radiotherapy
ATR	Selumetinib	Target tumour radioresistance and use of synthetic lethality	Phase 1	Selecting patients with appropriate and functional DNA repair mutations in tumours





Critical organs at risk determine PARPi dose that can be safely delivered with radical RT

- NKI NSCLC phase I
  - Olaparib 25 mg daily
- Colorado H&N phase I
  - Olaparib 50 mg daily
- PARADIGM GBM
  - **Olaparib 400 mg daily**

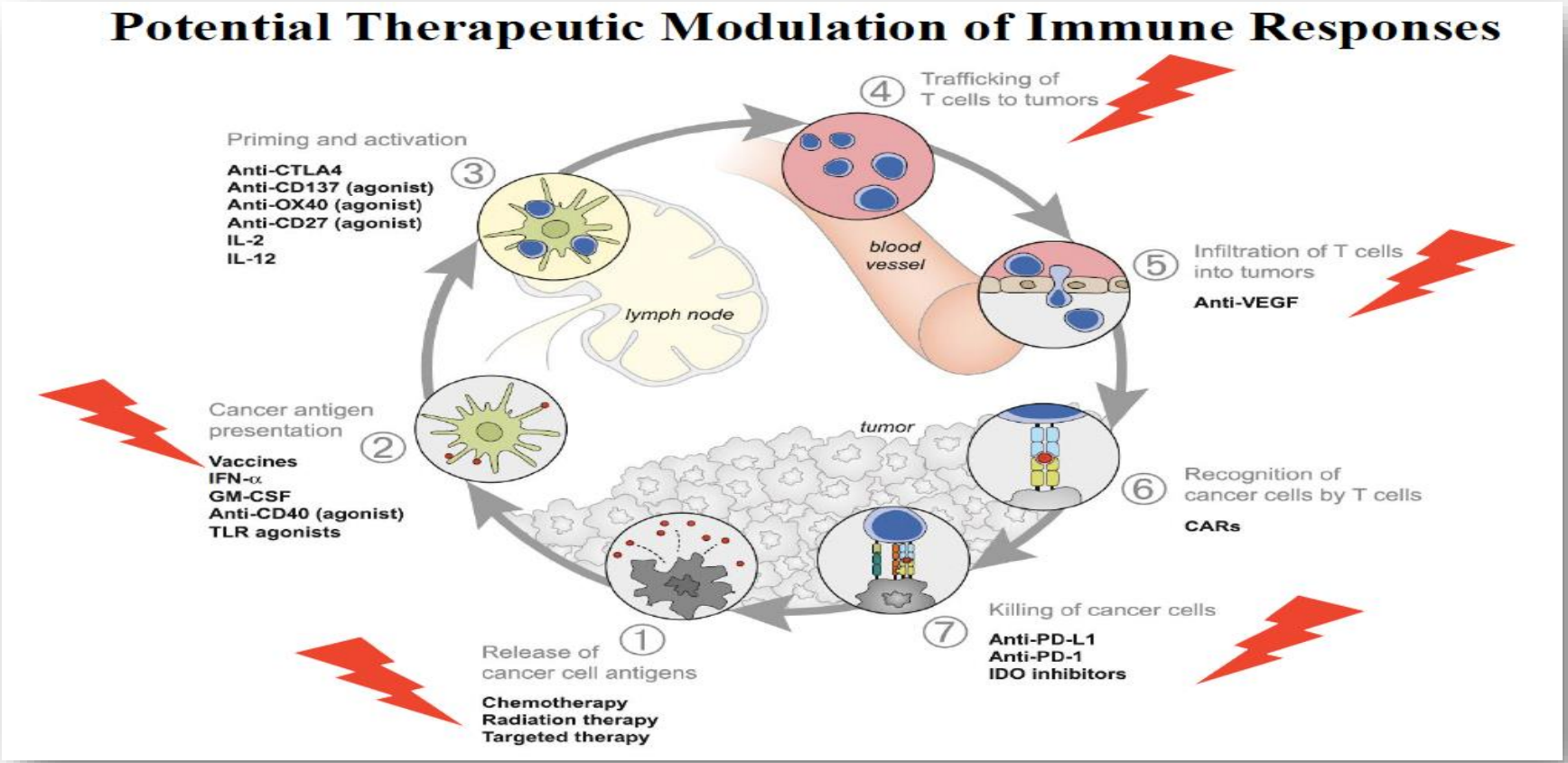
Supports hypothesis that PARPi radiosensitise replicating cells

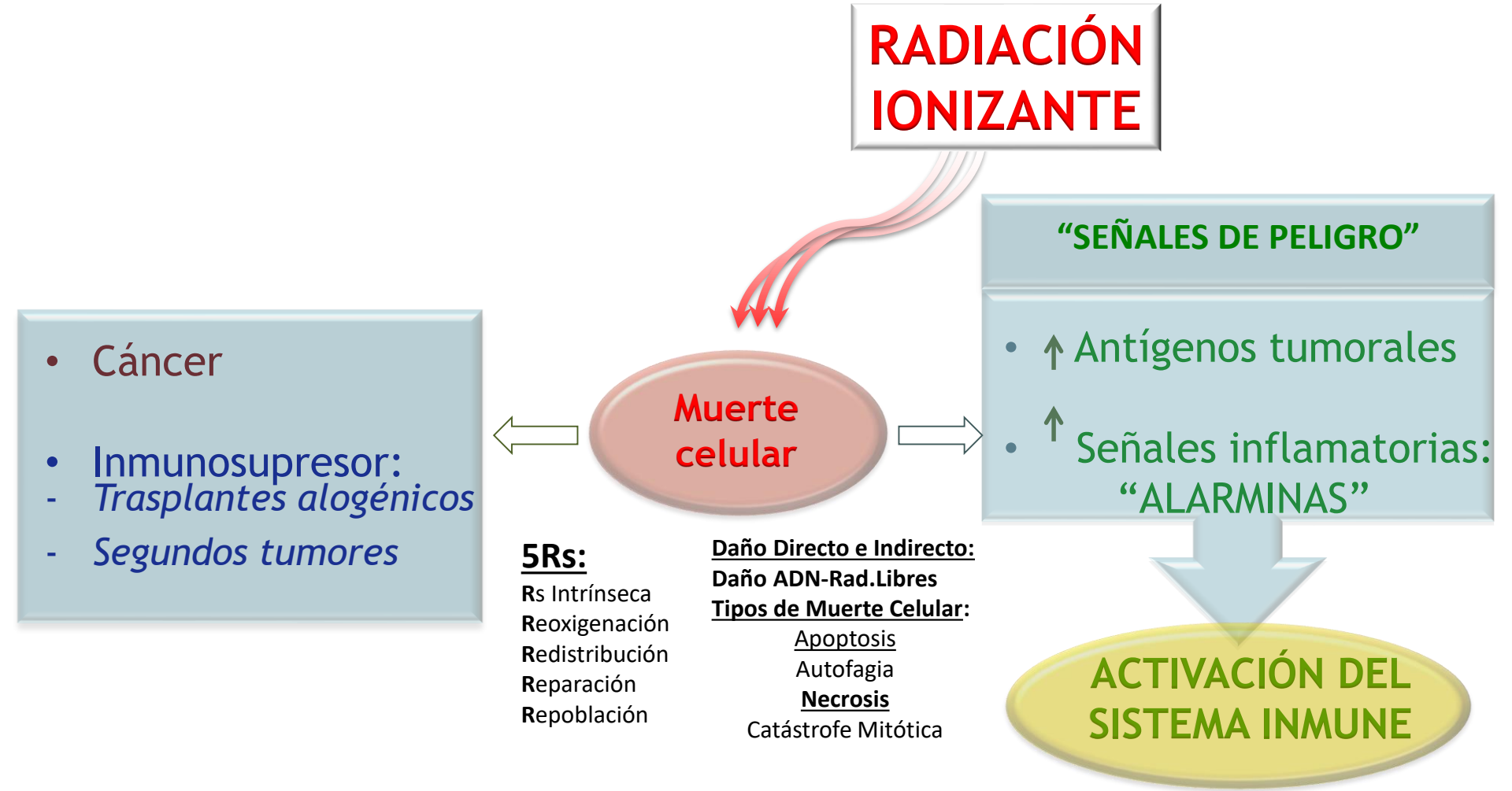
Mitigate acute toxicity problems by reducing RT dose to rapidly proliferating tissues

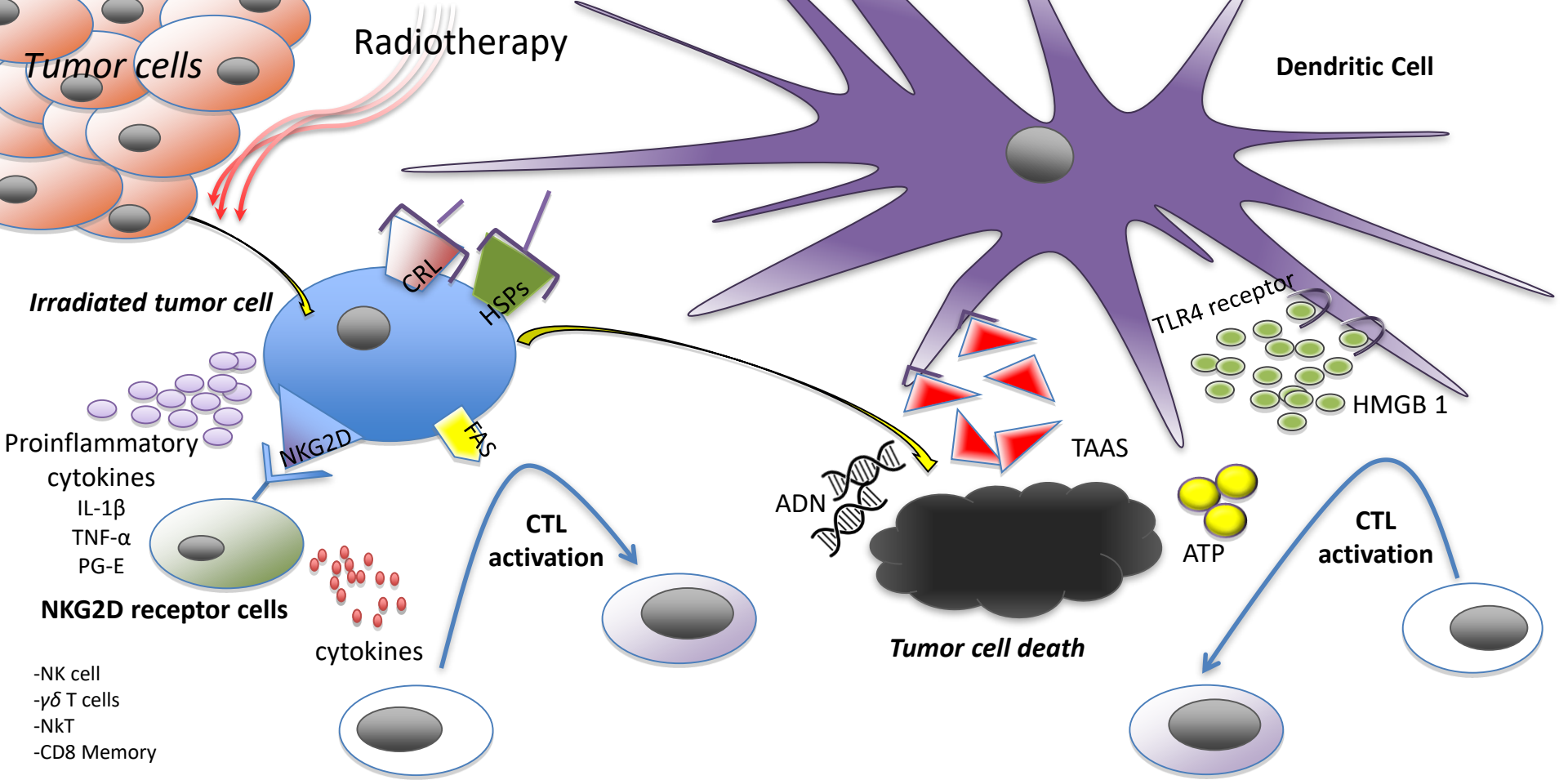
Combinación de fármacos

	Drug examples	Potential benefit of treatment	Trial status	Challenges
Immunotherapy				
PD-1 and PD-L1	Pembrolizumab, nivolumab, atezolizumab, avelumab, durvalumab	Augment immune T-cell response and use of abscopal effect	Phase 1–3	Establish tumour sites and biomarkers that are predictive of immune response, targeting low mutation-burden or poorly immunogenic tumours
CTLA-4	Ipilimumab, tremelimumab	Augment immune T-cell response and use of abscopal effect	Phase 1–3	Biomarker-driven trials, targeting low mutation-burden or poor immunogenic tumours
Cytokines	Interleukin-2, interferon, granulocyte-macrophage colony-stimulating factor, and transforming growth factor-β antagonists	Activate effector immune cells and use of abscopal effect	Phase 1–3	Toxic effects when given systemically
Other	Anti-OX40 (TNFRDF4) antibodies, anti-GITR (ENFSF18) antibodies, and TLR-7 and TLR-4 agonists	Augment abscopal effect	Phase 1–2	Integrating with established immunotherapy, managing potentially additive toxic effects

Radioinmunoterapia



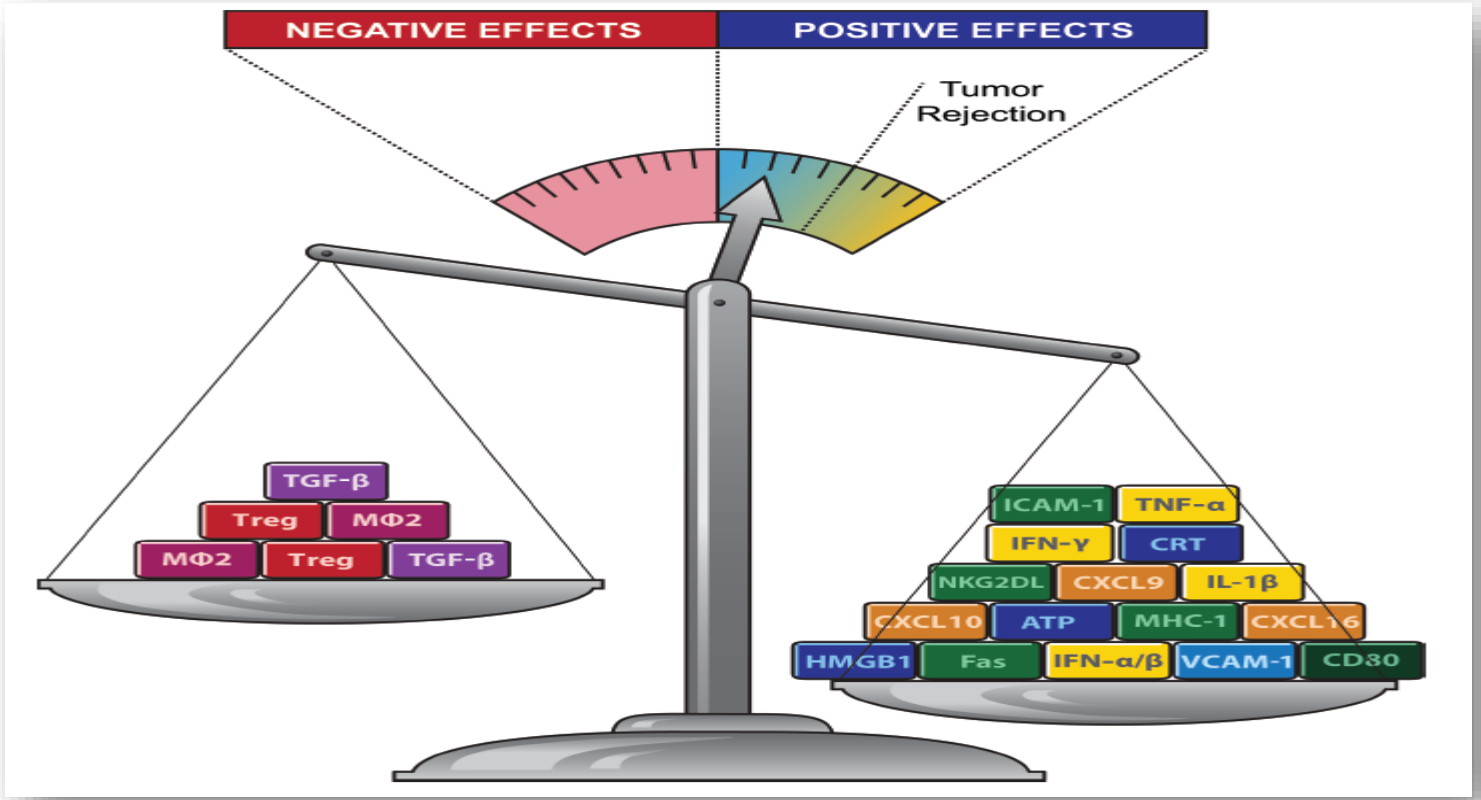

RADIACIÓN IONIZANTE
"SEÑALES DE PELIGRO"
• ↑ Antígenos tumorales
• ↑ Señales inflamatorias: "ALARMINAS"
Muerte celular
• Cáncer
• Inmunosupresor:
- Trasplantes alogénicos
- Segundos tumores
5Rs:
Rs Intrínseca
Reoxigenación
Redistribución
Reparación
Repoblación
Daño Directo e Indirecto:
Daño ADN-Rad.Libres
Tipos de Muerte Celular:
Apoptosis
Autofagia
Necrosis
Catástrofe Mitótica
ACTIVACIÓN DEL SISTEMA INMUNE



de la Cruz-Merino L, Illescas-Vacas A, Grueso-López A et al. Front Immunol. 2014 Mar 14;5:10.2

EFECTOS INMUNES LOCALES DE LA RT

Inhibición vs estimulación del sistema inmune



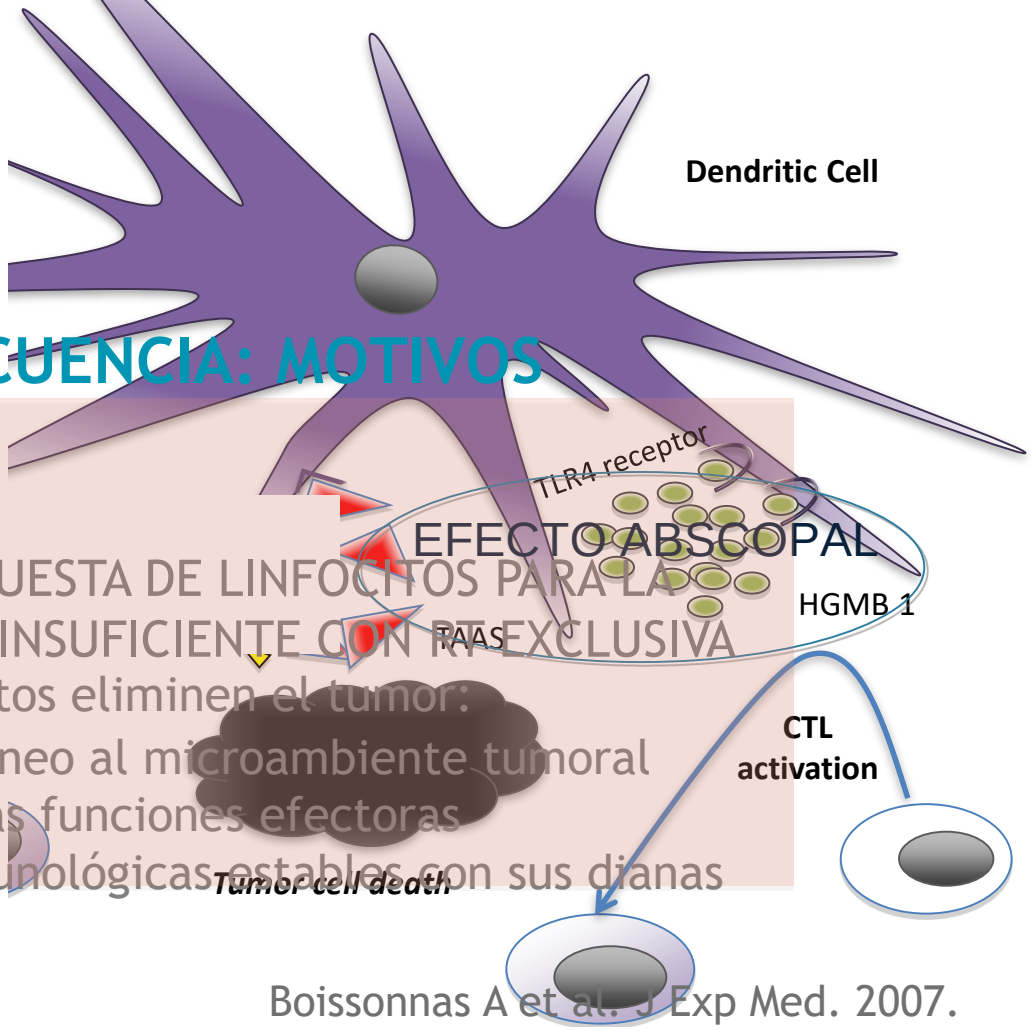
Silvia C et al. J Natl Cancer Inst. 2013

ESCASA FRECUENCIA: MOTIVOS

- INFRADIAGNOSTICADO
- INDUCCIÓN DE UNA RESPUESTA DE LINFOCITOS PARA LA DESTRUCCIÓN TUMORAL INSUFICIENTE CON RT EXCLUSIVA

Pasos para que los linfocitos eliminen el tumor:

1. Paso del vaso sanguíneo al microambiente tumoral
2. Mantenimiento de las funciones efectoras
3. Formar sinapsis inmunológicas estables con sus dianas



Cortesía Dr. Illescas

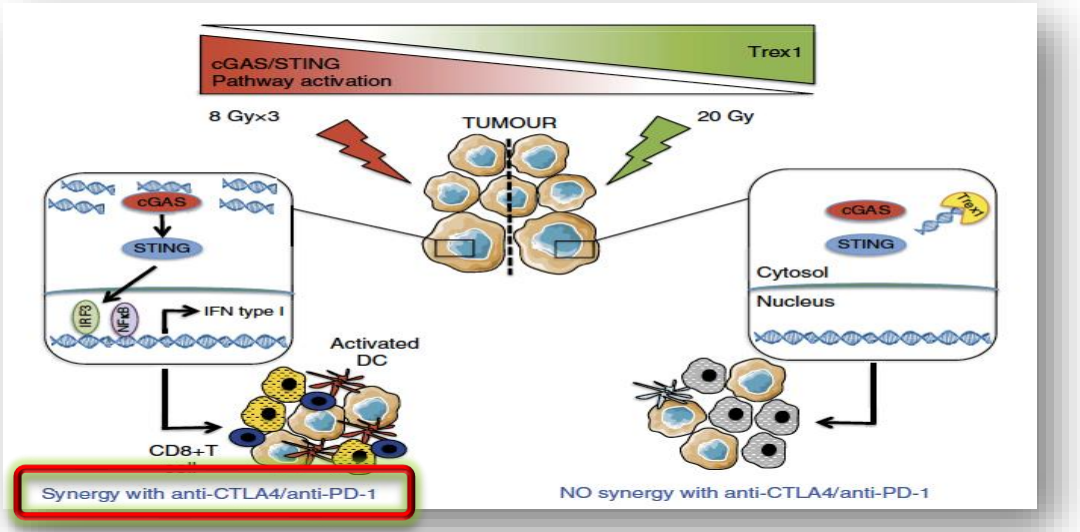
Boissonnas A et al. J Exp Med. 2007.
Breart B et al. J Clin Invest. 2008.

¿Dosis total? ¿Fraccionamiento?

- Low radiation doses seem to activate innate immune cells and fail to induce cell death:
  ➔*tumorigenic effect mediated by the cells of the immune microenvironment.* Coates 2008.

- A single dose ≥7.5Gy, but not lower than 5Gy, was immunostimulatory. Schaue 2012.

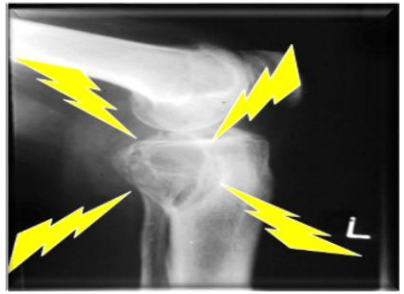
- In vivo labelling assays revealed that DCs require 48 hours to migrate to the LN. Frey 2012.



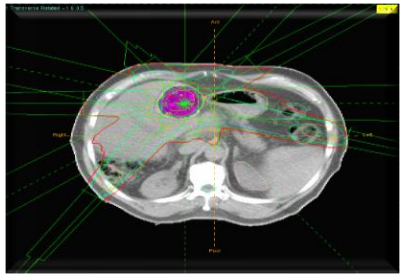
Claire Vanpouille-Box et al. Nature Com. 2017

¿Dónde?

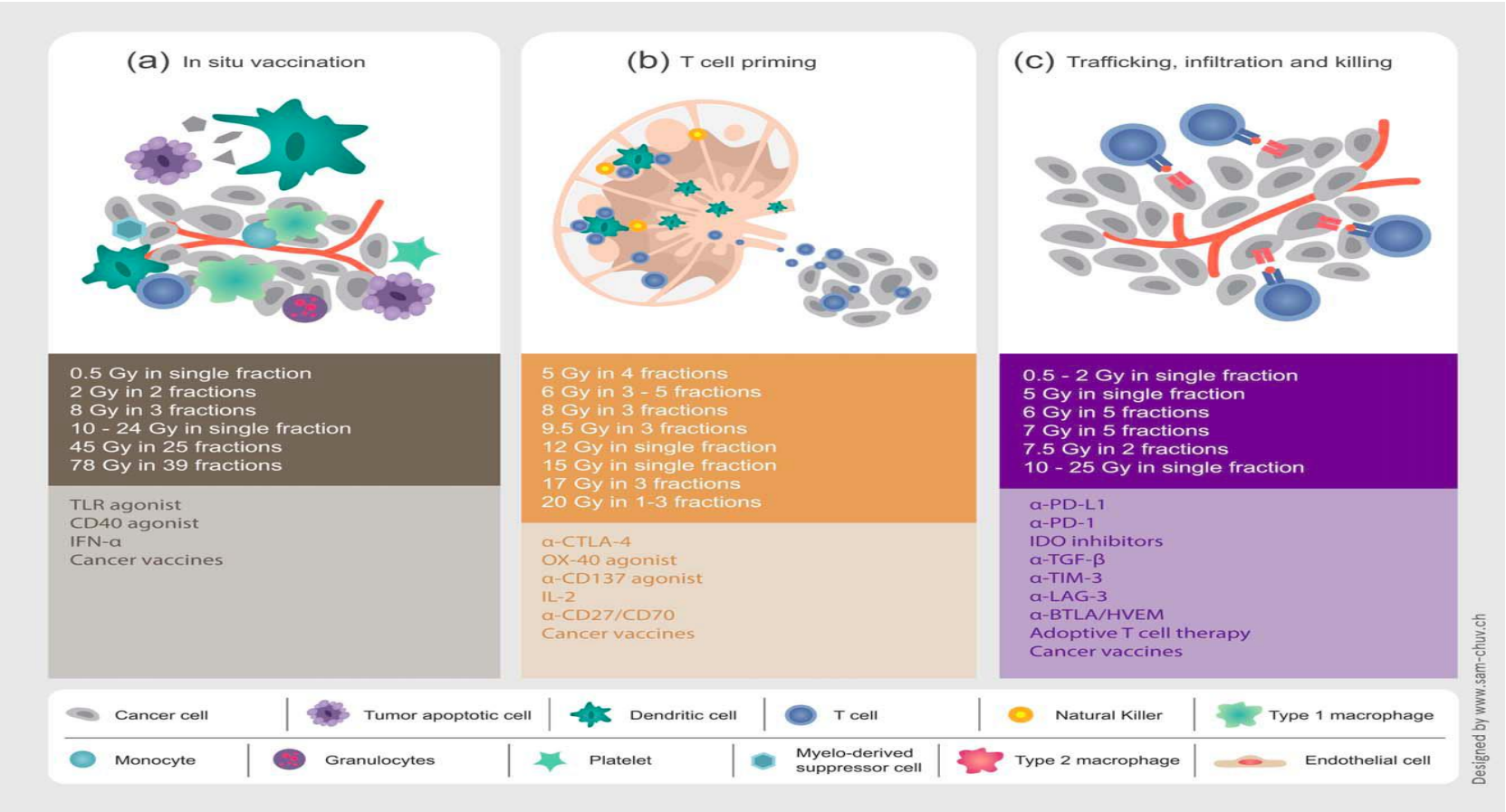
- Las lesiones óseas que hacen efecto abscopal tras RT son las que tienen una masa de partes blandas asociado *(el hueso tiene TGFβ y es una barrera anatómica)*.



- En muchos de los casos de efecto abscopal publicados se han irradiado metástasis viscerales.
  (Golden et al., Cancer Immunology Res. 2013)



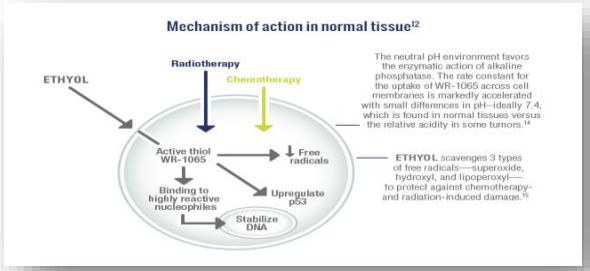
¿Mejor secuencia con fármacos?

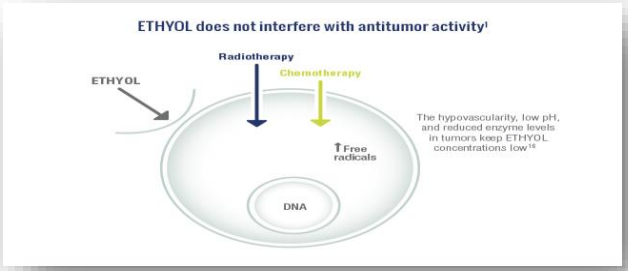


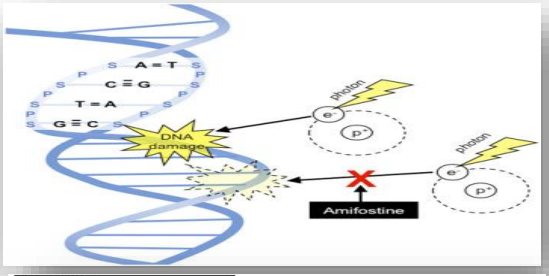
Herrera, Ca Cancer J Clin 2016

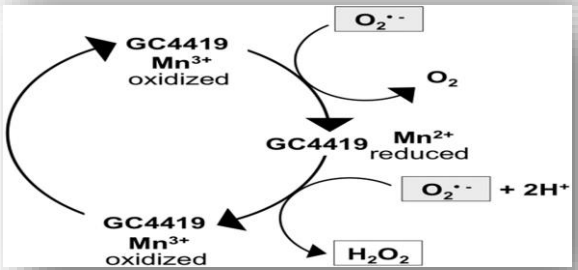
Combinación de fármacos

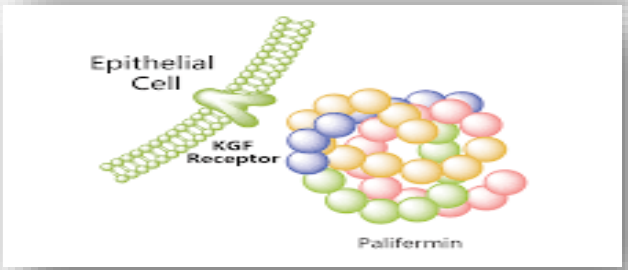
	Drug examples	Potential benefit of treatment	Trial status	Challenges
Radioprotection				
Reactive oxygen species	Amisfostine	Protect normal tissues from radiotherapy damage	Phase 2–3	Prove decreased toxic effects and increased therapeutic window
Reactive oxygen species	GC4419	Protect normal tissues from radiotherapy damage	Phase 2–3	Prove decreased toxic effects and increased therapeutic window

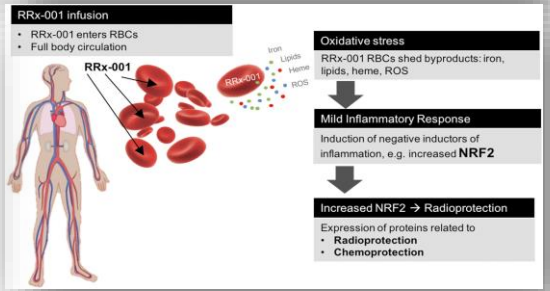








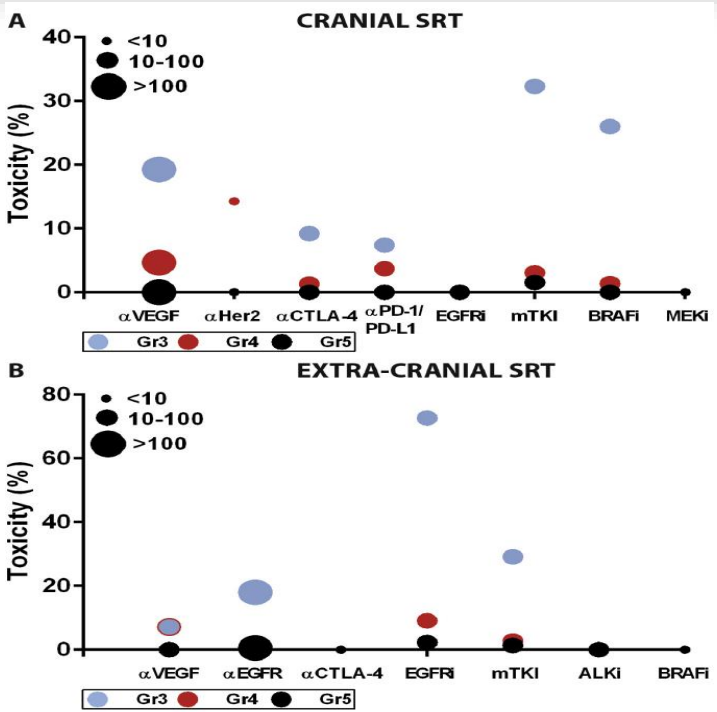


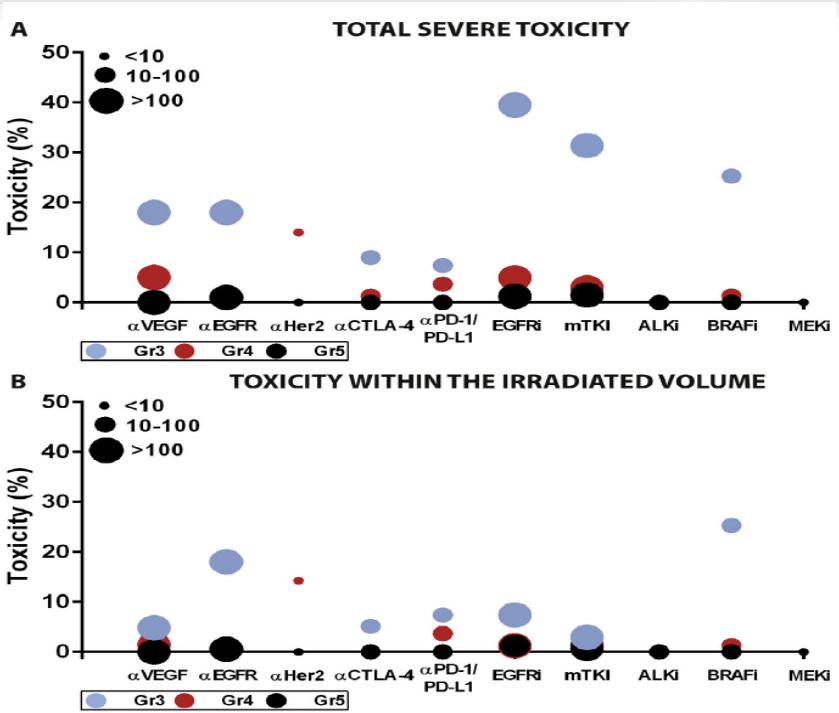


Systematic or Meta-analysis Studies

Toxicity of concurrent stereotactic radiotherapy and targeted therapy or immunotherapy: A systematic review

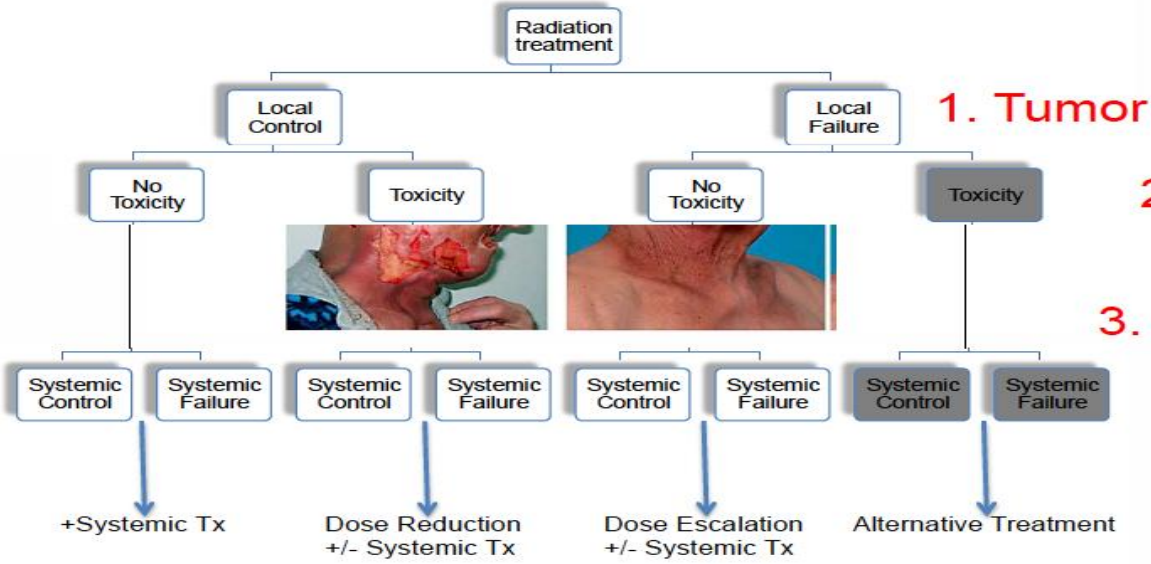
Stephanie G.C. Kroeze [a,*], Corinna Fritz [a], Morten Hoyer [b], Simon S. Lo [c], Umberto Ricardi [d], Arjun Sahgal [e], Rolf Stahel [f], Roger Stupp [f], Matthias Guckenberger [a]





Cancer Treatment Reviews 53 (2017) 25–37

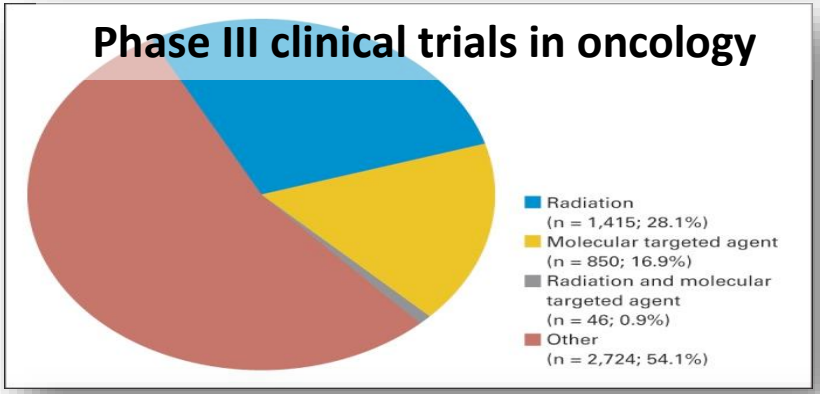
Retos de la Precisión Biológica



1. Tumor control
2. Toxicity
3. Immune/systemic response

Need 1+2+3 for successful biomarker

Carencia de Estudios y Biomarcadores



GLOBAL IMMUNOTHERAPY DRUGS MARKET ALL SET TO GROW EXPONENTIALLY DURING THE FORECAST PERIOD 2018 TO 2025

By Ashwini Kapadnis · January 22, 2019 · 28 · 0

FDA fast tracks Roche triple-negative breast cancer treatment

Nov 13, 2018

Print Email Tweet Share G+

Roche has announced that the U.S. Food and Drug Administration has granted priority review for Tecentriq (atezolizumab) plus chemotherapy (Abraxane) for the initial treatment of unresectable locally advanced or metastatic triple-negative breast cancer (TNBC) in people whose disease expresses the PD-L1 protein, as determined by PD-L1 biomarker testing. The FDA is expected to make a decision on approval by Mar. 12, 2019.

FDA U.S. FOOD & DRUG ADMINISTRATION AACR American Association for Cancer Research FINDING CURES TOGETHER™ ASTRO

FDA-AACR-ASTRO Clinical Development of Drug-Radiotherapy Combinations Workshop

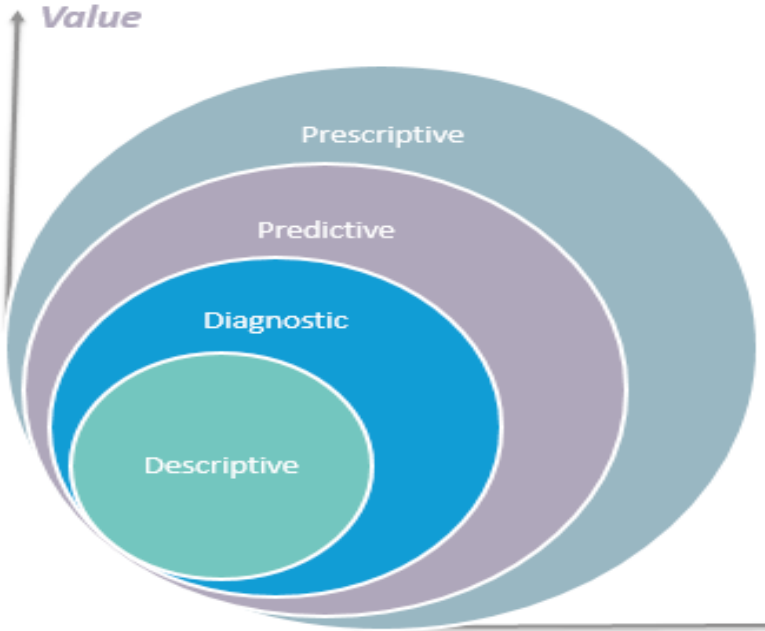
with support from Cancer Research UK Combinations Alliance

February 22-23, 2018 | Bethesda, MD

Amanda Walker, MD

Big Data & AI

4 types of Data Analytics



What is the data telling you?

Descriptive: ***What's happening in my business?***

- Comprehensive, accurate and live data
- Effective visualisation

Diagnostic: ***Why is it happening?***

- Ability to drill down to the root-cause
- Ability to isolate all confounding information

Predictive: ***What's likely to happen?***

- Business strategies have remained fairly consistent over time
- Historical patterns being used to predict specific outcomes using algorithms
- Decisions are automated using algorithms and technology

Prescriptive: ***What do I need to do?***

- Recommended actions and strategies based on champion / challenger testing strategy outcomes
- Applying advanced analytical techniques to make specific recommendations

Principa
www.principa.co.za

How Will Big Data Impact Clinical Decision Making and Precision Medicine in Radiation Therapy?

Ronald C. Chen, MD, MPH,* Peter E. Gabriel, MD, MSE,† Brian D. Kavanagh, MD, MPH,‡ and Todd R. McNutt, PhD§

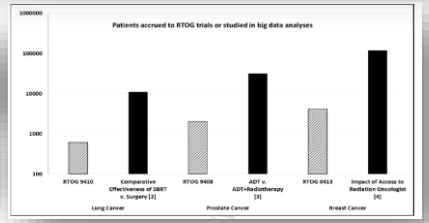
BD2K
Big Data to Knowledge

KGRT
Knowledge Guided RadioTherapy

	Observational Cohort ("Big Data")	Clinical Trial
Confounding	Disadvantage	Advantage
Detailed data elements	Disadvantage	Advantage
Sample size	Advantage	Disadvantage
Timely results	Advantage	Disadvantage
Generalizability	Advantage	Disadvantage

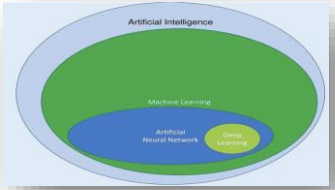
NIH NATIONAL CANCER INSTITUTE

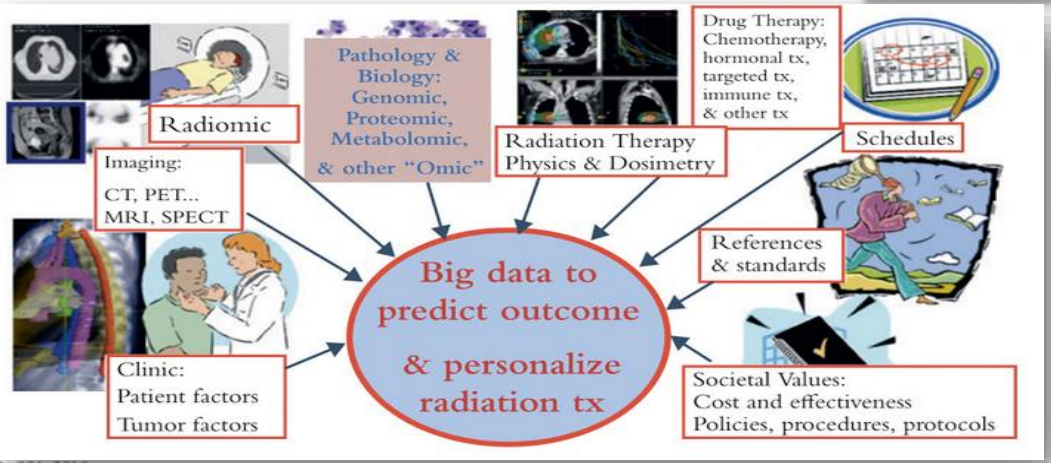
SEER

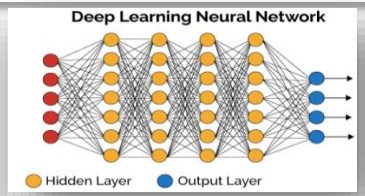


BIG DATA EN ONCO-RT

- ↑ N
- Rapidez análisis
- Tumores de baja incidencia/prevalencia
- Datos de "Práctica clínica"







Int J Radiation Oncol Biol Phys, Vol. 95, No. 3, pp. 880–884, 2016

Conclusiones

1. Los avances tecnológicos han permitido aumentar la **precisión física** de la radioterapia, aumentando las posibilidades de **control local** y **reduciendo la toxicidad.**

2. Los retos son:
   - ✓ **Adaptar la anatomía y la biología** durante el tratamiento.
   - ✓ **Adaptar la dosis** a cada paciente y a la respuesta (o no) al tratamiento.
   - ✓ Optimizar las **combinaciones de fármacos y radiación.**

3. La Clave:
   - ✓ **Ensayos clínicos** y **Biomarcadores.**
   - ✓ Nuevas tecnologías (**Big data & AI**).
   - ✓ **Abordaje y la cooperación multidisciplinar.**

GRACIAS

antoniojconde@gmail.com