SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF LOS ANGELES - COMPLEX

NC, A MINOR,

PLAINTIFF,

VS.

CASE NO. 21STCV22822

HAIN CELESTIAL GROUP, INC.; BEECH-NUT NUTRITION COMPANY; NURTURE, INC., PLUM, PBC, DBA PLUM ORGANICS; GERBER PRODUCTS COMPANY; WALMART, INC.; SPROUT FOODS, INC.; RALPHS GROCERY COMPANY; AND DOES 1 THROUGH 100, INCLUSIVE,

DEFENDANTS.

REPORTER'S TRANSCRIPT OF PROCEEDINGS

FEBRUARY 1, 2022

(DAY 2)

STENOGRAPHICALLY REPORTED BY:
JEANESE JOHNSON, CSR NO. 11635
OFFICIAL PRO TEMPORE

HELD BEFORE:

THE HONORABLE AMY D. HOGUE

A P P E A R A N C E S

(ALL APPEARANCES VIA REMOTE)

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ALSO PRESENT:

CHRISTOPHER CLEE, TECHNICIAN

IAN ANDRYSZAK, TECHNICIAN

I N D E X

WITNESS: BEATE RITZ, M.D., PH.D.

E X H I B I T S

LOS ANGELES, CALIFORNIA;

TUESDAY, FEBRUARY 1, 2022; 1:24 P.M.

BEFORE: HON. AMY D. HOGUE DEPARTMENT 7;

SUPERIOR COURT OF THE STATE OF CALIFORNIA

--OOO--

THE COURT: HELLO, IT'S JUDGE HOGUE SPEAKING.

CALLING THE NC MATTER.

MR. WISNER: YOUR HONOR, I'M HAVING A HARD TIME HEARING YOU.

MR. PETROSINELLI, ARE YOU HAVING A HARD TIME HEARING THE COURT?

THE COURT: MAYBE I'M NOT TALKING VERY LOUD.

CAN YOU HEAR ME BETTER NOW?

CAN YOU HEAR ME OKAY?

MR. PETROSINELLI: I CAN HEAR YOU FINE, JUDGE.

MR. WISNER: OKAY. THAT'S ON MY END. GIVE ME ONE SECOND, YOUR HONOR. LET ME JUST FIX THE TECH PROBLEM.

THE COURT: OKAY.

THE CLERK: YOUR HONOR, THIS IS THE CLERK. CAN YOU HEAR ME?

THE COURT: YES, I CAN.

THE CLERK: OH, GREAT.

(OFF-RECORD COMMENTS)

MR. WISNER: SO WE ARE READY TO PROCEED WHENEVER YOUR HONOR IS UNLESS THERE'S ANYTHING ELSE WE

NEED TO COVER.

THE COURT: I DON'T THINK SO.

YOU MAY PROCEED.

MR. WISNER: GREAT.

DR. RITZ, I THINK YOU'RE ON MUTE. LET'S GET YOU OFF MUTE. PERFECT.

THE WITNESS: NOW I AM.

DIRECT EXAMINATION (RESUMED)

MR. WISNER:

Q ALL RIGHT. DOCTOR, I JUST HAVE A FEW LAST THINGS I WANT TO COVER WITH YOU BEFORE WE HAND YOU OFF TO OPPOSING COUNSEL FOR EXAMINATION. AND I WANT TO COVER SOME THINGS THAT WERE SPECIFICALLY COVERED BEFORE YOU TOOK THE STAND.

SPECIFICALLY, I WANT TO SHOW YOU SOME THINGS THAT HAVE BEEN SAID ABOUT YOUR OPINIONS AND METHODOLOGY AND I WANT TO JUST GET THE RECORD STRAIGHT, IF THAT'S ACTUALLY WHAT YOU BELIEVE TO BE TRUE OR NOT OR WHATEVER JUST SO WE CAN GET IT CLEARED UP.

SO THE FIRST THING I'M GOING TO SHOW YOU IS THIS IS ACTUALLY A MOTION, DR. RITZ, THAT WAS FILED IN THIS CASE. AND ON PAGE 39 OF THIS MOTION, THE DEFENDANTS HERE AT THE VERY BOTTOM -- AND I'LL ZOOM IN SO YOU CAN SEE IT. CAN YOU SEE IT? I KNOW IT GETS A LITTLE FUZZY.

A YES, I CAN.

Q OKAY.

AND SO RIGHT HERE, IT SAYS, "BY DR. RITZ'S ACCOUNT, HOWEVER, CONSISTENCY REFERS NOT TO CONSISTENCY OF RESULTS, BUT THE CONSISTENCY WITH WHAT SHE BELIEVES THE ANSWER TO BE."

DO YOU SEE THAT?

A YES.

Q AND, DOCTOR, THIS IS IN THE CONTEXT OF A BRADFORD HILL ANALYSIS, AND I JUST -- LET ME JUST ASK YOU VERY PLAINLY: IS THAT HOW YOU APPLIED THE CONSISTENCY FACTOR IN YOUR ANALYSIS IN THIS CASE?

A ABSOLUTELY NOT. I DON'T HAVE BELIEFS. I MEAN, THIS IS SCIENCE. THIS IS NOT ABOUT BELIEFS. THE ONLY BELIEF WOULD COME IN IF I SAID, WELL, I BELIEVE THIS ABOUT THE STUDY AND I TRY NOT TO SPECULATE.

GENERALLY, CONSISTENCY MEANS I GO TO THE LITERATURE, I FIND OUT WHAT'S THERE, WHAT KIND OF FACTS, AND I COMPARE, YOU KNOW, EVERYTHING THAT COMES IN WITH WHAT I'VE ALREADY KNOWN THROUGH MY TRAINING. BUT THAT'S NOT A BELIEF. THAT'S EVALUATING OF SCIENTIFIC EVIDENCE AND MAKING SURE THAT THERE IS CONSISTENCY WITH WHAT THE STANDARDS ARE, WHAT MY SCIENCE TAUGHT ME TO LOOK OUT FOR.

THAT'S THE KIND OF CONSISTENCY I'M LOOKING FOR, THE CONSISTENCY IN THE SCIENTIFIC REASONING.

Q DOCTOR, I JUST WANT TO MAKE SURE.

IS ANYONE ELSE HAVING HER BREAK UP A LITTLE BIT IN HER ANSWER, OR ARE YOU GUYS ALL HEARING IT CLEAN?

THE COURT: I COULD HEAR HER FINE.

MR. WISNER: OKAY. SO I'LL JUST CONTINUE, THEN. GREAT.

Q ALL RIGHT. DOCTOR, I WANT TO SHOW YOU A SLIDE THAT WAS SHOWN TO THE COURT DURING THE OPENING STATEMENT YESTERDAY BY THE DEFENDANTS.

AND THERE'S A QUOTE HERE FROM A DEPOSITION.

IT SAYS, "YOU SAY IT IS CONSISTENT WITH THE EXPECTATION WITH RESPECT TO WHAT I THINK THE ANSWER SHOULD BE. IF THE STUDY HAD BEEN DONE CORRECTLY OR IF THE STUDY HAD BEEN DONE UNBIASSED OR WHAT I KNOW FROM MECHANISMS, WHAT I KNOW ABOUT THIS POPULATION, WHAT I KNOW ABOUT THE EXPOSURE LEVEL, WHAT I KNOW ABOUT CO-EXPOSURES AND WHAT I WOULD EXPECT TO SEE GIVEN THE SIZE OF THE COHORTS, THE SIZE OF THE STUDY."

DO YOU SEE THAT, DOCTOR?

A YES.

Q THEN DOWN HERE THERE'S A CITATION TO YOUR DEPOSITION AT PAGE 133.

DO YOU SEE THAT?

A YES.

Q LET'S TAKE A LOOK AT YOUR DEPOSITION.

AND I'LL GO TO PAGE 133 AND I'LL BLOW THIS UP SO WE CAN ALL SEE IT HERE.

AND ACTUALLY THE QUOTE THAT I JUST READ TO YOU IS ACTUALLY FROM PAGE 134, STARTING ON LINE 5.

DO YOU SEE THIS AREA RIGHT HERE, DOCTOR?

A YES, I DO.

Q OKAY.

BUT I WANT TO GO OVER WHAT WAS SAID BEFORE THIS IS WHAT YOU SAID TO PUT THIS INTO CONTEXT.

SO ON THE PRIOR PAGE THE QUESTION WAS PUT TO THIS: WELL, IT ACTUALLY STARTS ON AN EARLIER PAGE.

IT SAYS, "OKAY, LET'S ASK THIS QUESTION: DID THE NULL STUDIES THAT WE JUST TALKED ABOUT OF ABDULLAH AND DOHERTY AND I THINK WE TALKED ABOUT BEFORE SKOGHEIM, DO THEY SUPPORT YOUR OPINION THAT THE CONSISTENCY CRITERION OF THE BRADFORD HILL FACTORS WERE MET FOR 11 ASD?"

AND THEN I OBJECTED. THERE HAD BEEN A BUNCH OF OBJECTIONS PRIOR TO THIS.

AND THEN FINALLY YOU RESPOND: "CONSISTENCY IS A BROADER TERM IN THE BRADFORD HILL AS IT WOULD MEAN, WELL, WHAT IS THE EXPECTATION, RIGHT? IS IT CONSISTENT WITH MY EXPECTATION OF THIS HYPOTHESIS?"

AND THEN YOU SAY RIGHT HERE: "IF I SEE A NEGATIVE ASSOCIATION, IT WOULD DEFINITELY NOT BE CONSISTENT WITH ANYTHING ELSE."

DO YOU SEE THAT?

A YES.

Q AND YOU GO ON.

"I KNOW ABOUT METALS OF THIS TYPE IN THE LITERATURE AND ANIMAL STUDIES AND MECHANISTIC STUDIES, ALL OF THOSE HAVE SHOWN THAT THESE

METALS ARE NEUROTOXIC, SO I WOULD DEFINITELY NOT EXPECT TO SEE A NEGATIVE RESULT IN TERMS OF -- SO THEN I HAVE A STUDY THAT ACTUALLY SHOWS A NEGATIVE ASSOCIATION OR NO ASSOCIATION AND THEN I HAVE A STUDY -- STUDIES WHO SHOW POSITIVE ASSOCIATIONS."

AND THEN YOU SAY, "I LOOK AT ALL OF THEM AND I'M SAYING, WELL, IS THIS CONSISTENT? NOT, OH, ONE NEGATIVE, ONE NULL, TWO POSITIVES MAY BE NULL OR SOMEWHERE NEXT TO NULL, NO, THAT'S NOT WHAT YOU DO."

THEN THERE'S THAT QUOTE.

AND THEN YOU WENT ON TO SAY, "AND THAT IS CONSISTENCY IN A SCIENTIFIC WAY. IT IS NOT CONSISTENCY CHECKMARK ONE STUDY, YES, ONE STUDY NO, ONE STUDY NULL, THAT IS SIMPLISTIC AND THAT'S NOT SCIENCE."

THEN MR. PETROSINELLI ASKED YOU: "WHAT YOU JUST EXPLAINED IS THE WAY THAT YOU UNDERSTAND THE BRADFORD HILL CRITERION RE CONSISTENCY."

AND YOU SAY, "THAT IT IS CONSISTENT WITH THE EXPECTATION OF WHAT SCIENCE HAS TO SAY ABOUT THE DATA AND WHAT THE MEASURES THAT EACH OF THE STUDIES ARE USING ARE ACTUALLY TELLING ME AS A SCIENTIST, AND I'M NOT YOU, YOU KNOW, OTHERWISE YOU COULD DO A COMPUTER ANALYSIS. I COULD SAY OKAY, COMPUTER COUNT ONE, COUNT TWO, COUNT THREE AND THEN WE TOOK AN AVERAGE. THAT'S NOT

HOW I DO MY ANALYSIS AND NOBODY HAS RECOMMENDED THAT."

AND THEN MR. PETROSINELLI RESPONDED, "PERFECT."

DO YOU SEE THAT?

A YES.

Q ALL RIGHT.

SO I JUST WANT TO BE CLEAR, THAT QUOTE THAT THE COURT -- THAT THEY WERE SHOWING THE COURT YESTERDAY MORNING TRYING TO MAKE IT SEEM LIKE YOUR VIEW OF CONSISTENCY IS, "DOES IT MATCH WHAT I EXPECT THE RESULTS TO BE," CAN YOU PLEASE EXPLAIN WHAT YOU ACTUALLY SAID AT YOUR DEPOSITION AND WHAT YOU DID HERE.

A WELL, THE EXPECTATION IS ACTUALLY A SCIENTIFIC TERM. WE EVEN HAVE MEASURES WHERE WE CALCULATE THE OBSERVED NUMBER OVER THE EXPECTED AND THAT'S CALLED AN SMR IN OUR SCIENCE. AND WE GENERATE THE EXPECTED FROM THE UNEXPOSED GROUP, SO HOW MANY CANCERS DO I EXPECT IF THE EXPOSURE WOULD NOT EXIST AND I USE A POPULATION IN WHOM THE EXPOSURE DOESN'T EXIST, THAT GIVES ME MY RATE. THAT'S THE EXPECTED NUMBER I GET.

THEN I COUNT THE NUMBER OF CASES THAT WE OBSERVE UNDER EXPOSURE, AND WE COMPARE THE OBSERVED TO THE EXPECTED, SO THAT'S THE WAY I SEE EXPECTATION. IT'S A VERY SCIENTIFIC WAY. IT'S A WAY IN WHICH WE MAKE SURE THAT WE, YOU KNOW, USE SCIENTIFIC METHODS, ACTUALLY, AND FORMULATE THE METHODS THAT WE ARE USING TO GENERATE THE EXPECTED NUMBER AND THEN DEFEND THAT.

SO IT'S NOT MY OPINION. IT'S ACTUALLY THE WAY

THAT SCIENCE WORKS.

Q NOW, IN THE OPENING STATEMENT, THE COURT WAS ALSO SHOWN THIS SLIDE WHICH CONTAINED QUOTES FROM VARIOUS STUDIES, THE FIRST ONE BEING SKOGHEIM, 2021.

DO YOU SEE THAT?

A YES.

Q AND THIS WAS IN THE CONTEXT OF SAYING THAT, YOU KNOW, THERE'S INCONSISTENT RESULTS AND THAT THE STUDIES THEMSELVES ARE SAYING THERE'S A LACK OF CONSISTENCY.

NOW, I'D LIKE TO SHOW YOU THE SKOGHEIM PAPER.

SO I'M SHOWING YOU HERE, THIS IS EXHIBIT 119 IN THE RECORD, AND DO YOU SEE THAT THIS IS IN FACT A COPY OF THE SKOGHEIM PAPER, DOCTOR?

A YES, I SEE IT.

Q OKAY.

AND FIRST, THIS WAS A STUDY THAT WAS LOOKING AT PRENATAL EXPOSURES, NOT POST-NATAL; IS THAT RIGHT?

A CORRECT.

Q WHAT, IF ANY, RELEVANCE DOES THAT HAVE TO YOUR ANALYSIS?

A WELL, IT'S ALWAYS IMPORTANT TO LOOK AT EVERY SINGLE SENSITIVE PERIOD IN NEURODEVELOPMENT, AND PRENATAL EXPOSURES ARE OF COURSE CAPTURING A VERY SENSITIVE PERIOD, BUT ANY KIND OF PRENATAL STUDY, YOU HAVE TO BE, AS I TRIED TO EXPLAIN YESTERDAY, QUITE CAREFUL. I'VE DONE LOTS OF PRENATAL EXPOSURE STUDIES. THAT'S WHAT I ACTUALLY HAVE BEEN DOING FOR MORE THAN 20 YEARS IS MOSTLY LOOK AT THE PRENATAL EXPOSURES IN A LOT

OF WAYS. AND THERE ARE VERY SENSITIVE WINDOWS IN THE PRENATAL TIME, BUT THERE ARE SO-CALLED "POSSIBLE PARADOXICAL RESULTS YOU CAN GET WHERE ACTUALLY THE DOSE RESPONSE RELATIONSHIP DOESN'T LOOK LINEAR ALL. IT COULD LOOK -- IT COULD HAVE SOME WEIRD SHAPE.

AND THAT WEIRD SHAPE COMES ABOUT BECAUSE YOU'RE HITTING A FETUS AT CERTAIN VULNERABLE STAGES IN THEIR DEVELOPMENT AND YOU'RE NOT JUST PITTING ONE PART OF THE BRAIN OR, YOU KNOW, ONE PART OF THIS DEVELOPING CHILD, NO, YOU'RE HITTING THE WHOLE ORGANISM, AND SOME CHILDREN MAY NOT TAKE THE SAME AMOUNT OF TOXIC AGENTS IN THE WAY THAT OTHERS WOULD AND WE ACTUALLY GET A LOT OF ABORTIONS OR STILLBIRTHS; ACTUALLY LEAD HAS BEEN ASSOCIATED WITH STILL BIRTHS AND FETAL LOSS.

SO WE WOULD BE WORRIED THAT ACTUALLY AT VERY HIGH LEVELS OF EXPOSURE WE MIGHT SEE A DROP IN THE RATE OF CHILDREN WHO DEVELOP ADVERSE EFFECTS AFTER BIRTH AND I EXPLAINED THAT AS THE LIVE BIRTH BIAS.

HOWEVER, AT OTHER PARTS OF THE EXPOSURE SPECTRUM, YOU MIGHT EXACTLY SEE WHAT YOU WOULD EXPECT FOR THAT DEVELOPMENTAL PERIOD WHERE THE BRAIN IS, IT COULD BE BIRTH DEFECTS OF THE BRAIN IN THE FIRST TRIMESTER, IT COULD BE MAJOR FUNCTIONS THAT ARE AFFECTED IN THE SECOND TRIMESTER AND THEN MORE SYNAPTIC TYPE FUNCTIONS LIKE WHAT WE SEE IN AUTISM WHEN YOU GET LATER IN PREGNANCY.

SO I WOULD NEVER DISCOUNT ANY OF THESE STUDIES, BUT I NEED TO LOOK AT THEM WITH WHAT I KNOW ABOUT FETAL

DEVELOPMENT.

Q IN THE STUDY IN THE INTRODUCTION OF THE PAPER, THEY QUOTED THIS SECTION RIGHT HERE THAT SAYS, "ALL TOGETHER, THERE'S STILL LIMITED KNOWLEDGE ON PRENATAL EXPOSURE TO METALS OR VARIATIONS OF MATERNAL LEVELS OF ESSENTIAL ELEMENTS IN CLINICIAN-BASED ASD AND ADHD DIAGNOSIS IN CHILDHOOD. IN ADDITION, THERE ARE INCONSISTENCIES REGARDING STUDY DESIGNS AND FINDINGS."

DO YOU SEE THAT?

A YES.

Q NOW, IF YOU NOTICE THIS IS RIGHT IN THE INTRODUCTION PORTION.

DO YOU SEE THAT?

A YES.

Q NOW, WHEN AN AUTHOR IS IN THE PROCESS OF DISPLAYING -- AND THIS WAS RAISED IN THE BRIEFING, SO I KIND OF WANT TO FLUSH THIS OUT A LITTLE BIT -- VERY OFTEN IN THE PUBLISHED STUDIES, DO AUTHORS SET THE STAGE FOR WHY THEIR PAPER IS RELEVANT?

A WELL, THAT'S ACTUALLY HOW WE TEACH OUR STUDENTS TO DO IT WHEN THEY START WRITING THEIR FIRST PAPERS, AND OF COURSE WHAT WE DO WHEN WE WRITE THESE PAPERS, AND I'VE WRITTEN ABOUT 400 BY NOW, WE SET UP THE STAGE. AND ONE WAY YOU SET UP THE STAGE FOR YOUR PAPER IS BY BRIEFLY REVIEWING THE RELEVANCE OF THE SUBJECT MATTER AND THEN OUTLINING WHERE THE GAPS ARE.

AND WHEN YOU HAVE CERTAIN AUTHORS PREFER -- THERE ARE DIFFERENT PREFERENCES OF HOW TO DO THAT. I GENERALLY LIKE TO TELL MY STUDENTS THAT THEY SHOULD NOT SAY WE DON'T KNOW MUCH BECAUSE WE MIGHT KNOW A LOT, BUT WE MIGHT NOT KNOW CERTAIN THINGS AND THAT'S WHY WE ARE DOING THIS STUDY, WE ARE FILLING THIS GAP. BUT SOME AUTHORS PREFER TO SAY, WELL, THEY HAVE A LOT OF INCONSISTENCY AND WE ARE NOW GOING TO CONDUCT A STUDY THAT WILL GIVE YOU THE END-ALL OF, YOU KNOW, KNOWLEDGE THAT WILL HELP YOU GO BEYOND THE INCONSISTENCY.

NO ONE STUDY EVER DOES THAT, SO USUALLY RECOMMEND NOT TO SAY THAT, BUT I DO SEE THAT.

Q OKAY.

SO THEN IN THE ACTUAL DISCUSSION IF YOU GO INTO THE PAPER, THERE'S A SECTION ABOUT LEAD.

IS THIS HARD TO READ? PROBABLY IS. I'LL BREAK IT UP.

A YEAH.

Q SO IT STARTS OFF BY SAYING, "LEAD IS ANOTHER WELL-KNOWN DEVELOPMENTAL NEUROTOXICANT WITH NO KNOWN SAFE LEVELS OF EXPOSURE FOR NEURODEVELOPMENT."

DOCTOR, THAT'S SOMETHING THAT YOU'VE AGREED AND TESTIFIED ABOUT ALREADY?

A YES.

Q AND THEN IT TALKS ABOUT, "WE IDENTIFIED A NON LINEAR U SHAPED ASSOCIATION WITH PRENATAL LEAD EXPOSURE IN ASD."

DO YOU SEE THAT?

A YES.

Q THEN THAT WAS, AGAIN, THAT U SHAPE IS THAT EXACTLY WHAT YOU WERE TALKING ABOUT WHERE LOWER LEVELS AND REALLY HIGH LEVELS MIGHT SHOW UP, BUT MAYBE THE MIDDLE LEVELS DON'T; RIGHT?

A YES.

Q AND THEN AT THE BOTTOM PART OF IT, IT GOES REGARDING -- "WE ALSO DETECTED INCREASED RISK AT HIGHER LEVELS OF LEAD WHICH IS IN LINE WITH THE LITERATURE ALTHOUGH PROSPECTIVE STUDIES ARE LACKING WHEN IT COMES TO PRENATAL LEAD EXPOSURE IN ASD."

DO YOU SEE THAT?

A YES.

Q SO WHEN THEY SAY THIS IS IN LINE WITH THE LITERATURE BUT THERE'S A LACK OF PROSPECTIVE DATA IN PRENATAL LEAD EXPOSURE, WHAT DOES THAT TELL YOU AS A EPIDEMIOLOGIST READING THIS?

A SO THAT MEANS THERE'S QUITE A BIT OF LITERATURE OUT THERE ON LEAD AND ASD, BUT IT'S PROBABLY FOR THE POST-NATAL PERIOD AND FOR THE PRENATAL PERIOD WE WISH WE HAD MORE PROSPECTIVE STUDIES.

AND THAT'S HOW YOU WOULD ARGUE IN ORDER TO TELL THE READER PLEASE PAY ATTENTION TO MY STUDY BECAUSE WE ARE ONE OF THE FEW THAT ACTUALLY DOES WHAT IS MISSING. THAT'S EMPHASIZING THE GAP THAT YOU'RE FILLING.

Q AND THEN IN THE CON -- OH, SORRY, I'M HAVING

AUDIO PROBLEMS SO IF I INTERRUPT YOU IT'S BECAUSE I THINK YOU'RE DONE AND YOU'RE NOT AND I APOLOGIZE.

A YEAH.

Q IT SAYS RIGHT HERE IN THE FINAL CONCLUSION, "RESULTS FROM THE PRESENT STUDY SHOW SEVERAL ASSOCIATIONS BETWEEN LEVELS OF METALS AND ELEMENTS DURING GESTATION AND ASD AND ADHD IN CHILDREN. THE MOST NOTABLE ONES INVOLVE ARSENIC, CADMIUM, COPPER, MERCURY, MANGANESE, MAGNESIUM AND LEAD. THE MEASURE OF BLOOD LEVELS OF TOXIC LEVELS WERE IN LINE WITH PREVIOUS STUDIES OF PREGNANT WOMEN IN NORWAY AND OTHER EUROPEAN COUNTRIES."

DO YOU SEE THAT?

A YES.

Q AND WHEN YOU -- WHEN YOU'RE SAYING THAT YOURS -- AND IT GOES ON TO SAY: "INDICATING THAT EVEN POPULATION LEVELS OF THESE COMPOUNDS MAY HAVE NEGATIVE IMPACT ON NEURODEVELOPMENT."

DO YOU SEE THAT?

A YES.

Q WHEN AN AUTHOR SAYS IT'S THIS LINE WITH OTHER STUDIES, PREVIOUS STUDIES, IS THAT ESSENTIALLY SAYING IT'S CONSISTENT?

A YES, THAT'S WHAT THEY ARE SAYING.

IT'S CONSISTENT WITH WHAT THEY EXPECT GIVEN THE LITERATURE.

Q OKAY.

WE ALREADY TALKED ABOUT THE ARORA STUDY AND I DON'T WANT TO SPEND TOO MUCH TIME THIS MORNING, I WANT TO HAND YOU OVER TO OPPOSING COUNSEL, BUT LET'S QUICKLY TAKE A LOOK AT THE WANG STUDY.

AGAIN, THEY HERE HAVE A QUOTE, "DUE TO THE LACK OF CONSISTENCY AMONG THE VARIOUS STUDY FINDINGS THE EFFECTS OF INORGANIC ARSENIC AND LEAD ON ASD HAVE NOT BEEN ESTABLISHED."

DO YOU SEE THAT?

A YES.

Q ALL RIGHT. SO WE GO TO THE WANG STUDY.

WHERE THIS IS REFERRING TO IS, AGAIN, A QUOTE FROM THE INTRODUCTION RIGHT HERE.

DO YOU SEE THAT QUOTE?

A YES.

Q OKAY. AND AGAIN, AND THEN THESE KIND OF STATEMENTS IN THE INTRODUCTION, THEY ARE SETTING THE STAGE FOR THE PUBLICATION AS WE DISCUSSED WITH THE SKOGHEIM PAPER; RIGHT?

A CORRECT. YES, THAT'S WHAT THE PURPOSE IS.

Q SORRY.

NOW, DOCTOR, I KNOW YOU REVIEWED THE WANG STUDY AND I KNOW YOU HAVE OPINIONS ABOUT IT.

GENERALLY, DO YOU THINK THAT THESE AUTHORS DID A GOOD JOB WITH WHAT THEY PURPORT TO CLAIM IS A META ANALYSIS?

A NO, THEY ACTUALLY DID NOT CONDUCT A META ANALYSIS. THEY CONDUCT WHAT WE USUALLY REFER TO AS A

POOLED ANALYSIS. AND TO DO THAT IN THIS CONTEXT IS ACTUALLY RATHER STRANGE BECAUSE YOU ARE POOLING MEANS, YOU'RE USING THE DATA AND YOU ARE JUST COMBINING ALL CASES, ALL CASE DATA TOGETHER AND ALL CONTROL DATA TOGETHER ACROSS STUDIES. SO YOU ARE NOT COMPARING CASES AGAINST CONTROLS ANYMORE WITHIN A STUDY TO GENERATE A SUMMARY ESTIMATE FOR THE STUDY WITH ALL ITS PROBLEMS OR ALL ITS ADVANTAGES.

EACH STUDY ITSELF MAY HAVE ACTUALLY USED A LOT OF METHODOLOGIC APPROACHES THAT ARE SPECIFIC TO THE STUDY THAT ARE VERY IMPORTANT TO RETAIN BECAUSE THE CASES AND THE CONTROLS WERE TREATED IN EXACTLY THE SAME WAY. THAT'S NOT THE SAME WHEN YOU GO ACROSS STUDIES.

SO, FOR EXAMPLE, THE WAY THAT THE BLOOD LEAD WAS MEASURED MAY NOT -- WHICH LAB AND WHAT THE MINIMUM DETECTION LIMITS IN EACH LAB WERE ARE LIKELY DIFFERENT FROM STUDY TO STUDY, AND NOW YOU'RE BEHAVING AS IF THAT DOESN'T MAKE ANY DIFFERENCE, YOU CAN JUST SUMMARIZE ACROSS ALL CASES ACROSS ALL STUDIES AND ACROSS ALL CONTROLS ACROSS ALL STUDIES AND IGNORE ALL OF THESE METHODOLOGICAL DIFFERENCES.

AND THAT'S USUALLY NOT RECOMMENDED. THAT'S WHY WE DO META ANALYSES IN THESE CASES, NOT POOLED ANALYSES TO ACTUALLY PRESERVE THE SPECIFICS OF EACH STUDY IN TERMS OF THESE ISSUES SO THAT WE ARE NOT COMPARING APPLES AND ORANGES, BUT APPLES AND APPLES.

Q NOW, DOCTOR, IN THIS STUDY IT'S MY UNDERSTANDING THAT THE -- THAT THEY FOUND PRETTY

CONSISTENT ASSOCIATIONS WITH ARSENIC BUT INCONSISTENT RESULTS FOR DIFFERENT BIOMARKERS FOR LEAD; IS THAT RIGHT?

A THAT'S CORRECT.

Q AND THAT SORT OF NOT SEEING A RESULT IN A POOLED ANALYSIS IN LEAD, THEY SPECIFICALLY NOTED THAT THERE WAS HETEROGENEITY IN IT; IS THAT RIGHT?

A YES, YES. AND THAT'S THE OTHER PROBLEM WHEN, YOU KNOW, SOME HETEROGENEITY BETWEEN STUDY RESULTS MEANS THAT THERE ARE VERY BIG DIFFERENCES IN THE AMOUNT OF ASSOCIATION OR NOT ASSOCIATION THAT YOU'RE SEEING.

SO BASICALLY IT SAYS WE INCLUDE SOME STUDIES THAT DID NOT SEE DIFFERENCES BETWEEN CASES AND CONTROLS, OTHERS THAT DID PLUS STUDIES THAT MAY HAVE SHOWN THE OPPOSITE, BUT WE'RE INCLUDING THEM ALL. AND WHEN YOU HAVE A VERY HIGH MEASURE OF HETEROGENEITY IN A META ANALYSIS, THAT'S USUALLY APT TO TAKE CARE AND GIVE A WARNING TO THE READER BECAUSE IT MIGHT NOT BE APPROPRIATE TO SUMMARIZE ACROSS THESE STUDIES. THAT'S WHY WE USE THIS MEASURE TO GIVE US AN IDEA WHETHER IT'S APPROPRIATE OR NOT APPROPRIATE TO ACTUALLY GENERATE THE SUMMARY MEASURE.

WHAT WE TEACH AND WHAT I'VE BEEN TAUGHT IS THAT IN THIS CASE YOU'RE ACTUALLY LOOKING AT THESE STUDIES THAT HAVE MAYBE OPPOSITE RESULTS MUCH MORE DEEPLY AND YOU TRY TO UNDERSTAND WHY THEY CAME UP WITH OPPOSITE RESULTS.

IS A THERE A BIAS IN ONE STUDY OR THE OTHER?

DID THEY LOOK AT DIFFERENT TYPES OF POPULATIONS AT DIFFERENT TIME POINTS IN DEVELOPMENT? WHAT IS IT THAT REALLY GENERATES THIS OBVIOUS HETEROGENEITY AND YOU TRY TO UNDERSTAND SCIENTIFICALLY WHAT THAT MEANS AND NOT JUST GENERATE A SUMMARY ESTIMATE. AND BASICALLY BRUSHING OVER ALL THESE DIFFERENT DIFFERENCES ACROSS STUDIES.

MR. WISNER: OKAY. YOUR HONOR, COULD WE JUST HAVE A QUICK RECESS. I CAN'T HEAR HER RIGHT NOW. I'M HAVING REAL BAD AUDIO PROBLEMS. CAN YOU JUST GIVE ME TWO MINUTES TO FIX, I'M SORRY?

THE COURT: OF COURSE.

(OFF-RECORD COMMENTS)

MR. WISNER: ALL RIGHT.

Q WELL, DR. RITZ, SO IN THIS STUDY IT SAYS RIGHT HERE. "AFTER CONSIDERING" -- LET ME SHOW YOU RIGHT HERE. IT SAYS, "AFTER CONSIDERING STRENGTH AND LIMITATIONS OF THE BODY OF RESEARCH, WE HAVE CONCLUDED THAT THERE IS CONSISTENT EVIDENCE SUPPORTING A POSITIVE ASSOCIATION BETWEEN EARLY LIFE ARSENIC EXPOSURE AND DIAGNOSIS OF ASD AND INCONSISTENT EVIDENCE FOR LEAD EXPOSURE AND ASD."

DO YOU SEE THAT?

A YES.

Q NOW, IT'S REALLY INTERESTING. THAT IF YOU GO BACK TO THE CONCLUSION OF THIS STUDY, THE AUTHORS EXPLAIN THAT A LITTLE BIT MORE.

THEY SAY, "THE EVIDENCE TO SUPPORT A RELATIONSHIP -- FOR A RELATIONSHIP BETWEEN BODY EXPOSURE TO LEAD AND ASD IS NOT CONSISTENT, BUT OVERALL IT IS MORE SUPPORTIVE RATHER THAN AGAINST IT."

DO YOU SEE THAT?

A YES.

Q AND I GUESS YOU HAVE YOUR CRITICISMS OF WHY THE LEAD DATA IN THEIR META ANALYSIS OR POOL ANALYSIS DIDN'T SHOW A RESULT OR NOT.

BUT WHEN THEY STATE HERE THAT IT'S MORE SUPPORTIVE RATHER THAN AGAINST IT, I MEAN, IS THAT ANOTHER WAY OF SAYING THAT IT'S MORE LIKELY THAN NOT?

A YES, THAT'S EXACTLY WHAT THEY ARE SAYING, UM-HMM.

Q OKAY.

ALL RIGHT. DOCTOR, I WANT TO FINISH UP ON THE REVERSE CAUSATION ISSUE.

AND IN THE DEFENSE OPENING SLIDES, THEY HAD THIS DIAGRAM HERE DISCUSSING THE RESULTS OF THE ABDALLAH -- AL-AYADHI PAPER, AND THIS ISN'T RENDERING PROBABLY IT'S ACTUALLY IN THE ORIGINAL SLIDE IT SAYS IT UP THERE IN THE HEADER, BUT IT'S NOT SHOWING RIGHT NOW, BUT IT'S REFERRING TO THAT STUDY, OKAY, DOCTOR?

A YES.

Q AND THEY EXPLAIN HOW IN THAT STUDY THERE WAS MEASUREMENTS TAKEN ON AVERAGE AT 8.8 YEARS AND THAT CHILDREN ARE TYPICALLY, YOU KNOW, SYMPTOMATIC WITH ASD

AT 3, AND SO BETWEEN THIS PERIOD OF 3 AND 8.8 YEARS, THEY WERE ARGUING THAT THE LEAD BURDEN THAT YOU'RE SEEING IS REALLY A FUNCTION OF THESE THINGS THAT THEY HAVE HIGHLIGHTED HERE; PICA, DECREASED ABILITY TO METABOLIZE METAL AND NUTRITIONAL DEFECTS.

DO YOU SEE THAT?

A YES.

Q NOW, WE TALKED ABOUT PICA YESTERDAY. I DON'T WANT TO TALK ABOUT IT AGAIN.

BUT LET'S TALK BRIEFLY ABOUT DECREASED ABILITY TO METABOLIZE METALS, OKAY.

A UM-HMM.

Q IS THE DECREASED ABILITY TO METABOLIZE METAL IS THAT REVERSE CAUSATION, DOCTOR?

A NO, THAT'S JUST THE ABILITY OR NON ABILITY TO DEAL WITH WHAT COMES YOUR WAY. SO IF THERE WEREN'T ANY EXPOSURES, THEN THE ABILITY, THE GENETIC OR PHYSIOLOGIC ABILITY TO DEAL WITH THESE TOXINS WOULD BE IRRELEVANT, RIGHT. THE TOXINS ONLY MATTER WHEN THEY HIT A VULNERABLE ORGANISM. AND THIS JUST MEANS THERE'S A VULNERABLE ORGANISM AND WE ARE HITTING IT NOW.

Q THEY EVEN CITE TO THIS QUOTE FROM THE STUDY.

"THE POSSIBLE EXPLANATION FOR THE RESULT IS THAT AUTISTIC CHILDREN MIGHT LACK THE ABILITY TO DETOXIFY TOXINS RESULTING IN AN ACCUMULATION OF TOXIC SUBSTANCES IN THE BODY."

DO YOU SEE THAT?

A YES.

Q SORRY. IS IT BLURRY?
A YEAH, THERE ARE, YEAH.
Q YOU NOTICE RIGHT THERE IN THE QUOTE, THOUGH, THERE IS NO PERIOD.
DO YOU SEE THAT?
A YES, I DO.
Q SO I WENT AHEAD AND I ACTUALLY LOOKED UP THE ORIGINAL STUDY. THIS IS THE AL-AYADHI STUDY FROM 2005.
DO YOU SEE THAT?
A YES. AL-AYADHI.
Q THANK YOU. I'M NOT GOING TO SAY THAT CORRECTLY SO I WON'T EVEN TRY.
AND THEN WE HAVE HERE THAT PORTION THAT THEY QUOTED FROM. AND I'LL SHOW YOU THE PORTION THAT THEY HIGHLIGHTED -- THEY QUOTED, THEY SAID, IT'S A PORTION -- IT WAS RIGHT HERE.
"THE POSSIBLE EXPLANATION FOR THIS IS THAT AUTISTIC CHILDREN MIGHT LACK THE ABILITY TO DETOXIFY TOXINS RESULTING IN AN ACCUMULATION OF TOXIC SUBSTANCES SUBSTANCES IN BODY."
DO YOU SEE THAT THAT'S WHAT THEY QUOTED?
A YES.
Q I THINK WE SHOULD LOOK AT THE BEGINNING OF AND AT THE END OF IT AND THEN SEE HOW IT RELATES TO REVERSE CAUSATION.
THEY ACTUALLY START OFF BY TALKING ABOUT THE MOST LIKELY EXPLANATION THAT IS AS MENTIONED EARLIER:
"DUE TO EXPOSURE TO TOXIC METALS THROUGH

DRINKING WATER, COMBUSTION EMISSIONS, SOIL, PAINT CHIPS, FERTILIZER, FOOD, CAR EXHAUST, AND SO FORTH; HOWEVER, A QUESTION MIGHT BE RAISED CHILDREN WITH AUTISM SPECTRUM DISORDER ARE NOT THE ONLY CHILDREN EXPOSED TO THESE TOXIC HAZARDOUS CONDITIONS. NORMAL CHILDREN ARE ALSO EXPOSED. THE POSSIBLE EXPLANATION FOR THIS IS THAT AUTISTIC CHILDREN MIGHT LACK THE ABILITY TO DETOXIFY TOXINS RESULTING IN AN ACCUMULATION OF TOXIC SUBSTANCES IN THE BODY."

AND THEN IT GOES ON:

"AND LEADING TO ALTERATIONS IN BIOCHEMICAL PROCESSES TAKING PLACE IN THE BODY."

DO YOU SEE THAT?

A YES.

Q THAT SECOND PART, THE "LEADING TO ALTERATIONS IN THE BIOCHEMICAL PROCESS TAKING PLACE IN THE BODY" IS THAT BEING -- AND THE FACT THAT THESE TOXIC METALS ARE ACCUMULATING IN AUTISTIC CHILDREN, IS THAT A CASE FOR REVERSE CAUSATION OR A CASE FOR CAUSATION, DOCTOR?

A YEAH, IT'S A CAUSE FOR CUMULATIVE CAUSATION.

SO IT'S WHERE YOU, YOU KNOW, OVER TIME, THE BODY BECOMES MORE AND MORE VULNERABLE.

YOU COULD ARGUE WHY SHOULD THEY ALL OF A SUDDEN AT THE AGE OF THREE HAVE STARTED TO BE VULNERABLE AND NOT BEEN VULNERABLE BEFORE, RIGHT. SO BASICALLY IT'S -- IF WE BELIEVE THESE KIDS ARE MORE VULNERABLE AND DON'T DETOXIFY, THEY WOULD DO THAT AT ANY AGE SO THEY WOULD

HAVE ALREADY STARTED TO BE VULNERABLE AT BIRTH BECAUSE THEY CAN'T DETOXIFY TOXINS.

IF YOU NOW EXPOSE THEM TO TOXINS WELL, THEY CAN'T DETOXIFY, THEY ARE VULNERABLE, THEY HAVE THE REACTIONS -- THEIR BODY WILL HAVE THE REACTIONS THAT WE THEN SEE PLAY OUT IN THESE KIND OF SYMPTOMS.

Q ALL RIGHT. DOCTOR, I KNOW THERE'S BEEN SOME ALLEGATIONS THAT YOU HAVE -- THAT YOU VIEW THE BRADFORD HILL CRITERION AS BEING ARBITRARY.

LET ME JUST ASK YOU, DOCTOR, IS THAT EVEN REMOTELY TRUE?

A NO. IF -- I MEAN, IF WE WOULD -- IF WE WOULD THINK THEY ARE ARBITRARY, WE WOULDN'T BE USING THEM. THEY ARE THE OPPOSITE OF ARBITRARY. THEY ARE ACTUALLY GIVING US THE SCIENTIFIC GUIDE TO HOW WE CAN ARGUE ABOUT CAUSALITY AND STILL UNDERSTAND EACH OTHER, STILL USE FACTS, STILL USE SCIENTIFIC INSIGHT AND BE VERY TRANSPARENT ABOUT IT. THAT'S THE OPPOSITE OF ARBITRARY.

Q AND, DOCTOR, JUST TO WRAP THIS UP: DID YOU REACH A DEGREE TO A REASONABLE SCIENTIFIC CERTAINTY ABOUT WHETHER OR NOT EARLY LIFE EXPOSURE TO LEAD CAN CAUSE ASD AND OR ADHD?

A ABSOLUTELY. AND I'VE WRITTEN SO IN MY REPORT.

Q OKAY. AND THE SCIENTIFIC RIGOR WITH WHICH YOU ARRIVED AT THOSE OPINIONS, IS THAT THE SAME SCIENTIFIC RIGOR THAT YOU WOULD APPLY IN YOUR WORK AS AN EPIDEMIOLOGIST AS YOU HAVE FOR THE LAST FEW DECADES?

A ABSOLUTELY. I WOULDN'T DO ANYTHING ELSE.

Q SAME QUESTION FOR ARSENIC AND ASD.

DID YOU APPLY THE SAME PRINCIPLES AND METHODS THAT YOU USE IN YOUR REGULAR LIFE?

A I WOULDN'T KNOW HOW TO DO ANYTHING ELSE.

Q AND I GUESS IN THE LAST ONE, MERCURY AND ASD: DID YOU ALSO USE THE SAME SCIENTIFIC RIGOR?

A YES. YES AND I LOOKED VERY CLOSELY AT MERCURY.

Q THANK YOU.

MR. WISNER: AT THIS TIME, YOUR HONOR, I HAVE NO FURTHER QUESTIONS AND I PASS THE WITNESS.

THE COURT: OKAY. THANK YOU.

CROSS EXAMINATION.

MR. PETROSINELLI: THANK YOU, YOUR HONOR. MAY I PROCEED?

THE COURT: PLEASE.

CROSS EXAMINATION

MR. PETROSINELLI:

Q DR. RITZ, GOOD AFTERNOON. NICE TO SEE YOU AGAIN.

A HELLO.

Q LET ME JUST JUMP RIGHT TO YOUR BRADFORD HILL ANALYSIS.

THAT IS THE FRAMEWORK YOU USED TO REACH AN OPINION ON WHETHER OR NOT THE EXPOSURE TO HEAVY METALS COULD CAUSE ASD OR EXPOSURE TO LEAD COULD CAUSE ADHD; IS THAT CORRECT?

A YES.

Q AND THE BRADFORD HILL FRAMEWORK INCLUDES NINE FACTORS TO CONSIDER, DOES IT NOT?

A IT CON -- YES.

Q AND DO YOU AGREE THAT BEFORE APPLYING THE BRADFORD HILL FACTORS TO ASSESS CAUSATION, THERE MUST BE AN ASSOCIATION BETWEEN THE EXPOSURE AND THE OUTCOME THAT IS NOT EXPLAINED BY BIAS OR CONFOUNDING?

A I AM NOT SURE THAT I UNDERSTAND WHAT YOU MEAN, BUT BIAS AND CONFOUNDING IS WHAT I ALWAYS CONSIDER AND EVERY SCIENTIST IN MY AREA CONSIDERS, AND OF COURSE WE ARE LOOKING AT EVERY STUDY VERY CLOSELY IN TERMS OF BIAS AND CONFOUNDING.

BUT YOU CAN APPLY THE BRADFORD HILL CRITERIA WITHOUT EPIDEMIOLOGIC STUDIES. IT'S ACTUALLY DONE BY THE AGENCY ON RESEARCH OF CANCER ON AND AGAIN, AT IARH, THAT'S THE W-H-O ORGANIZATION THAT BRINGS OUT MONOGRAPHS ON CARCINOGENICITY AND THEY USE CAUSALITY BASED ON ANIMAL STUDIES AND MECHANISTIC STUDIES IF THERE ARE NO EPIDEMIOLOGIC STUDIES, BUT WHEN WE GO TO EPIDEMIOLOGIC STUDIES, YES, WE ARE ALWAYS CONSIDERING BIAS.

Q NOW, MY QUESTION PERHAPS, DOCTOR, I -- PERHAPS YOU DIDN'T HEAR ME, MY QUESTION WAS WHEN YOU'RE RELYING ON EPIDEMIOLOGICAL STUDIES, BEFORE YOU APPLY THE BRADFORD HILL FRAMEWORK, DON'T YOU HAVE TO BE SURE THERE IS AN ASSOCIATION THAT IS NOT EXPLAINED BY BIAS OR CONFOUNDING; CORRECT?

A I THINK IF YOU SAY IT THIS WAY, IT'S NOT CORRECT, NO. ABSOLUTELY NOT.

WE, AS EPIDEMIOLOGISTS, ARE LEARNING TO EVALUATE BIAS IN THE CONTEXT OF EVERY SINGLE STUDY WE LOOK AT. THERE IS NOT ONE STUDY IN THE WORLD THAT YOU CAN SHOW ME, NOT EVEN IN RCT, A RANDOMIZED CONTROL TRIAL, THAT IS COMPLETELY FREE OF BIAS.

IT IS A QUESTION OF DEGREE. HOW MUCH BIAS IS THERE AND IS THAT A BIAS THAT ACTUALLY MATTERS; MEANING, THAT THE EFFECT ESTIMATE I'M SEEING IS REALLY FAR AWAY FROM THE TRUTH, FROM THE UNDERLYING TRUE ASSOCIATION OR TRUE CAUSALITY, AND THAT WE EVALUATE IN EVERY ASPECT.

YOU WILL NEVER EVER FIND A STUDY IN THE WORLD THAT IS ABSOLUTELY FREE OF BIAS. AND IF YOU SHOW ME ONE, THEN YOU PROBABLY ARE DESERVING THE NOBLE PRIZE. IT DOESN'T EXIST.

WHAT WE DO AS SCIENTISTS IS WE AGREE THAT WE ARE LOOKING AT SCIENCE WITH A CRITICAL EYE, AND THE CRITICAL EYE IN MY SCIENCE MEANS WE HAVE TO BE VERY CAREFUL ABOUT ASSESSING BIASES. AND EVERY SINGLE STUDY HAS BIASES. BUT SOME BIASES ACTUALLY ALLEVIATE EACH OTHER.

FOR EXAMPLE, THE PRINCIPLE OF CONFOUNDING, IT IS AN OVERARCHING CONCEPT, BUT THERE ARE CONFOUNDERS THAT PULL THE ESTIMATE IN ONE DIRECTION AND THERE ARE CONFOUNDERS THAT PULL THE ESTIMATE IN THE OPPOSITE DIRECTION. ON AVERAGE THERE IS NO BIAS, OKAY, BUT THAT WHAT WE DO WHEN WE EVALUATE STUDIES, WE LOOK AT EVERY SINGLE ONE AND WE GO THROUGH ALL OF THE BIASES, AND THAT'S ACTUALLY THE CLASS I'M TEACHING CURRENTLY AT UCLA

IN BASIC METHODS HOW YOU DO THAT.

Q DOCTOR, THAT WAS A VERY LONG ANSWER.

I JUST ASKED -- IS YOUR ANSWER NO THAT YOU DO NOT BELIEVE -- AND IT'S FINE IF IT'S NO.

YOU DON'T BELIEVE -- LET ME STRIKE THAT.

YOU BELIEVE THAT YOU CAN APPLY THE BRADFORD HILL CRITERIA WITHOUT FIRST FINDING AN ASSOCIATION THAT IS NOT EXPLAINED BY BIAS OR CONFOUNDING; YES OR NO?

MR. WISNER: OBJECTION; ASKED AND ANSWERED AND, FRANKLY, IMPROPER HYPOTHETICAL.

THE WITNESS: I DON'T THINK I UNDERSTAND YOUR QUESTION. I TRIED TO EXPLAIN TO YOU.

MR. WISNER: DR. -- DR. RITZ.

THE WITNESS: OKAY.

THE COURT: JUST A MOMENT. JUST A MOMENT. I ACTUALLY THINK I DON'T UNDERSTAND THE QUESTION EITHER SO PERHAPS YOU WOULD REPHRASE IT JUST A LITTLE BIT.

MR. PETROSINELLI: I WILL.

Q BEFORE YOU APPLY A BRADFORD HILL ANALYSIS, THERE MUST BE AN ASSOCIATION BETWEEN AN EXPOSURE AND OUTCOME; YOU AGREE WITH THAT?

A IF YOU HAVE NO ASSOCIATION, WHAT ARE YOU EVALUATING? THAT'S WHAT I'M ASKING. YES, OF COURSE THERE HAS TO BE ASSOCIATIONS.

Q OKAY.

AND THEN MY -- SO THEN MY NEXT QUESTION IS BEFORE APPLYING A BRADFORD HILL ANALYSIS DOESN'T THERE HAVE TO BE AN ASSOCIATION THAT IS NOT EXPLAINED BY BIAS

OR CONFOUNDING IN THE STUDIES?

THAT'S MY QUESTION.

A THAT'S WHERE I THINK WE ARE NOT UNDERSTANDING EACH OTHER, BUT MAYBE IT'S ME, I CAN'T EXPLAIN IT WELL.

EVERY ASSOCIATION WE LOOK AT IN A STUDY IS MOST LIKELY INFLUENCED BY SOME KIND OF BIAS, BUT --

THE COURT: LET ME JUST INTERRUPT BECAUSE I THINK WE'RE GOING AROUND IN CIRCLES. I THINK THE PROBLEM IS THE NEGATIVE PHRASING OF THE QUESTION IS CONFUSING.

THE WITNESS: RIGHT.

MR. PETROSINELLI: WELL, LET ME TRY THIS, YOUR HONOR.

THE COURT: IF -- NO, GO AHEAD. SORRY.

MR. PETROSINELLI:

Q DO YOU AGREE -- I'LL MOVE ON -- DO YOU AGREE THAT BEFORE APPLYING BRADFORD HILL FACTORS, THERE MUST BE AN ASSOCIATION BETWEEN THE EXPOSURE AND THE OUTCOME THAT IS PERFECTLY CLEAR-CUT AND BEYOND WHAT WOULD BE EXPLAINED BY CHANCE?

A CHANCE IS A VERY DIFFERENT CONCEPT FROM BIAS. CHANCE IS A RANDOM CONCEPT OF IS THE STUDY BIG ENOUGH THAT, YOU KNOW, CHANCE DOES NOT EXPLAIN WHAT I'M SEEING?

BIAS IS A SYSTEMIC ERROR. CHANCE IS A RANDOM ERROR. SO THESE TWO CONCEPTS ARE COMPLETELY DIFFERENT FROM EACH OTHER.

IF YOU SAY CHANCE, THEN YES, IT'S -- WE HAVE STUDIES THAT ARE SO SMALL THAT THEY ARE NOT SHOWING AN

EFFECT AND EVERYTHING IS POSSIBLY RANDOM, THEN I DON'T HAVE TO APPLY BRADFORD HILL.

Q OKAY.

LET'S LOOK AT THE BRADFORD HILL FACTORS.

LET ME PULL UP EXHIBIT 679, WHICH IS A DEMONSTRATIVE THAT HAS THE NINE FACTORS.

GIVE ME ONE SECOND.

A OH, YOU'RE SHOWING ME?

Q YES SORRY.

A THANK YOU.

Q OKAY.

DOCTOR, THESE ON THE SCREEN, THESE ARE THE BRADFORD HILL CRITERIA; CORRECT?

A YES.

Q AND IN CONDUCTING A BRADFORD HILL ANALYSIS, THE SCIENTIST HAS TO CONSIDER ALL NINE OF THESE; CORRECT?

A WELL, WE CONSIDER ALL NINE OF THESE, BUT IF YOU READ BRADFORD HILL'S PAPER, IT SAYS THAT, YOU KNOW, IT'S NOT A CHECKLIST AT ALL, IT IS JUST A GUIDELINE OF HOW TO ARRIVE AT A CAUSAL REASONING AND OPINION.

SO IT COULD BE THAT ANY ONE OF THESE DOES NOT APPLY TO THE LITERATURE, BUT YOU STILL COME UP WITH A CAUSAL INFERENCE.

Q THE ONE BRADFORD HILL FACTOR THAT ABSOLUTELY MUST EXIST IN ORDER TO CONCLUDE THAT THE EXPOSURE TO A SUBSTANCE CAN CAUSE A DISEASE IS TEMPORALITY; CORRECT?

A IT DEPENDS ON WHAT YOU MEAN BY TEMPORALITY.

GENERALLY, YES. WHEN WE SAY CAUSAL, ARE YOU --

WHEN WE MAKE CAUSAL ARGUMENTS, WE WANT THE CAUSE TO PRECEDE THE EFFECT, THAT'S ABSOLUTELY CORRECT. HOW WE DO THAT IN OUR SCIENCE, HOWEVER, IS REALLY DEPENDENT ON WHAT WE'RE LOOKING AT, HOW DO WE ESTABLISH TEMPORALITY IS DIFFERENT FROM DOES IT EXIST OR NOT.

Q AND NO MATTER WHAT THE OTHER EIGHT BRADFORD HILL FACTORS WOULD SHOW, IF ONE CONCLUDES THAT TEMPORALITY IS NOT MET, THEN THERE CAN BE NO FINDING OF CAUSATION; CORRECT?

A I DON'T THINK I REALLY UNDERSTAND WHAT YOU MEAN BY THIS.

MEAN -- DOES IT MEAN THAT I CANNOT ESTABLISH TEMPORALITY AT ALL? OR THAT MY -- THAT I'M CONVINCED THAT THE EFFECT PRECEDED THE CAUSE?

Q LET'S TRY THE LATTER. LET'S TRY BOTH OF THOSE.

IF YOU -- WELL, MY QUESTION REALLY WAS THE SECOND ONE.

IF YOU CONCLUDE THAT TEMPORALITY CANNOT BE MET NO MATTER WHAT THE OTHER EIGHT FACTORS SHOW, YOU CANNOT CONCLUDE CAUSATION; CORRECT?

A WELL, IF I CAN -- IF I CAN CLEARLY SHOW THAT THE EFFECT PRECEDED THE CAUSE, YES, THEN I WOULD SAY THERE'S NO CAUSALITY.

Q ALL RIGHT.

LET ME TALK ABOUT A COUPLE OF THESE FACTORS BEFORE WE TALK ABOUT TEMPORALITY IN A LITTLE MORE DETAIL.

ONE OF THE FACTORS IS SPECIFICITY; IS THAT

RIGHT?

A YES, I SEE IT.

Q AND SPECIFICITY, THAT FACTOR MEANS THAT THE EXPOSURE TO THE SUBSTANCE IS ASSOCIATED WITH A SPECIFIC HEALTH OUTCOME; CORRECT?

A THAT'S GENERALLY HOW IT'S SEEN, YES.

Q AND IF THAT'S TRUE, IF THERE IS SPECIFICITY, THEN IT'S MORE LIKELY THAT THERE'S A CAUSAL RELATIONSHIP; CORRECT?

A NO, IT'S JUST ONE OF THE CRITERIA AND ACTUALLY ONE OF THE CRITERIA THAT IS A LITTLE BIT UNFORTUNATE BECAUSE WE KNOW THAT IT'S NOT CORRECT FOR MOST TOXIC AGENTS BECAUSE THEY ARE DIRTY, THEY ARE DIRTY CHEMICALS.

SO, FOR EXAMPLE, IF YOU SAID SMOKING COULD ONLY CAUSE LUNG CANCER AND THAT'S SPECIFIC, RIGHT, ONLY ONE TYPE OF LUNG CANCER, AND IF THAT'S ALL YOU WOULD EVER PRESUME, THEN WE WOULD SAY, WELL, THEN, YOU KNOW, WE CAN'T CLAIM THAT SMOKING IS A CAUSE OF LUNG CANCER BECAUSE WE ALSO SEE BLADDER CANCER AND WE SEE CERVICAL CANCER, ET CETERA, ET CETERA.

AND ALSO SMOKING CAUSES HEART DISEASE. SMOKING CAUSES STROKE. THERE ARE SO MANY DIFFERENT DISEASES THAT -- MISCARRIAGES, ET CETERA, ET CETERA, SO THERE'S NO SPECIFICITY.

UNFORTUNATELY, THIS CRITERIA ON SPECIFICITY IS MORE LIKE IF I SEE IT THAT IT ONLY CAUSES ONE SPECIFIC THING, THAT'S REALLY COOL, AND THEN I'M REALLY HAPPY AND I PARADED AROUND LIKE ASBESTOSIS, I MEAN, THE WHOLE

ILLNESS IS CALLED AFTER THE AGENT, NOTHING ELSE CAN CAUSE ASBESTOSIS BECAUSE IT'S ASBESTOS, RIGHT.

BUT THAT'S NOT HOW IT WORKS IN THE REAL WORLD FOR MOST TOXINS, UNFORTUNATELY.

Q AND ISN'T IT TRUE, DOCTOR, THAT SPECIFICITY IS NOT MET FOR ANY OF THE HEAVY METALS THAT YOU EVALUATED IN ASD OR ADHD; CORRECT?

A WELL, SPECIFICITY IS NOT WHAT I WOULD EXPECT FOR MOST OF THESE METALS. I WOULD ACTUALLY EXPECT THAT THEY CAUSE A LOT OF DIFFERENT DAMAGE JUST LIKE SMOKING DOES.

SPECIFICITY IS NOT THE CRITERIA TO THROW AT METALS THAT HAVE SO MANY TOXIC EFFECTS ON AN ORGANISM.

Q OKAY.

A ESPECIALLY A BRAIN ORGANISM.

Q DOCTOR, I DIDN'T ASK YOU WHAT YOU EXPECT.

IS IT TRUE THAT IT IS NOT MET FOR ANY OF THE HEAVY METALS THAT YOU EVALUATED IN THIS CASE AND ASD OR ADHD? IS THAT TRUE?

A IF YOU MEAN SPECIFICITY IN TERMS OF THAT IT ONLY KILLS ONE CELL TYPE, THAT IT ONLY IMPACTS ONE ORGAN IN THE CELL, THAT IT ONLY AFFECTS ONE ORGAN ALONE, THEN THERE IS NO SPECIFICITY BECAUSE WE KNOW THAT LEAD CAUSES NOT ONLY COGNITIVE ISSUES, BEHAVIORAL ISSUES, IT CAUSES KIDNEY DAMAGE, IT CAUSES A LOT OF OTHER DAMAGE IN THE BODY.

Q AND LET'S LOOK AT ANOTHER BRADFORD HILL FACTOR; EXPERIMENT.

IN THE CONTEXT OF BRADFORD HILL THAT MEANS CLINICAL TRIALS OR TESTS INVOLVING HUMANS; CORRECT?

A THAT CAN MEAN THAT IN HUMANS -- EXPERIMENT IS YOU -- NO, EXPERIMENT ACTUALLY MEANS THAT YOU ARE CONTROLLING THE ENVIRONMENT OF THE EXPOSURE.

SO EXPERIMENT IS YOU PUT A RAT IN A CAGE, YOU FEED IT A CERTAIN DIET, YOU GIVE IT A CERTAIN NUMBER OF HOURS OF DAYLIGHT AND YOU CONTROL WHAT THIS ANIMAL'S EXPOSURE IS IN EVERY DETAIL. THAT'S AN EXPERIMENT.

IN HUMANS WE DON'T DO THIS. THE ONLY EXPERIMENT WE REALLY HAVE IS A RANDOMIZED CLINICAL TRIAL, AND WITH TOXINS WE DO NOT DO THOSE BECAUSE WE WOULD NOT EXPOSE SOMEBODY ON PURPOSE WITH A TOXIN AND WAIT FOR EFFECTS.

Q AND SO WHEN YOU APPLY THE BRADFORD HILL FACTORS, THE BRADFORD HILL FACTOR OF EXPERIMENT, YOU INCLUDE ANIMAL STUDIES; DID I HEAR YOU JUST SAY THAT CORRECTLY?

A YES, ANIMAL STUDIES DO INCLUDE ABSOLUTELY INCLUDE HERE.

Q OKAY.

AND IS IT TRUE THAT FOR THE HEAVY METALS AT ISSUE IN THIS CASE AND ASD OR ADHD, THE EXPERIMENT FACTOR OF BRADFORD HILL IS NOT MET?

A I DON'T UNDERSTAND WHAT YOU'RE ASKING ME BECAUSE I JUST EXPLAINED THAT THERE ARE NO HUMAN STUDIES.

IF I SAY ADHD AND ASD, THOSE ARE HUMAN

DISEASES, VERY SPECIFIC DISEASES TO THE BRAIN THAT HAVE NO ANIMAL MODEL THAT IS COMPLETELY LIKE THE HUMAN, SO IF WE'RE TALKING ABOUT HUMANS, THEN WE WOULDN'T HAVE EXPERIMENTS, HOWEVER, WE DO HAVE EXPERIMENTS IN ANIMALS.

Q OKAY.

I'M JUST TRYING TO FIND OUT, DOCTOR, IN YOUR BRADFORD HILL ANALYSES THAT YOU DID IN THIS CASE, DID YOU FIND THAT THE EXPERIMENT FACTOR WAS MET OR NOT MET?

A NOT IN HUMANS. BUT IT'S NOT MET OR NOT MET. EXPERIMENTS HOPEFULLY DON'T EXIST. IF YOU WOULD SEE THEM IN HUMANS, I THINK THAT'S -- YOU KNOW THAT WOULD BE A CRIME.

Q OKAY. LET'S TALK ABOUT CONSISTENCY.

SO AS I UNDERSTOOD YOUR TESTIMONY YESTERDAY AND TODAY, YOU AGREE THAT THE DEFINITION OF CONSISTENCY FOR PURPOSES OF A BRADFORD HILL ANALYSIS IS THAT THE ASSOCIATION YOU'RE EVALUATING HAS BEEN REPEATEDLY OBSERVED BY DIFFERENT PERSONS IN DIFFERENT PLACES, CIRCUMSTANCES AND TIMES; CORRECT?

A CORRECT.

Q ALL RIGHT.

AND DO YOU AGREE THAT FOR PURPOSES OF JUDGING THE BRADFORD HILL FACTOR OF CONSISTENCY, DIFFERENT STUDIES THAT EXAMINE THE SAME EXPOSURE-DISEASE RELATIONSHIP GENERALLY SHOULD YIELD SIMILAR RESULTS?

A THAT IS MUCH TOO GENERAL BECAUSE NO TWO STUDIES ARE THE SAME. YOU HAVE STUDIES -- I MEAN, WE'RE NOT --

THE COURT: SOMEONE NEEDS TO MUTE THEIR AUDIO.

MAYBE MR. WILLIAMS. I CAN'T TELL.

THE WITNESS: IT'S ACTUALLY INTERESTING THAT YOU TALK ABOUT CONSISTENCY AFTER WE JUST TALKED ABOUT EXPERIMENTS BECAUSE IT IS EXPERIMENTS WHERE WE ARE CONTROLLING THE EXPOSURE IN THE WAY THAT YOU ARE EXPECTING IT TO HOLD FOR CONSISTENCY IN HUMAN STUDIES. IT'S NOT THE CASE. THAT'S WHY OBSERVATIONAL EPIDEMIOLOGY AND OBSERVATIONAL HUMAN STUDIES ARE VERY DIFFERENT.

OBSERVATION STUDIES ARE OBSERVATIONAL BECAUSE WE CANNOT CONTROL THE EXPOSURE. THAT MEANS THAT THE LEVELS OF EXPOSURE ARE VERY DIFFERENT IN DIFFERENT POPULATIONS. IT ALSO MEANS THAT WE ARE HITTING DIFFERENT POPULATIONS WITH DIFFERENT LEVELS OF EXPOSURE AND THESE POPULATIONS MAY BE MORE OR LESS SENSITIVE AT THE TIME OF THEIR LIVES TO THESE EXPOSURES.

SO CONSISTENCY REALLY MEANS SOMETHING DIFFERENT THAN THE WAY YOU'RE TRYING TO TELL ME IT SHOULD BE INTERPRETED BECAUSE IT'S NOT AN EXPERIMENT, IT'S AN OBSERVATIONAL STUDY IN AN OBSERVATIONAL ENVIRONMENT.

CONSISTENCY MEANS, DOES THE STUDY THAT HAS LOW LEVEL OF LEAD SHOW ONE THING AND THE STUDY THAT HAS HIGH LEVELS OF LEAD SHOW SOMETHING ELSE? OR DOES THE STUDY WHERE LEAD EXPOSURE IS OUTSIDE A VULNERABLE PERIOD SHOW SOMETHING DIFFERENT FROM THE STUDY WHERE THE LEAD EXPOSURE HAPPENS DURING A VERY SENSITIVE TIME PERIOD?

SO THAT IS THE SCIENTIFIC AND CAUSAL CONSISTENCY THAT WE WOULD BE EXPECTING.

MR. PETROSINELLI:

Q WELL, LET ME JUST SHOW YOU, DOCTOR, THE STATEMENT WHERE I JUST -- THE REFERENCE YOU JUST READ IT FROM.

LET ME PULL UP A DEMONSTRATIVE. THIS IS FROM WHAT WE CALL THE REFERENCE MANUAL ON SCIENTIFIC EVIDENCE.

SO LET ME ASK YOU IF YOU AGREE WITH SOME OF THESE STATEMENTS. THIS IS FROM PAGE 604 OF THE REFERENCE MANUAL.

THE FIRST HIGHLIGHTED STATEMENT SAYS: "IT IS IMPORTANT THAT A STUDY BE REPLICATED IN DIFFERENT POPULATIONS AND BY DIFFERENT INVESTIGATORS BEFORE A CAUSAL RELATIONSHIP IS ACCEPTED BY EPIDEMIOLOGISTS AND OTHER SCIENTISTS."

DO YOU SEE WHERE I'M READING?

A YES.

Q AND DO YOU AGREE WITH THAT STATEMENT?

A IT'S A VERY GENERAL STATEMENT, AND AS GENERAL AS IT IS, I CAN AGREE WITH IT.

Q OKAY.

NOW, LET ME GO DOWN TO THE STATEMENT I JUST READ TO YOU.

"CONSISTENCY IN THESE FINDINGS IS AN IMPORTANT FACTOR IN MAKING A JUDGMENT ABOUT CAUSATION. DIFFERENT STUDIES THAT EXAMINE THE SAME EXPOSURE-DISEASE RELATIONSHIP GENERALLY SHOULD

YIELD SIMILAR RESULTS."

DO YOU SEE WHERE I JUST READ?

A YES.

Q DO YOU AGREE WITH THAT?

A YES. GENERALLY SHOULD YIELD. IF IT'S THE SAME EXPOSURE-DISEASE RELATIONSHIP.

BUT AS I JUST EXPLAINED, IT WILL IN HUMAN STUDIES NEVER BE THE SAME EXPOSURE BECAUSE THE EXPOSURE IS NOT GIVEN AS A TREATMENT IN AN EXPERIMENT, IT IS OBSERVED.

Q OKAY.

DOCTOR, DO YOU AGREE THAT -- WE CAN TAKE THAT DOWN -- DO YOU AGREE THAT IN THIS CASE FOR -- LET'S TALK ABOUT LEAD BECAUSE THAT'S WHAT YOUR TESTIMONY FOCUSED ON. FOR LEAD AND ASD, WE HAVE SOME STUDY SHOWING A POSITIVE ASSOCIATION, SOME STUDIES SHOWING NO ASSOCIATION AND SOME STUDIES SHOWING A NEGATIVE ASSOCIATION.

DO YOU AGREE WITH THAT?

A WELL, THAT'S VERY GENERAL, AND AS GENERAL AS YOU STATED, THAT'S CORRECT. BUT THAT'S, YOU KNOW, THAT MEANS NOTHING.

Q AND --

A I DON'T HAVE COUNT THE STUDIES. I NEVER RECOMMENDING COUNTING STUDIES.

Q AND --

A I WOULD ACTUALLY BE SURPRISED IF THERE WEREN'T STUDIES ON EACH END OF THE SPECTRUM BECAUSE, YOU KNOW,

IF YOU DO SCIENCE, YOU COME UP WITH DIFFERENT RESULTS.

Q AND THAT'S WHAT WE HAVE HERE: DIFFERENT RESULTS; CORRECT?

A CAN YOU PUT THAT IN CONTEXT AGAIN?

Q YOU JUST SAID TO ME, IF WE HAVE SCIENCE, WE HAVE DIFFERENT RESULTS. AND HERE WE HAVE DIFFERENT RESULTS.

DO WE NOT?

A WHAT IS "HERE"?

Q THE RELATIONSHIP BETWEEN THE STUDIES STUDYING LEAD AND ASD.

A THERE ARE SOME STUDIES SHOWING NO ASSOCIATION. THERE ARE VERY FEW STUDIES SHOWING THE OPPOSITE OF AN ASSOCIATION; MEANING, LEAD BEING, YOU KNOW, GOOD FOR YOU. AND THERE ARE A MULTITUDE OF STUDY SHOWING POSITIVE ASSOCIATIONS. YES, CORRECT.

Q NOW, LET ME --

A IF YOU CONSIDER THAT INCONSISTENT, THAT'S UP TO YOU.

Q WELL, THAT'S WHAT I WANT TO ASK YOU ABOUT.

ISN'T IT A FACT, DOCTOR, THAT IN MANY OF THE STUDIES THAT YOU RELIED ON, THE AUTHORS THEMSELVES DESCRIBE THE STATE OF THE SCIENCE AS TO LEAD AND ASD AS INCONSISTENT; CORRECT?

A NO AUTHOR OF A STUDY OF ONE SINGLE STUDY WHO HASN'T DONE A VERY CAREFUL META ANALYTIC SUMMARY SHOULD EVER SAY SOMETHING LIKE THAT, EXCEPT FOR POINTING OUT WHERE THEIR STUDY BELONGS BECAUSE THEY ARE -- FOR ANY

ONE STUDY, THEY ARE NOT USUALLY DOING WHAT I'M DOING HERE, WHICH IS GO WITH A FINE-TOOTHED COMB THROUGH THE WHOLE LITERATURE AND COMING UP WITH A VERY THOROUGH AND THOUGHTFUL REVIEW OF THIS LITERATURE.

GENERALLY, WHAT ANY ONE STUDY AUTHOR DOES IS THEY LOOK INTO THE LITERATURE, THEY FIND REASONS TO MAKE THEIR OWN STUDY SOUND LIKE IT WILL SOLVE A PROBLEM, AND THEY SAY IN THEIR INTRODUCTIONS, THIS IS WHAT I DO MY STUDY, I DO IT BECAUSE I IDENTIFIED THIS GAP IN THE LITERATURE AND THERE ARE STILL INCONSISTENCIES AND NOW I'M DOING THIS EXPERIMENT, I'M JUSTIFYING WHY I'M DOING THIS STUDY AND WHY I'M TELLING YOU YOU SHOULD BE READING MY REPORT. AND THAT'S ALL THEY DO. THEY ARE NOT DOING A BRADFORD HILL. THEY ARE NOT TELLING YOU THAT, YOU KNOW, THEY HAVE AN EXPERT OPINION. THEY ARE JUST POINTING OUT WHY THE READER SHOULD BE INTERESTED IN THEIR MATERIAL.

Q LET'S LOOK AT SOME OF THESE STUDIES, DOCTOR.

LET ME SHOW YOU A DEMONSTRATIVE OF THIS SOME OF THESE STUDIES. ALL OF THESE ARE MARKED AS EXHIBITS. HOLD ON ONE SECOND.

LET'S -- I'VE ARRANGED THESE STUDIES -- I'VE PICKED FIVE OF THEM CHRONOLOGICALLY. LET'S START AT THE TOP.

THERE'S A STUDY CALLED ABDULLAH.

YOU'VE READ THAT STUDY, DID YOU NOT, DOCTOR?

A YES, I DID.

Q AND THIS IS A STUDY OF BABY TEETH WHERE THE

AUTHORS LOOKED AT SHED BABY TEETH AND THEY LOOKED AT EXPOSURES TO LEAD AND MERCURY THAT WOULD HAVE OCCURRED BEFORE THE DIAGNOSIS OF ASD; CORRECT?

A THEY LOOKED AT BABY TEETH AND ASD, YES.

Q YEAH. OKAY.

AND THIS IS -- EXHIBIT 14 IS THE ABDULLAH STUDY, AND THIS IS A QUOTE FROM PAGE 933 TO 934.

"THESE NULL FINDINGS ADD TO THE CONTRADICTORY EVIDENCE REGARDING LEAD AND MERCURY EXPOSURE IN ASD."

DO YOU SEE THAT?

A YES, I SEE THAT.

Q AND DO YOU AGREE THAT AS OF -- THIS STUDY IS FROM 2012 -- DO YOU AGREE THAT AS OF 2012 THERE WAS CONTRADICTORY EVIDENCE IN THE LITERATURE REGARDING LEAD AND MERCURY EXPOSURE IN ASD?

A I ALSO RECALL THAT THEY ARE THEN GOING ON TO SAY THAT THEIR STUDY JUST TELLS YOU WE NEED MORE STUDIES AND DOES NOT CONTRADICT THE CAUSAL -- ANY CAUSAL RELATIONSHIP BETWEEN THESE AGENTS AND ASD. AND IF YOU WOULD LIKE, WE CAN GO TO THAT PART OF THEIR DISCUSSION WHERE THEY ACTUALLY PUT THAT IN CONTEXT.

Q I'M JUST ASKING, DO YOU AGREE WITH THIS STATEMENT, DR. RITZ, THAT'S ON THE SCREEN?

A I CANNOT AGREE. WITHOUT THE CONTEXT, I DON'T AGREE WITH IT. I AGREE WITH IT THE WAY THE AUTHORS ACTUALLY FORMULATED IT, WHICH WAS IN THE CONTEXT OF OUR STUDY IS JUST ONE STUDY, WE SEE WHAT WE SEE, WE NEED

MORE -- WE NEED MORE STUDIES.

AND I'M SURE THEY WANTED MONEY TO DO MORE STUDIES. AND THEY ARE CORRECT. WE SHOULD BE DOING MORE STUDIES.

Q AND ONE OF THE THINGS YOU SAID EARLIER WHEN MR. WISNER WAS ASKING YOU QUESTIONS IS THAT THESE STATEMENTS WERE, I THINK YOU SAID THEY ARE IN THE INTRODUCTION AND AUTHORS PUT THEM THERE TO SET THINGS UP WAS I THINK THE PHRASE YOU USED. WAS THAT CORRECT?

A THEY SET THE STAGE FOR WHAT THEY ARE GOING TO TELL THE READER, YES.

Q ALL RIGHT.

THIS STATEMENT BY ABDULLAH, THIS IS NOT IN THE INTRODUCTION. THIS IS IN THE DISCUSSION, IS IT NOT?

A YOU NEED TO SHOW ME. I DON'T KNOW.

Q OKAY. LET'S --

A I JUST SEE ONE SENTENCE.

Q ALL RIGHT. WE'LL LOOK AT THAT. WE'LL PULL UP EXHIBIT 14.

A AM I SUPPOSED TO LOOK UP SOMETHING?

Q OH, WE'RE GOING TO HAVE IT ON THE SCREEN IN A SECOND. AND WE'RE GOING TO GO TO PAGE 933.

OKAY. AND IF YOU SEE AT THE -- WE'RE GOING TO BLOW IT UP -- THE BOTTOM PARAGRAPH ON THE RIGHT SIDE. THIS IS IN THE DISCUSSION SECTION.

DO YOU SEE WHERE IT SAYS "DISCUSSION," DOCTOR?

A YES, I DO.

Q OKAY.

AND RIGHT AT THE BOTTOM AND THEN RUNNING OVER TO PAGE 934.

"THESE NULL FINDINGS" -- WELL, LET ME START AT THE BEGINNING OF THE PARAGRAPH SO WE GET THE RESULTS OF THE STUDY.

IN THIS STUDY THEY FOUND NO SIGNIFICANT DIFFERENCES IN LEAD OR MERCURY CONCENTRATIONS IN THE PRE- OR POST-NATAL REGION FOR CHILDREN WITH ASD'S OR TYPICAL DEVELOPMENT.

DO YOU SEE THAT?

A YES.

Q AND THAT WAS THE RESULT OF THE STUDY. IT WAS A NO ASSOCIATION FOUND; CORRECT?

A THAT'S CORRECT.

Q AND THEN THEY SAY, "THESE NULL FINDINGS ADD TO THE CONTRADICTORY EVIDENCE REGARDING LEAD AND MERCURY AND EXPOSURE IN ASD'S."

AND THEN THEY CITE A NUMBER OF STUDIES.

DO YOU SEE THAT?

A YES.

Q OKAY.

A BUT LET'S -- LET'S READ ON.

"THE MIXED CONCLUSIONS MAY BE ATTRIBUTABLE TO DIFFERENCES IN SAMPLE TYPE, MEANS OF EXPOSURE AND TIMING OF EXPOSURE; GIVEN THAT THERE ARE MANY KNOWN ADVERSE DEVELOPMENTAL CONSEQUENCES OF EXPOSURE OF LEAD, FURTHER INVESTIGATION OF HEAVY METALS IN DIFFERENT BIOMARKERS AND TIMING

OF EXPOSURE MAY PROVIDE VALUABLE INFORMATION IN THE ETIOLOGY OF DISPARATE NEUROBEHAVIORAL DEVELOPMENTS."

SO THIS IS EXACTLY THE CONTEXT THAT I WAS REFERRING TO. THESE AUTHORS ARE NOT SAYING, WE ARE THE END-ALL OF THIS RESEARCH. THEY ARE SAYING, WELL, THIS IS WHAT WE SEE, BUT THEY EVEN SAY THERE ARE OTHER STUDIES OUT THERE, THERE ARE OTHER STUDIES SHOWING LEAD IS NO GOOD FOR NEURODEVELOPMENT AND WE DEFINITELY NEED TO KNOW MORE AND WE ARE WORRIED ABOUT IT.

THAT'S WHAT THIS SAYS TO ME.

Q OKAY.

LET'S GO BACK TO THE DEMONSTRATIVE THAT WE JUST HAD ON THE SCREEN TO THE NEXT STUDY.

THIS IS KIM, ET AL.

YOU RELIED ON THE KIM STUDY, DID YOU NOT?

A KIM -- IF IT'S THE KIM STUDY FROM KOREAN ON LEAD IN 8 YEAR OLDS.

Q YES.

A YES.

Q AND WHAT THE AUTHORS IN KIM SAID WAS: "THE ASSOCIATION BETWEEN LEAD EXPOSURE AND AUTISM SPECTRUM DISORDER IS INCONCLUSIVE. PREVIOUS STUDIES EVALUATING THE ASSOCIATION BETWEEN LEAD EXPOSURE AND AUTISM SPECTRUM DISORDER HAVE REPORTED INCONCLUSIVE RESULTS WITH EVIDENCE FOR POSITIVE, NULL AND NEGATIVE ASSOCIATIONS."

DO YOU SEE THAT?

A YES.

Q AND DO YOU AGREE WITH THAT STATEMENT?

A CAN YOU SHOW ME THIS STATEMENT IN CONTEXT?

Q OF COURSE. THIS IS EXHIBIT 87.

AND WE'LL PULL THAT UP IN A SECOND.

WE'LL GO TO THE SECOND PAGE OF THE STUDY.

AND THAT FIRST FULL PARAGRAPH ON THE LEFT.

A YEAH, THAT'S THE INTRODUCTION. THAT'S EXACTLY WHAT I TRIED TO EXPLAIN BEFORE THAT'S WHERE AUTHORS SET UP THE STAGE AND TELL YOU WHY YOU, AS A READER, SHOULD REALLY KEEP READING.

Q RIGHT.

AND MY QUESTION TO YOU IS DO YOU AGREE WITH THE FIRST SENTENCE?

A I AGREE THAT THIS IS A REALLY GREAT WAY TO MAKE ME WANT TO SEE WHAT THEY ARE SHOWING. BUT THIS IS NOT AN EVALUATION OF EVERYTHING THAT'S OUT THERE IN THE LITERATURE. THIS IS JUST A TEASER.

Q OKAY. IT'S A TEASER.

DOCTOR, THIS WAS A PEER-REVIEWED STUDY, WAS IT NOT?

A OF COURSE.

Q AND YOU EXPLAINED YESTERDAY THE IMPORTANCE OF PEER-REVIEW IN I THINK YOU SAID YOU ONLY LOOKED AT PEER-REVIEWED -- OR ONLY RELIED ON PEER-REVIEWED STUDIES; CORRECT?

A CORRECT.

Q AND PEER-REVIEW MEANS THAT INDEPENDENT EXPERTS IN THE FIELD HAVE REVIEWED THE MANUSCRIPT BEFORE PUBLICATION TO ENSURE THAT THE CONCLUSIONS BEING DRAWN AND THE STATEMENTS BEING MADE IN THE ENTIRE MANUSCRIPT ARE APPROPRIATE; CORRECT?

A YES. AND I, AS A REVIEWER, WOULD NOT HAVE A PROBLEM WITH THIS BECAUSE ALL IT SAYS IS, OKAY, THE LITERATURE IS NOT AT A POINT WHERE, YOU KNOW, WE WOULD -- WHERE OUR STUDY WOULDN'T CONTRIBUTE MORE INFORMATION.

THAT'S WHAT THIS SAYS.

IT SAYS IF WE HAVE SATURATED TO A POINT WHERE ANY OTHER STUDY WOULD NOT GIVE ME ANY ADDITIONAL INFORMATION ANYMORE, THEN I SHOULDN'T BE READING THIS ANYMORE. THAT'S ALL THAT THEY ARE TRYING TO SAY HERE, AND THAT'S FINE. THEY ARE NOT -- THEY ARE NOT SAYING, YOU KNOW, THERE IS ABSOLUTELY NOTHING WE DON'T KNOW -- WE KNOW ABOUT ASD. THEY ARE JUST SAYING, WELL, THERE ARE STUDIES AND THERE ARE ACTUALLY MORE STUDIES SHOWING POSITIVE RESULTS THAN THERE ARE STUDIES SHOWING NO RESULTS OR MAYBE NEGATIVE ASSOCIATIONS, BUT OUR STUDY IS GOING TO BE BIG BECAUSE THEY ARE ALSO SAYING IN THE NEXT SENTENCE, THESE STUDIES EMPLOY CASE CONTROL DESIGNS, VIA A COHORT STUDY, THESE STUDIES HAD SAMPLE SIZES OF 105 CHILDREN OR LESS. OUR STUDY IS THOUSANDS OF CHILDREN.

ALL OF THIS IS TO SET THE STAGE FOR THIS STUDY TO BE ONE THAT I WANT TO KEEP READING. THAT'S ALL.

Q OKAY. LET'S GO TO THE NEXT STUDY.

A DIDN'T YOU HAVE SOMETHING ELSE IN THIS STUDY

YOU WANTED TO SHOW ME?

Q NO. I'M GOING TO DO ONE MORE.

ARORA, THAT IS A STUDY YOU TALKED ABOUT QUITE AT LENGTH YESTERDAY.

DO YOU REMEMBER TALKING ABOUT THE ARORA STUDY?

A OF COURSE, YES.

Q OKAY.

AND THE ARORA STUDY, THE ONE WITH THE TWINS AND THE BABY TEETH THAT YOU TALKED ABOUT YESTERDAY, THESE AUTHORS SAID, "STUDIES OF TOXIC METALS AND NUTRITIONAL ELEMENTS OF ASD HAVE YIELDED MIXED RESULTS ALTHOUGH SEVERAL STUDIES REPORTED HIGHER CONCENTRATIONS FOR TOXIC METALS IN ASD, INCLUDING THE NEUROTOXIN LEAD, OTHERS FOUND NO ASSOCIATION."

DO YOU SEE THAT?

A YES.

Q AND DO YOU AGREE THAT AS OF 2017, THE STUDIES OF TOXIC METALS IN ASD YIELDED MIXED RESULTS?

A CAN YOU PUT THIS IN CONTEXT? WHERE THEY --

Q YOU'D LIKE TO LOOK AT --

A YEAH, I WANT TO SEE WHERE THEY --

Q OKAY.

A -- SAY THAT.

Q THIS IS EXHIBIT 27. WE'LL PULL THAT UP.

IT'S THE FIRST TWO SENTENCES OF THIS PARAGRAPH ARE THE ONES I JUST SHOWED YOU.

AND THEN IT TALKS ABOUT -- ACTUALLY, THE

CONTEXT IS -- IT TALKS -- THE NEXT SENTENCE IS SAYING:

"PREVIOUS RESEARCH SHOWED METHODOLOGICAL SHORTCOMINGS THAT LIMITED INTERPRETATION AND GENERALIZE ABILITY OF THE FINDINGS."

AND THEN IT TALKS FURTHER ABOUT THOSE SHORTCOMINGS.

DO YOU AGREE WITH THESE STATEMENTS, DOCTOR?

A WELL, CAN YOU SHOW ME IN WHAT PART OF THE PAPER THIS IS?

Q THIS IS IN THE INTRODUCTION OF THE PAPER.

A EXACTLY. MY POINT.

THEY ARE, AGAIN, JUST, YOU KNOW, SETTING IT UP AS THE STAGE FOR WHY THEIR STUDY IS SO MUCH BETTER THAN EVERYTHING ELSE THAT WE HAVE IN THE LITERATURE AND YOU SHOULD PLEASE READ THIS BECAUSE WE ARE GOING TO NOW HELP SOLVE THIS GAP IN THE SCIENCE AND WE ARE GOING TO BE BETTER THAN ALL THESE OTHERS.

THAT'S WHAT THEY ARE SAYING.

Q OKAY. BUT MY QUESTION TO YOU IS DO YOU AGREE WITH THE AUTHORS THAT THERE'S A GAP IN THE SCIENCE?

A WELL, THAT'S WHAT THE AUTHORS ARE SAYING, BUT THEY ARE SAYING THIS VERY GENERALLY, AND YOU KNOW, IT DOESN'T MATTER WHETHER I AGREE WITH THEM OR NOT. IT'S NOTHING BUT A TEASER. AND THEY ARE CALLING LEAD A KNOWN NEUROTOXIN BY THE WAY.

Q YOU TALKED WITH MR. WISNER ABOUT THE SKOGHEIM -- LET'S GO BACK TO THE DEMONSTRATIVE ONE MORE TIME -- YOU TALKED TO HIM ABOUT THE SKOGHEIM STUDY TODAY.

DO YOU RECALL THAT?

A YES.

Q OKAY.

AND THIS IS THE QUOTE FROM THE SKOGHEIM STUDY TALKING ABOUT INCONSISTENCIES REGARDING STUDY DESIGNS AND FINDINGS.

DO YOU SEE THAT?

A YEAH.

Q OKAY.

AND IS IT YOUR TESTIMONY, DOCTOR, THAT THESE STATEMENTS BY THE AUTHORS, THAT THEY DON'T HONESTLY BELIEVE?

A NO, BUT THEY MIGHT BE FORMULATED TOO GENERALLY.

BECAUSE IF YOU, FOR EXAMPLE, READ SKOGHEIM VERY CAREFULLY, WHAT THEY ARE SAYING IS ALL TOGETHER THERE'S STILL LIMITED KNOWLEDGE ON PRENATAL EXPOSURE TO METALS, SO THIS IS ACTUALLY MUCH MORE CAREFULLY FORMULATED THAN SOME OF THE OTHER SENTENCES WHERE THEY ARE SAYING, OH, IN GENERAL, WE DON'T KNOW ENOUGH.

NO, THAT'S NOT RIGHT. IN GENERAL WE KNOW A LOT. BUT SPECIFICALLY WE DON'T KNOW ENOUGH YET. AND EVERY -- EVERY SPECIFIC STUDY ADDS TO THE BIGGER SCIENTIFIC PICTURE BECAUSE THEY GO INTO DETAIL AND THEY ARE ADDING TO THE LITERATURE IN ONE SPECIFIC WAY.

THIS SKOGHEIM STUDY IS ABOUT PRENATAL EXPOSURES, AND THAT'S WHAT THEIR CONTRIBUTION TO THE LITERATURE IS, AND IN THAT AREA THEY WANT TO MAKE THEIR OWN ENTRE INTO, YOU KNOW, WHAT IS KNOWN ABOUT THIS. AND

THAT'S WHAT THEY ARE SAYING THERE. THEY ARE ACTUALLY MUCH MORE CAREFUL THAN THESE OTHER STATEMENTS.

Q ALL RIGHT. DOCTOR, LET'S LOOK AT YOUR EXPERT REPORT. THIS IS EXHIBIT 4. AND WE'RE GOING TO LOOK AT PAGE 30 TO YOUR REPORT WHICH IS YOUR BRADFORD HILL ANALYSIS ON LEAD AND ASD.

AND I WANT TO LOOK AT YOUR ANALYSIS OF CONSISTENCY, WHICH IS NEAR THE BOTTOM OF THE PAGE WHICH WE'RE GOING TO BLOW UP IN A SECOND.

ALL RIGHT. THIS IS -- IN YOUR BRADFORD HILL OF CONSISTENCY ON LEAD AND ASD, YOU SAID: "THIS CRITERION

IS MET SINCE POSITIVE ASSOCIATIONS HAVE BEEN REPORTED FOR DIFFERENT POPULATIONS AND IN DIFFERENT GEOGRAPHIC REGIONS AND DIFFERENT TIME PERIODS AS WELL AS DIFFERENT BIOLOGIC MATRICES WHICH STRENGTHENS THE LIKELIHOOD OF A TRUE EFFECT."

DO YOU SEE THAT?

A YES, I DO.

Q AND ISN'T THE SAME EXACT THING TRUE OF STUDIES THAT FOUND NO ASSOCIATIONS BETWEEN LED AND ASD?

IN OTHER WORDS, STUDIES THAT HAVE FOUND NO ASSOCIATIONS HAVE BEEN REPORTED FOR DIFFERENT POPULATIONS AND IN DIFFERENT GEOGRAPHIC REGIONS AND DIFFERENT TIME PERIODS AS WELL AS DIFFERENT BIOLOGIC MATRICIS; ISN'T THAT TRUE?

A I AM NOT SURE WHAT YOU'RE ASKING ME.

Q WELL, I'M ASKING YOU, YOU SAID HERE THAT THERE

WERE STUDIES THAT FOUND POSITIVE ASSOCIATIONS THAT HAD THE CHARACTERISTICS I JUST READ ABOUT, THE DIFFERENT POPULATIONS, AND SO ON.

A RIGHT.

Q MY QUESTION IS, ISN'T IT TRUE THAT THERE ARE STUDIES FINDING NO ASSOCIATIONS BETWEEN LEAD AND ASD IN DIFFERENT POPULATIONS AND IN DIFFERENT GEOGRAPHIC REGIONS AND DIFFERENT TIME PERIODS AS WELL AS DIFFERENT BIOLOGIC MATRICES; ISN'T THAT TRUE?

A WELL, IF THERE ARE STUDIES, AND THERE ARE STUDIES, THAT ARE SHOWING NO ASSOCIATIONS OR NEGATIVE ASSOCIATIONS, THEN THIS STATEMENT IS ALSO CORRECT BECAUSE IT'S MORE THAN ONE STUDY, SO THEY HAVE TO HAVE BEEN IN DIFFERENT POPULATIONS OR IN DIFFERENT REGIONS OR AT DIFFERENT TIME PERIODS.

WHETHER THEY ARE IN DIFFERENT BIOLOGIC MATRICES, I DON'T KNOW RIGHT NOW OFF THE TOP OF MY HEAD, BUT I IMAGINE YES, BECAUSE WE JUST LOOKED AT THE TOOTH STUDY AND I KNOW THERE ARE SOME ON URINE OR HAIR AS WELL.

Q OKAY.

A BUT THAT DOESN'T MEAN THERE'S NO ASSOCIATION.

THAT'S JUST SOMETHING YOU WOULD EXPECT TO BE CORRECT IF THERE'S MORE THAN ONE STUDY THAT DOESN'T SHOW AN ASSOCIATION.

AND IF -- THE MORE STUDIES YOU HAVE -- THE MORE STUDIES YOU HAVE IN SCIENCE, THE MORE INFORMATION YOU GENERATE, THE MORE KNOWLEDGE YOU GENERATE, THE MORE

STUDIES YOU ALSO WILL HAVE THAT JUST RANDOMLY DON'T SHOW AN EFFECT, THAT ARE TOO SMALL TO SHOW AN EFFECT, THAT USE METHODS THAT ARE INAPPROPRIATE THAT HAVE LOWER LIMITS OF DETECTION THAT ARE NOT, YOU KNOW, SENSITIVE ENOUGH, ET CETERA, ET CETERA, ET CETERA.

SO, YES, THE MORE YOU ACTUALLY DO SCIENCE, THE MORE YOU MIGHT ALSO GENERATE SOME BAD STUDIES.

Q OKAY. WE CAN TAKE THAT DOWN.

DOCTOR, LET ME TALK TO YOU ABOUT THE TEMPORALITY FACTOR OF BRADFORD HILL.

AND PARTICULARLY I WANT TO ASK YOU, YESTERDAY WHEN YOU WERE DOING YOUR EPI 101, I THINK YOU CALLED IT, PRESENTATION, YOU TALKED ABOUT SOME DIFFERENT TYPES OF STUDY DESIGNS.

DO YOU REMEMBER THAT?

A YES.

Q AND YOU TALKED ABOUT, AS I RECALL, THREE TYPES OF STUDIES; COHORT STUDIES, CASE CONTROL STUDIES AND CROSS-SECTIONAL STUDIES.

DO YOU REMEMBER TALKING ABOUT THOSE STUDIES YESTERDAY?

A YES.

Q AND DO YOU AGREE WITH ME THAT ALMOST ALL OF THE STUDIES ON AUTISM SPECTRUM DISORDER TO DATE RELY ON CASE CONTROL OR CROSS-SECTIONAL DESIGNS?

A NO, NOT ALMOST ALL.

Q OKAY. LET'S LOOK AT YOUR REPORT. THIS IS EXHIBIT 4. AND PAGE 17 AT THE TOP. RIGHT AT THE TOP,

DOCTOR.

YOU SAID IN YOUR REPORT, "RATHER, ALMOST ALL STUDIES OF ASD AND MOST ADHD STUDIES TO DATE RELIED ON THE MUCH MORE EFFICIENT CASE CONTROL OR CROSS-SECTIONAL DESIGN."

CORRECT?

A YEAH, CASE CONTROL, NOT CROSS-SECTIONAL.

I MEAN, YES, WE HAVE A TON OF CASE CONTROL STUDIES.

SO WHAT IS YOUR QUESTION? WHAT IS YOUR QUESTION? I DON'T GET IT.

Q OKAY.

MY QUESTION WAS SIMPLY, ISN'T IT TRUE THAT ALMOST ALL OF THE STUDIES OF ASD TO DATE RELY ON THE CASE CONTROL OR CROSS-SECTIONAL DESIGN; CORRECT?

A WHAT I'M SAYING HERE IS THAT THEY ARE RELYING ON A MUCH MORE EFFICIENT DESIGN, WHICH IS THE CASE CONTROL STUDY, THAN THE COHORT STUDY BECAUSE THE COHORT STUDIES ARE REALLY, REALLY INEFFICIENT FOR RARE DISORDERS LIKE ASD.

ADHD, WE HAVE A LOT MORE COHORT STUDIES. BUT FOR ASD WE MOSTLY HAVE CASE CONTROL STUDIES FOR A GOOD REASON BECAUSE THEY ARE THE MOST EFFICIENT STUDY DESIGN WE HAVE WHEN IT COMES TO A REALLY RARE DISORDER WHICH ASD IS.

Q OKAY. WE CAN TAKE THAT DOWN.

THANK YOU, DOCTOR.

ONE ADVANTAGE OF A -- LET'S TALK ABOUT THE

COHORT STUDY.

THE ADVANTAGE OF THE -- ONE ADVANTAGE OF A COHORT STUDY IS THAT IT CAN BE USED TO ESTABLISH TEMPORALITY; THAT IS, THE RESEARCHERS KNOW THAT THE EXPOSURE IN QUESTION OCCURRED BEFORE THE OUTCOME THAT YOU'RE STUDYING; CORRECT?

A THAT'S ONE ADVANTAGE, YES.

Q AND IN A CASE CONTROL STUDY, I THINK YOU EXPLAINED THIS YESTERDAY, YOU BEGIN WITH A GROUP OF INDIVIDUALS WHO HAVE THE DISEASE HERE, LET'S SAY ASD, AND THEN YOU COMPARE THEM TO PEOPLE WHO DON'T HAVE THE DISEASE.

THOSE ARE THE CASES AND THE CONTROLS; CORRECT?

A THAT'S -- YEAH, THAT'S USUALLY HOW WE DESCRIBE IT.

Q YEAH.

AND THEN WHEN -- THEN SOMETIME AFTER THE CASES AND THE CONTROLS ARE SELECTED, THE RESEARCHER WILL MEASURE LEVELS OF, IN THIS CASE, HEAVY METALS AND COMPARE THE GROUPS; CORRECT?

A I'M NOT SURE WHAT YOU MEAN BY "SOMETIME AFTER" BECAUSE CASE CONTROL STUDIES, THE ONLY REASON WHY TEMPORALITY COMES IN HERE, IT DOESN'T MATTER WHEN THE RESEARCHER DECIDES TO MEASURE; IT MATTERS WHAT THE RESEARCHER MEASURES AND WHEN THAT MEASURE WAS ACTUALLY TAKEN.

SO, FOR EXAMPLE, IF I HAVE A CASE CONTROL STUDY WITH BLOOD SAMPLES STORED IN THE CALIFORNIA BIO BANK AND

I GO BACK TO THE BIO BANK AND FIND A BLOOD SPOT FROM A CHILD AND I MEASURE EXPOSURE IN THAT BLOOD SPOT, I KNOW THAT TEMPORARILY THAT BLOOD SPOT'S EXPOSURE IS PRIOR TO THE ONSET OF ANYTHING THAT HAPPENED AFTER BIRTH, AND THAT'S A PERFECT TEMPORALITY I CAN ESTABLISH IN A CASE CONTROL STUDY. IT DOESN'T MATTER WHEN THE RESEARCHER DOES THAT. IT MATTERS WHEN THE EXPOSURE OR THE SAMPLE IN WHICH I MEASURE THE EXPOSURE WAS ACTUALLY TAKEN.

Q ISN'T IT TRUE THAT, DOCTOR, IN THE CASE CONTROLS -- ALMOST ALL OF THE CASE CONTROL STUDIES THAT YOU RELIED ON IN CONNECTION WITH LEAD AND ASD, THE EXPOSURE TO LEAD THAT'S BEING MEASURED OCCURRED AFTER THE CHILDREN DEVELOPED ASD? ISN'T THAT CORRECT?

A THAT'S AN ASSUMPTION YOU'RE MAKING. NO. THE SAMPLE WAS COLLECTED AFTER THE -- AFTER THE CASE WAS DIAGNOSED. THAT WE KNOW.

SO THE BLOOD SAMPLE, THE HAIR SAMPLE, THE URINE SAMPLE MAY HAVE BEEN TAKEN FROM THE CHILD OR WILL HAVE BEEN TAKEN FROM THE CHILD AFTER THE CHILD WAS DIAGNOSED AND AT THE SAME TIME A CONTROL SAMPLE WAS TAKEN. WHAT THAT SAMPLE REPRESENTS DEPENDS ON WHAT IT ACTUALLY -- WHAT IT GIVES YOU.

IN TERMS OF LEAD, THE BLOOD SAMPLE GIVES YOU RELATIVELY RECENT EXPOSURE UNLESS THERE WAS NO RECENT EXPOSURE. WHAT DO I MEAN BY THIS? WE KNOW LEAD IS STORED IN THE BODY. LEAD IS STORED IN THE BONE. SO THE CHILD CAN HAVE BEEN EXPOSED IN UTERO, CAN HAVE BEEN EXPOSED IN THE FIRST, SECOND, THIRD YEAR OF LIFE, THE

LEAD GETS STORED IN THE BONE.

WHAT DOES LEAD DO? IT HAS AN EQUILIBRIUM WITH THE BLOOD. SO WHAT YOU MEASURE IN THE BLOOD OF A THREE YEAR OLD MAY ACTUALLY REFLECT THE EXPOSURE AT AGE ONE BECAUSE UNLESS AT THREE YEARS OLD THE KID ALSO GETS EXPOSED.

SO WHAT WE ARE MEASURING IN ONE BLOOD SAMPLE MEANS VERY DIFFERENT THINGS DEPENDING ON WHETHER THERE'S CURRENT EXPOSURE OR NOT. IF THERE'S NO CURRENT EXPOSURE IN THE CASE, THEN IT ACTUALLY REFLECTS PAST EXPOSURE, HISTORICAL EXPOSURE, BECAUSE THE LEAD LEECHES OUT THE BONE OF THE CHILD INTO THE BLOOD, AND THAT'S WHAT I'M MEASURING.

Q WELL, LET ME ASK YOU SOME QUESTIONS ABOUT THAT.

FIRST LET'S SEE WHAT YOUR TESTIMONY WAS ON THIS TOPIC. LET'S LOOK AT YOUR DEPOSITION AGAIN WHICH IS EXHIBIT 7 AT PAGE 38.

AND IF YOU LOOK STARTING WITH THE QUESTION AT LINE 9.

LET'S BLOW THAT UP. AND THE ANSWER.

I ASKED YOU, DOCTOR, THE QUESTION I JUST ASKED YOU:

"IN CASE CONTROL STUDIES THAT YOU RELY ON IN YOUR REPORT, FOR MOST OF THE STUDIES, THE MEASUREMENT OF THE EXPOSURE OCCURRED AFTER THE DIAGNOSIS OF ASD; CORRECT?"

YOU SAID, "FOR MOST OF THE STUDIES, NOT FOR ALL."

IS THAT TRUE?

A IT'S WHAT'S WRITTEN HERE, SO I IMAGINE IT'S TRUE, YES.

Q OKAY.

NOW --

A WHAT I MEANT IS WHAT I JUST EXPLAINED.

Q YOU MENTIONED SOMETHING ABOUT BONE.

THERE'S NO STUDIES -- NONE OF THE STUDIES YOU RELY ON MEASURED LEAD LEVELS OF BONE IN CHILDREN; CORRECT?

A NO, NONE OF THE STUDIES DID BECAUSE YOU COULD DO THAT, HOWEVER, YOU HAVE TO MAKE A CHILD SIT STILL FOR HALF AN HOUR. THAT'S A REALLY HEAVY -- HARD THING TO DO ESPECIALLY IN AN AUTISTIC CHILD OR IN AN ADHD CHILD.

Q RIGHT.

SO WHEN YOU GAVE -- YOU JUST TESTIFIED A WHILE AGO THIS COULD BE LEVELS OF LEAD THAT SEEPED OUT OF THE BONE AND THEN WAS LATER REFLECTED IN THE BLOOD.

THERE'S NO STUDIES OF THAT THAT YOU RELIED ON HERE; CORRECT?

A WELL, THAT IS WHAT WE KNOW ABOUT HOW LEAD BEHAVES.

LEAD IS RARELY -- IT IS EXCRETED IN THE URINE. IT DOES GET INTO THE HAIR. WE KNOW THAT. BUT WHAT IT MOSTLY DOES IS IT IS -- IT BEHAVES LIKE CALCIUM AND IT GETS STORED IN THE BONE, IT GETS STORED IN THE TIBIA IN THE PATELLA. AND THEN WHILE THE CHILD IS GROWING, THE BONE REMODELS, AND DURING THIS BONE REMODELLING, THE

LEAD GETS ACTIVATED AND THE LEAD GETS OUT INTO THE BLOODSTREAM AGAIN.

SO IT'S A CONSTANT BALANCE BETWEEN WHAT'S IN THE BONE AND WHAT'S IN THE BLOOD.

IF THE CHILD IS EXPOSED AT AGE ONE AND HAS NO OTHER EXPOSURES AFTERWARDS, WHAT YOU ARE MEASURING AT AGE 5 IS ACTUALLY WHAT HAPPENED AT AGE 1 BECAUSE OF THAT BALANCE BETWEEN THE BONE LEAD AND THE BLOOD LEAD.

Q DOCTOR, NONE OF THE AUTHORS, NONE OF THE AUTHORS OF THE STUDIES ON WHICH YOU RELY THAT USE BIOMARKERS OF EXPOSURE IN CASE CONTROL STUDIES LIKE BLOOD OR URINE SUGGESTED THAT THE LEAD LEVEL WAS FROM LONG-TERM EXPOSURE FROM BONES; ISN'T THAT TRUE?

MR. WISNER: OBJECTION -- OBJECTION. OVERBROAD AS TO EVERY STUDY, EVERYTHING HE SAID.

THE COURT: OVERRULED.

THE WITNESS: YEAH, I MEAN, WE WOULD NEED TO LOOK AT HOW THEY --

THE COURT: DR. RITZ --

THE WITNESS: YEAH.

MR. WISNER: I'M SORRY, THIS ISN'T A DEPOSITION. I'VE OBJECTED. THE COURT HAS TO RULE.

THE COURT: I'M SORRY. I SAID OVERRULED.

MR. WISNER: OKAY. THANK YOU.

MR. PETROSINELLI:

Q GO AHEAD, DOCTOR. WOULD YOU LIKE ME TO REPEAT THE QUESTION?

A OH, YES. PLEASE.

Q OKAY.

ISN'T IT TRUE THAT IN NONE OF THE STUDIES IN WHICH YOU RELIED, THE CASE CONTROL AND CROSS-SECTIONAL STUDIES, WHERE LEAD WAS MEASURED IN BLOOD OR URINE OR HAIR, DID THE AUTHORS SAY THAT THAT MEASUREMENT WAS REFLECTIVE OF EARLIER LEAD EXPOSURE THAT CAME FROM BONES; CORRECT?

A ACTUALLY, I CAN'T ANSWER THIS QUESTION IN THIS GENERAL WAY, BUT I DO RECALL THAT QUITE A FEW AUTHORS DO SAY, WHILE WE KNOW THAT THESE MATRICES HAVE DIFFERENT LENGTHS OF TIMING OR THEY REFLECT DIFFERENT LENGTHS OF TIMING, WE KNOW THAT TEETH OF COURSE REFLECT VERY EARLY LIFE, BUT WE ALSO KNOW THAT HAIR REFLECTS GIVEN THE LENGTH OF THE HAIR MONTHS OR YEARS OF EXPOSURE, AND YES, I'M PRETTY CERTAIN THAT ONE REASON WHY THEY TOOK BLOOD LEAD IS BECAUSE OF COURSE WE KNOW THAT BIOMARKERS AREN'T JUST BIOMARKERS OF WHAT'S HAPPENING YESTERDAY, THEY ARE BIOMARKERS OF WHAT HAPPENED HISTORICALLY IF THERE IS A STORAGE ORGAN.

AND WE ALL WHO DO LEAD STUDIES KNOW THE STORAGE ORGAN IS THE BONE. AND OF COURSE THERE IS COMMUNICATION BETWEEN THE BONE AND THE BLOOD. AND IF THERE IS NO CURRENT EXPOSURE, THEN LEAD IN THE BLOOD REFLECTS PAST EXPOSURES.

Q NO. MY QUESTION WAS -- I UNDERSTAND THAT THAT'S YOUR THEORY.

MY QUESTION WAS --

A NOT MY THEORY. IT'S A FACT.

THE COURT: COUNSEL, I THINK SHE ANSWERED THE QUESTION. SHE SAID SHE DIDN'T KNOW AND SHE TOLD YOU WHAT SHE RECALLED AS BEST SHE COULD.

MR. PETROSINELLI: OKAY. OKAY. THANK YOU, YOUR HONOR.

Q DOCTOR, IT'S ANOTHER TYPE OF A STUDY IS A CROSS-SECTIONAL STUDY AND YOU RELIED ON SOME OF THOSE IN FORMULATING YOUR OPINIONS; CORRECT?

A YES.

Q AND DO YOU AGREE THAT IN CROSS-SECTIONAL STUDIES IT'S NOT POSSIBLE TO ESTABLISH THE TEMPORAL RELATION BETWEEN EXPOSURE AND DISEASE THAT WOULD BE NECESSARY FOR DRAWING A CAUSAL INFERENCE?

A IT'S ACTUALLY THE SAME SITUATION THAT WE HAVE IN THE CASE CONTROL STUDY. IT'S ONLY -- IT'S ONLY ON A -- ON A -- HOW DO I SAY THIS? WE HAVE -- IN A CROSS-SECTIONAL STUDY, WE ARE AT THE SAME TIME ESTABLISHING EXPOSURE LEVEL AND THE OUTCOME.

SO THE OUTCOME BY DEFINITION IS A PREVALENT OUTCOME, MEANING, WE DON'T KNOW WHEN THE CHILD WAS DIAGNOSED WITH THE DISORDER. IT COULD HAVE BEEN FIVE YEARS AGO. IT COULD HAVE BEEN FIVE DAYS AGO. AND WE ARE TAKING A BLOOD SAMPLE OR A HAIR SAMPLE OR A URINE SAMPLE AT THAT TIME, THE SAME TIME THAT WE ARE INVESTIGATING THE OUTCOME.

HOWEVER, WE CAN SAY THAT, FOR EXAMPLE, FOR THE CHILDREN THAT WERE DIAGNOSED YESTERDAY, THE BLOOD LEAD PROBABLY REFLECTS A FEW MONTHS PRIOR BECAUSE IT'S, YOU

KNOW, IT'S A CUMULATIVE MEASURE IN THE SAME WAY THAT I JUST EXPLAINED.

AND HAIR DEFINITELY GOES BACK.

SO THEORETICALLY, YOU COULD HAVE A CROSS-SECTIONAL STUDY THAT LIMITS TO THE DIAGNOSIS WITHIN A CERTAIN NUMBER OF MONTHS THAT TAKES HAIR SAMPLES AND THE HAIR SAMPLES THEN WOULD REFLECT EXPOSURE OF PRIOR TO THE ONSET OF THIS DISEASE BECAUSE OF WHAT WE KNOW ABOUT THE BIOLOGY.

HOWEVER, YES, WE ARE WORRIED ABOUT CROSS-SECTIONAL STUDIES NOT BEING VERY CLEAR ABOUT EXACTLY WHEN THE DIAGNOSIS WAS MADE, AND THEREFORE, THE TEMPORALITY ISSUE IS NOT AS EASILY RESOLVABLE, BUT IT IS RESOLVABLE IF YOU PAY ATTENTION.

Q OKAY. WELL, LET ME SHOW YOU ONE MORE EXCERPT FROM WHAT WE CALL THE REFERENCE MANUAL ON SCIENTIFIC EVIDENCE AND SEE IF YOU AGREE WITH WHAT THEY SAY ABOUT CROSS-SECTIONAL STUDIES.

ONE SECOND, DOCTOR.

OKAY. THIS IS FROM THE REFERENCE MANUAL ON SCIENTIFIC EVIDENCE PAGES 560 TO 6 IS AND ON CROSS-SECTIONAL STUDIES.

AND, DOCTOR, I'M GOING TO READ TO YOU THE FIRST SENTENCE THAT'S HIGHLIGHTED: "BECAUSE BOTH EXPOSURE AND DISEASE ARE DETERMINED IN AN INDIVIDUAL AT THE SAME POINT IN TIME, IT IS NOT POSSIBLE TO ESTABLISH THE TEMPORAL RELATION BETWEEN EXPOSURE AND DISEASE; THAT IS, THAT THE

EXPOSURE PRECEDED THE DISEASE WHICH WOULD BE NECESSARY FOR DRAWING ANY CAUSAL INFERENCE."

DO YOU SEE WHERE I JUST READ FROM?

A YES.

Q DO YOU AGREE WITH THAT STATEMENT?

A IT IS SO BROAD AND SO NON SPECIFIC. IT IS CORRECT IF REALLY WHAT YOU DO IN A CROSS-SECTIONAL STUDY IS ESTABLISH EXPOSURE AT THAT POINT IN TIME; HOWEVER, IF YOU ASK SOMEBODY TODAY, DID YOU SMOKE WHEN YOU WERE AGE 15, AND THAT PERSON DEVELOPED THEIR CANCER AT AGE 50, AND THEY ANSWER YES, I ALREADY SMOKED AT AGE 15. I HAVE TEMPORALITY, RIGHT.

SO A CROSS-SECTIONAL STUDY IS VERY MUCH CAPABLE OF ESTABLISHING TEMPORALITY, BUT IF YOU ASK QUESTIONS LIKE, ARE YOU A SMOKER NOW, AND YOU ASSESS WHETHER OR NOT SOMEBODY HAS CANCER NOW, THEN YOU CAN'T ESTABLISH TEMPORALITY. AND THAT'S WHAT THIS SAYS AND I AGREE WITH THAT.

IF YOU ARE GOING ABOUT IT A LITTLE SMARTER AND YOU SAID -- SAY -- YOU ASK WHEN DID YOU START SMOKING, WHAT WAS YOUR AGE, AND THE AGE IS IS PRIOR TO THE ONSET OF DISEASE, YOU HAVE ESTABLISHED TEMPORALITY. IT MAKES TOTAL SENSE, RIGHT.

Q OKAY.

AND THEN LET ME ASK YOU ABOUT THE -- BEFORE I MOVE TO A DIFFERENT TOPIC, MAYBE WE'LL TAKE A BREAK AFTER THIS. THE LAST SENTENCE IN THE REFERENCE MANUAL. THIS IS ON -- THIS WOULD BE ON PAGE 561.

"CROSS-SECTIONAL STUDIES ARE INFREQUENTLY USED WHEN THE EXPOSURE OF INTEREST IS AN ENVIRONMENTAL TOXIC AGENT, BUT THESE STUDIES CAN PROVIDE VALUABLE LEADS FOR FURTHER DIRECTIONS -- TO FURTHER DIRECTIONS FOR RESEARCH."

DO YOU SEE THAT?

A YES.

Q DO YOU AGREE WITH THAT?

A ABSOLUTELY NOT BECAUSE WE HAVE A FEDERAL GOVERNMENT THAT SPENDS MILLIONS OF DOLLARS EVERY YEAR TO CONDUCT THE LARGEST CROSS-SECTIONAL STUDY IN THE NATION CALLED NHNES, NATIONAL HEALTH AND NUTRITION EXAMINATION SURVEY, AND ALL THEY DO IS ESTABLISH ENVIRONMENTAL TOXINS. THERE'S A WHOLE LAB OF ANTONIO KALIFAT AT THE CDC THAT MEASURES EVERY TOXIN, EVERY PESTICIDES, EVERY METAL IN THESE INDIVIDUALS EXACTLY FOR THE PURPOSE OF FOR THESE KIND OF VERY INFORMATIVE CROSS-SECTIONAL STUDIES.

WE WOULDN'T BE SPENDING SO MUCH MONEY AT CDC AND AT THE FEDERAL LEVEL TO CONDUCT THESE NHNES SURVEYS IF WE THOUGHT THEY WERE USELESS. THEY ARE NOT. THEY ARE VERY, VERY INFORMATIVE AND VERY WELL SUPPORTED BY NIH.

MR. PETROSINELLI: OKAY. DOCTOR, WE CAN TAKE THAT DOWN.

YOUR HONOR, I KNOW WE WERE GOING TO TAKE A BREAK AT ABOUT 3:00. WE'RE JUST BEFORE 3:00. I'M ABOUT

TO MOVE TO A DIFFERENT TOPIC. WOULD THIS BE A GOOD TIME?

THE COURT: YES, IT WOULD.

LET'S BREAK, PLEASE, UNTIL 3:15.

MR. PETROSINELLI: THANK YOU.

THE COURT: OKAY. THANK YOU.

THANK YOU, DOCTOR.

THE WITNESS: THANK YOU.

(RECESS)

THE COURT: LET'S MOVE ON FOR TODAY AND KEEP GOING.

MR. PETROSINELLI: OKAY. THANK YOU, YOUR HONOR.

Q DR. RITZ, LET ME SHOW YOU AGAIN YOUR REPORT WHICH IS EXHIBIT 4 ON PAGE 30.

I WANTED TO SHOW YOU, THIS IS YOUR TEMPORALITY ANALYSIS ON LEAD AND ADHD.

AND YOU SEE IT ON THE SCREEN HERE.

YOU RECOGNIZE THIS, DO YOU NOT?

A YES.

Q OKAY.

AND YOU SAY THAT -- YOU CITE THREE STUDIES TO SUPPORT TEMPORALITY. THE FIRST ONE SAYS, EARLY INFANCY AND BABY TEETH.

THAT'S THE ARORA STUDY; CORRECT?

A YES.

Q AND THEN THE KOREAN CHILD COHORT STUDY, THAT'S THE KIM 2016 STUDY; CORRECT?

A YES, WHERE THEY MEASURED LEAD AND AGE 8 AND THE AUTISTIC BEHAVIOR AT AGE 12.

Q RIGHT.

AND THEN THE THIRD STUDY, IT SAYS NORWEGIAN MOBA COHORT, THAT'S THE STUDY WHERE THE FIRST AUTHOR IS SKOGHEIM; CORRECT?

A CORRECT.

Q OKAY.

A THAT'S THE PRENATAL EXPOSURE STUDY.

Q OKAY. SO WHAT I WANT TO DO IS I WANT TO PUT UP THE CHART THAT YOU USED IN YOUR DIRECT YESTERDAY OF THE STUDIES ON LEAD AND ASD.

THIS IS THE CHART THAT YOU USED DURING YOUR TESTIMONY YESTERDAY.

DO YOU RECALL THAT?

A YEAH, THAT'S NOT MY CHART, BUT THAT'S THE CHART I WAS ASKED TO GO OVER, YES.

Q OH, I WAS JUST GOING TO ASK YOU. THAT WAS -- YOU YOU'VE ANTICIPATED MY FIRST QUESTION.

DID YOU PREPARE THIS CHART?

A NO.

Q DID YOU REVIEW IT FOR ACCURACY BEFORE YOU TESTIFIED ABOUT IT?

A NO, I WAS SHOWN THIS AS KIND OF AND AN AIDE TO WHAT'S OUT THERE.

Q OKAY. SO LET'S LOOK AT IT.

NOW, IN TERMS OF THE THREE STUDIES ON TEMPORALITY THAT YOU CITED FOR LEAD AND ASD, I WANT TO

LOOK FOR THOSE ON THIS CHART AND SO WE'RE GOING TO DO SOME ANIMATION. THERE'S KIM AND THERE'S ARORA.

DO YOU SEE THOSE TWO?

A YES, UM-HMM.

Q AND WHERE IS SKOGHEIM?

A I DON'T KNOW.

Q IN FACT, SKOGHEIM IS NOT ON THIS CHART; ISN'T THAT TRUE?

A WELL, I -- I CAN'T SEE THE REST SO I DON'T KNOW.

Q ALL RIGHT. WE'LL -- I'LL REPRESENT TO YOU JUST TO PUSH THIS ALONG THAT SKOGHEIM WAS NOT ON THIS CHART.

SKOGHEIM SHOULD BE ON THIS CHART, RIGHT? THIS A STUDY ON LEAD AND ASD IN THE PEER-REVIEWED LITERATURE; TRUE?

A CORRECT.

Q AND IF WE PUT SKOGHEIM ON THIS CHART, WHICH WE'LL DO RIGHT NOW, IT WOULD BE HERE BECAUSE WITH RESPECT TO LEAD AND ASD, THE SKOGHEIM STUDY CALCULATED ODDS RATIOS THAT WERE NEGATIVE BUT NOT STATISTICALLY SIGNIFICANT; CORRECT?

A I CAN'T REMEMBER. WE HAVE TO GO OVER THE STUDY.

BUT WHAT I RECALL IS, I MEAN, THE DETAILS WE HAVE TO GO TO THE STUDY FOR. BUT WHAT I RECALL IS THAT THEY DESCRIBED A INVERSE U SHAPED RELATIONSHIP THAT YOU JUST CITED BEFORE IN ONE OF YOU OWN SLIDES WHERE LOWER LEVELS AND HIGH LEVELS HAD POSITIVE ASSOCIATIONS;

WHETHER THAT'S STATISTICALLY SIGNIFICANT OR NOT, I CAN'T RECALL.

Q ALL RIGHT. WELL, LET'S LOOK AT THAT STUDY AND NOT LEAVE ANY QUESTION ABOUT IT.

THE SKOGHEIM STUDY IS EXHIBIT 629.

WHICH WE'LL PULL UP -- HERE IS THE ACTUAL STUDY.

AND LET'S GO TO -- FIRST OF ALL, LET ME JUST -- LET'S JUST SET UP WHAT THIS STUDY IS.

THEY MEASURED MATERNAL BLOOD, IN OTHER WORDS, FOR THE WOMEN WHO WERE PREGNANT, THEY MEASURED METAL LEVELS IN THEIR BLOOD; CORRECT?

A I BELIEVE SO, BUT WE HAVE TO GO TO THE METHODS TO LOOK THAT UP.

Q OKAY.

AND LET'S LOOK AT FIGURE 2 WHICH IS ON PAGE 7 OF THE STUDY.

NOW, YOU RECALL, DO YOU NOT, DOCTOR, THAT WHAT THEY DID HERE IS THEY DIVIDED THE LEVELS OF EXPOSURE TO THE METALS INTO QUARTILES; CORRECT?

A THAT'S WHAT IT LOOKS LIKE BECAUSE THE Q PROBABLY MEANS QUARTILES AND THERE ARE FOUR, SO THAT WOULD BE CORRECT.

Q ALL RIGHT. AND THE WAY TO READ THIS CHART, AND WE'VE HIGHLIGHTED THE FINDINGS ON LEAD.

YOU SEE THE ABBREVIATION FOR LEAD PB; CORRECT?

A YES.

Q ALL RIGHT.

AND THE WAY TO READ THIS CHART IS THAT THE FIRST QUARTILE IS THE REFERENCE LEVEL OF THE METAL IN THE MOTHER'S BLOOD, SO THAT'S AT THE LINE THAT'S EXACTLY AT ONE; CORRECT?

A YES.

Q AND THEN THE SUBSEQUENT THREE QUARTILES, QUARTILES TWO, THREE AND FOUR, THOSE ARE INCREASING LEVELS OF LEAD IN THE MOTHER'S BLOOD; CORRECT?

A CORRECT.

Q AND WHAT WE SEE FOR LEAD IN QUARTILES TWO, THREE AND FOUR, THOSE INCREASING LEVELS OF LEAD IN THE MOTHER'S BLOOD, IS THAT THE ODDS RATIO WHICH YOU TALKED ABOUT YESTERDAY FOR ALL THREE QUARTILES IS BELOW ONE; CORRECT?

A CORRECT.

Q AND THE CONFIDENCE INTERVALS WHICH ARE THOSE, I THINK YOU CALLED THE WHISKERS YESTERDAY, AROUND EACH OF THE POINT ESTIMATES, FOR EACH OF THOSE QUARTILES CROSS ONE; CORRECT?

A CORRECT.

Q AND SO WHAT YOU WOULD SAY IS THAT THIS STUDY SHOWED A NEGATIVE ASSOCIATION BETWEEN LEAD AND THESE QUARTILES OF -- THESE QUARTILES OF LEVELS OF LEAD IN THE MOTHER'S BLOOD AND ASD THAT WAS NOT STATISTICALLY SIGNIFICANT; CORRECT?

A ACCORDING TO THIS ONE GRAPH, YES, BUT THAT'S NOT THE ONLY GRAPH THEY SHOWED.

Q ALL RIGHT.

LET'S GO BACK TO THE -- OR LET ME SHOW YOU ONE MORE THING IN THE SKOGHEIM STUDY WHERE THEY DISCUSS WHAT THEIR RESULTS WERE. THIS IS ON PAGE 9 OF THE STUDY. AND THE FIRST -- THIS IS THE FIRST PARAGRAPH OF THE DISCUSSION SECTION OF THE STUDY.

THEY SAID, "IN THIS LARGE PROSPECTIVE STUDY" -- BY THE WAY, LET ME BEFORE I READ FURTHER, THIS WAS A LARGE PROSPECTIVE STUDY; CORRECT?

A IT WAS A PROSPECTIVE STUDY, YEAH, A BIRTH COHORT OR BETTER PREGNANCY COHORT.

Q RIGHT.

"IN THIS LARGE PROSPECTIVE STUDY, WE FOUND ASSOCIATIONS INDICATING INCREASED RISK OF ASD IN CHILDREN WITH INCREASED MATERNAL LEVELS OF ARSENIC, CADMIUM AND MANGANESE AND INCREASED RISK OF ASD WITH INCREASED MATERNAL LEVELS OF CADMIUM AND MAGNESIUM."

CORRECT?

A YES.

Q AND THEY DID NOT FIND INCREASED RISK OF ASD OR ADHD WITH LEAD ACCORDING TO THIS SENTENCE?

A IN THIS SENTENCE, NO. BUT WE CAN GO TO WHERE THEY DESCRIBE THEIR LEAD EXPOSURES.

Q OKAY.

LET'S GO BACK TO THE DEMONSTRATIVE CHART.

MR. WISNER: YOUR HONOR, I'M GOING TO HAVE TO ISSUE AN OBJECTION. THE STUDY CLEARLY SAYS IT'S AN ASSOCIATION WITH LEAD IN THE LEAD SECTION. THIS IS

CLEARLY MISLEADING.

THE COURT: OVERRULED.

MR. PETROSINELLI:

Q NOW, WE JUST DISCUSSED YOU HAD CITED THESE THREE STUDIES; KIM, ARORA AND SKOGHEIM IN YOUR SUPPORT FOR TEMPORALITY WITH LEAD.

I WANTED TO ASK YOU, DOCTOR, DO YOU AGREE WITH ME THAT THERE ARE OTHER STUDIES OF LEAD AND ASD WHERE THE LEAD MEASUREMENTS WERE TAKEN BEFORE ASD DEVELOPED SO TEMPORALITY IS ESTABLISHED?

DO YOU AGREE WITH THAT?

A WELL, THESE WERE EXAMPLES, AND THAT'S HOW I QUOTE MYSELF, RIGHT. THESE ARE EXAMPLES OF WHERE TEMPORALITY IS WELL ESTABLISHED. IT DOESN'T MEAN THAT YOU CAN'T COME TO THE CONCLUSION THAT TEMPORALITY CAN BE ESTABLISHED IN OTHER STUDIES.

Q RIGHT.

I WAS JUST --

A YES, YOU CAN DO THAT IN OTHER STUDIES TOO, YES.

Q RIGHT. THAT'S EXACTLY WHAT I WAS ASKING YOU.

AND I'M GOING TO SHOW YOU -- AND WE COUNTED FIVE OTHER STUDIES OF LEAD AND ASD WHERE TEMPORALITY COULD BE ESTABLISHED; DOHERTY, FRYE, LONG, ALAMPI AND ABDULLAH, WHICH ARE SHOWED HERE.

DO YOU SEE THAT?

A YES.

Q AND DO YOU AGREE WITH ME -- LET ME PUT UP ANOTHER DEMONSTRATIVE SO WE CAN FOCUS ON THESE STUDIES,

THESE TEMPORALITY STUDIES.

NO, THE OTHER. EXHIBIT 682. WE HAVE IT. WE'RE GOING TO MARK IT.

OKAY. SO THESE ARE EIGHT STUDIES THAT WE JUST TALKED ABOUT. LET'S LOOK AT THE CHARACTERISTICS OF THESE STUDIES.

DO YOU AGREE WITH ME WITH RESPECT TO THESE EIGHT STUDIES THAT FIVE OF THEM HAD AUTISM SPECIFICALLY AS AN END POINT AND THREE OF THEM HAD AUTISTIC BEHAVIORS?

A I BELIEVE YOU'RE CORRECT. I'M NOT RECALLING ALAMPI, BUT I BELIEVE YOU. BUT YOU CAN SHOW ME.

Q OKAY.

A I CAN'T REMEMBER IF WHETHER IT'S ASD OR ASD BEHAVIORS IN THAT STUDY.

THE REST I THINK, YES, THERE IS A DIAGNOSIS BECAUSE FRYE, LONG, ARORA, ABDULLAH, THOSE ARE CASE CONTROL STUDIES SO THEY WOULD BE ESTABLISH. AND SKOGHEIM WE JUST LOOKED AT.

Q OKAY.

AND LET'S LOOK AT THE NEXT COLUMN ON THIS CHART.

THESE ARE THE BIOMARKERS IN THESE STUDIES. YOU CAN -- THEY RANGE FROM BABY TEETH TO AMNIOTIC FLUID TO MATERNAL BLOOD TO MATERNAL AND INFANT TOENAILS.

IS IT CORRECT THAT THESE ARE THE BIOMARKERS THAT THESE STUDIES MEASURED?

A AS FAR AS I RECALL, YES. I WOULD IMAGINE YOU

DID THIS CORRECTLY.

Q OKAY.

AND THIS IS WHY THESE STUDIES CAN SHOW TEMPORALITY BECAUSE WHEN YOU MEASURE MATERNAL BLOOD OR AMNIOTIC FLUID OR BABY TEETH AND THINGS LIKE THAT, THE EXPOSURE THAT YOU'RE MEASURING PRE-DATES THE DEVELOPMENT OF AUTISM; CORRECT?

A IT DEPENDS ON WHEN THEY ARE TAKEN AND HOW THE MEASURES ARE DONE. AMNIOTIC FLUID IS CERTAINLY PRIOR TO THE DIAGNOSIS. BABY TEETH PROBABLY ALSO MATERNAL BLOOD, DEPENDS ON WHEN IT WAS TAKEN. MATERNAL TOENAILS, DEPENDS ON WHEN THEY WERE TAKEN. CHILD BLOOD, DEPENDS ON WHEN IT WAS TAKEN.

BUT YES, IF WE KNOW MORE ABOUT THESE STUDIES, WE CAN PROBABLY AGREE THAT WE CAN ESTABLISH TEMPORALITY.

Q OKAY.

AND THEN LET ME SHOW YOU THE FINAL COLUMN.

WHETHER -- THE QUESTION IS WHETHER THERE WAS -- THESE STUDIES SHOWED A SIGNIFICANT ASSOCIATION -- A STATISTICALLY SIGNIFICANT ASSOCIATION THE EXPOSURE AND EITHER THE ASD DIAGNOSIS OR THE ASD BEHAVIORS.

DO YOU AGREE WITH ME THAT SKOGHEIM, FRYE, LONG, ABDULLAH, ALAMPI, DOHERTY DID NOT FIND A STATISTICALLY SIGNIFICANT ASSOCIATION BETWEEN EXPOSURE TO LEAD IN THE BIOMARKER THAT WAS MEASURED AND ASD?

A I TRIED TO EXPLAIN TO YOU IN MY DEPOSITION THAT THE LAST -- THE LAST THING AN EPIDEMIOLOGIST IS TAUGHT TO USE IS THE CRITERIA OF STATISTICAL SIGNIFICANCE. WE

LOOK AT THE DATA AS A WHOLE. WE LOOK AT EFFECT ESTIMATES, CONFIDENCE INTERVALS AND BIASES.

I DO NOT LOOK AT STATISTICAL SIGNIFICANCE AS A CRITERIA FOR EVALUATING STUDIES. IF YOU WANT ME TO LOOK AT EVERY SINGLE ONE OF THESE, I'M HAPPY TO DO SO AND I'M HAPPY TO TELL YOU WHAT I THINK ABOUT THE RESULTS.

Q DO YOU -- CAN YOU TELL ME -- YOU READ ALL THESE STUDIES AND DISCUSSED THEM IN YOUR REPORT, DID YOU NOT?

A YES.

Q OKAY. AND CAN YOU -- AND I'LL TALK TO YOU ABOUT STATISTICAL SIGNIFICANCE IN A MOMENT AND I APPRECIATE YOUR POSITION ON THAT.

MY QUESTION IS SIMPLY, CAN YOU TELL ME THAT YOU AGREE THAT THE STUDIES -- SIX OF THESE EIGHT STUDIES DID NOT FIND A STATISTICALLY SIGNIFICANT ASSOCIATION BETWEEN LEAD EXPOSURE AND ASD?

A I WOULD HAVE TO LOOK AT EVERY SINGLE STUDY AND TELL YOU WHAT IT -- WHAT IT SHOWS. I CAN'T RECALL STATISTICAL SIGNIFICANCE BECAUSE THAT'S NOT A CRITERION I WOULD EVER USE.

Q ALL RIGHT.

WELL, LET'S LOOK -- WE'RE NOT GOING TO LOOK AT ALL THESE STUDIES, BUT LET'S JUST DO A COUPLE OF THEM JUST TO -- JUST AS A CHECK.

BY THE WAY, LET'S GO BACK TO THE DEMONSTRATIVE WE JUST HAD ON THE SCREEN WHILE WE -- SO THAT WE CAN GO THROUGH A COUPLE OF THESE.

BUT I JUST WANT TO ASK A QUESTION.

THIS DEMONSTRATIVE YOU SHOWED YESTERDAY DURING YOUR TESTIMONY, IT DID NOT HAVE ON IT ALAMPI, DOHERTY, FRYE, LONG OR SKOGHEIM; CORRECT?

A I DON'T RECALL. I ONLY SAW THIS ON THE SCREEN ONCE.

Q OKAY.

AND YOU AGREE THAT ALAMPI, DOHERTY, FRYE, LONG AND SKOGHEIM BELONG ON THIS CHART, THEY ARE LEAD -- STUDIES OF LEAD IN ASD IN THE PEER-REVIEWED LITERATURE; CORRECT?

A YES, THEY ARE.

Q OKAY.

SO LET'S LOOK AT JUST ONE OF -- MAYBE ONE OR TWO OF THESE.

LET'S LOOK AT DOHERTY.

OH, BY THE WAY, BEFORE WE DO THAT, LET ME JUST ASK YOU ONE OTHER THING.

DO YOU SEE WHERE IT SAYS ARORA AND IT SAYS H?

A YES.

Q AND DO YOU SEE THE LEGEND, H IS COHORT STUDY?

A WHERE IS THAT?

Q UP ON THE TOP RIGHT, I'M SORRY.

A OH. OH, I NEVER LOOKED AT THAT. I WASN'T SURE WHAT H MEANT. I THOUGHT IT WAS --

Q OKAY. THAT'S WRONG. ARORA IS NOT A COHORT STUDY. ARORA IS A CASE CONTROL STUDY?

A YES.

Q OKAY.

A IT'S ACTUALLY A TWIN STUDY. IT'S A VERY SPECIAL DESIGN.

Q RIGHT.

BUT IT'S A CASE CONTROL DESIGN?

A YES, IT'S A SPECIAL KIND OF CASE CONTROL DESIGN THAT'S USUALLY REFERRED TO AS A TWIN STUDY, YES.

Q RIGHT. OKAY.

SO THAT'S A MISTAKE ON THIS CHART. THAT SHOULD NOT BE LABELED AS A COHORT STUDY; CORRECT?

A IF H MEANS COHORT, THEN NO. I THOUGHT IT WAS TEETH.

Q ALL RIGHT.

LET'S LOOK AT THE LONG STUDY WHICH IS EXHIBIT 92.

YOU READ THIS STUDY, DOCTOR, DID YOU NOT?

A I KNOW THIS GROUP VERY WELL BECAUSE I WORK WITH THEM.

Q RIGHT.

THAT'S WHAT I RECALLED, I THINK, FROM YOUR DEPOSITION.

A UM-HMM.

Q AND THIS IS A STUDY WHERE THEY MEASURE METALS AND OTHER THINGS, CHEMICALS, IN AMNIOTIC FLUID OF MOTHERS; CORRECT?

A I SEEM TO RECALL, YES.

Q ALL RIGHT.

AND ONE OF THE METALS THEY DETECTED IN AMNIOTIC FLUID WAS LEAD; CORRECT?

A YES.
Q ALL RIGHT.
AND LET'S LOOK AT WHAT THEY FOUND.
ON PAGE 7 OF THE STUDY -- AND I'M GOING TO DIRECT YOU, DOCTOR, UNDER THE HEADING UNDER "RESULTS," THE HEADING IS "LEVELS OF ELEMENTS AND HEAVY METALS," AND THEY FOUND, "SIMILAR METALS OF ELEMENTS IN HEAVY METALS BETWEEN ASD CASES AND CONTROLS WERE OBSERVED."
DO YOU SEE THAT?
A YES.
Q AND THEN WE'LL GO -- WE'LL LOOK AT THE TABLE JUST SO WE HAVE THE NUMBERS IN FRONT OF US.
IF YOU GO TO PAGE 10 OF THE STUDY, THIS IS WHERE THEY LAY OUT THE RESULTS OF THESE VARIOUS METALS THAT ARE ON THE LEFT AND THE LEVELS IN THE CASES AND THE CONTROLS; CORRECT?
A YES.
Q AND THE LAST ONE IS LEAD; TRUE?
A CORRECT. UM-HMM.
Q AND WHAT THEY FOUND WAS NO STATISTICALLY SIGNIFICANT DIFFERENCE BETWEEN THE CASES, THE KIDS WITH ASD, AND THE CONTROLS, THE KIDS WITHOUT ASD, IN TERMS OF LEAD; TRUE?
A YES. AND IN THIS CASE THEY HAVE 37 CASES AND 51 CONTROLS AND THEIR ODDS RATIO, OR 50 CONTROLS WITH ADJUSTMENT, THEIR ODDS RATIO IS 1.3, THAT INDICATES A 30 PERCENT INCREASE IN RISK ACCORDING TO LEAD, HIGHER LEAD, AND THEIR CONFIDENCE INTERVAL INCLUDES THE ONE,

BUT CLEARLY THE POINT ESTIMATE POINTS INTO THE DIRECTION OF AN EFFECT; HOWEVER, WHEN YOU KNOW WHERE THESE KIDS LIVE AND HOW LOW THE LEVELS ARE, YOU WOULD NEED 3,000 CHILDREN TO MAKE THIS ODDS RATIO STATISTICALLY SIGNIFICANT IF THE TRUE ODDS RATIO WAS 1.3 INDICATING AN INCREASE.

SO IT'S A COMPLETELY UNDERPOWERED STUDY.

Q BUT IT'S -- YOU AGREE -- MY QUESTION WAS YOU AGREE THAT THERE'S NO STATISTICALLY SIGNIFICANT DIFFERENCE BETWEEN THE CASES AND THE CONTROLS?

A WHICH IS COMPLETELY IRRELEVANT WHEN YOU HAVE A STUDY THAT IS SO UNDERPOWERED THAT IT COULDN'T SEE ANYTHING EVEN IF YOU TRIED.

Q OKAY.

LET'S LOOK AT ONE MORE OF THE STUDIES, A STUDY CALLED DOHERTY, WHICH IS EXHIBIT 630.

THIS IS A STUDY -- THIS IS ACTUALLY ONE OF THE FEW COHORT STUDIES OF LEAD AND ASD; ISN'T THAT TRUE?

A IT IS SIMILAR TO THE SKOGHEIM, BUT MUCH SMALLER.

Q IT'S A --

A A PRENATAL EXPOSURE STUDY, YES.

Q YES.

THIS IS WAS DONE IN NEW HAMPSHIRE; DO YOU RECALL THAT?

A YES.

Q AND THE STUDY WAS FUNDED BY NIH, THE NATIONAL STATUTES OF HEALTH, AND EPA; CORRECT?

A YES, AND IT WAS INTERESTED IN ARSENIC.
Q AND IT'S -- THIS STUDY HAD -- YOU'D CHARACTERIZE THIS AS A MEDIUM SIZE STUDY, WOULDN'T YOU? IT HAD 371 PARTICIPANTS?
A YEAH, FOR -- NO, ACTUALLY, FOR A COHORT STUDY, IT'S VERY SMALL.
Q OKAY.
LET'S SEE HOW YOU CHARACTERIZE IT IN YOUR DEPOSITION JUST FOR ONE SECOND.
LET'S GO TO -- THIS IS YOUR EXHIBIT 7, WHICH IS YOUR DEPOSITION ON PAGE 169.
AND IF YOU LOOK AT LINES -- FROM LINES 10 TO 18 WHEN I ASKED YOU ABOUT THE DOHERTY STUDY, THE PROSPECTIVE COHORT STUDY, IT'S 371 PARTICIPANTS.
AND I SAID: "AND SO WOULD YOU CHARACTERIZE THAT AS A SMALL, MEDIUM OR A LARGE STUDY?"
YOU SAID "MEDIUM."
DO YOU SEE THAT, DOCTOR?
A YEAH.
Q IT'S A MEDIUM SIZED STUDY; DO YOU AGREE?
A WELL, I SAID MEDIUM THEN, BUT HONESTLY, WHEN YOU COMPARE IT TO SKOGHEIM, IT SEEMS RATHER SMALL. SKOGHEIM WAS A HUNDRED THOUSAND CHILDREN.
Q ALL RIGHT. WE'LL GO BACK TO THE STUDY AND LET'S LOOK AT THE RESULTS.
IN THIS STUDY WHAT THEY DID BASICALLY IS TAKE MEASURES OF LEAD AND OTHER METALS IN THE TOENAILS OF MOTHERS, BOTH BEFORE OR AFTER BIRTH, AND THE CHILDREN

RIGHT AFTER BIRTH; CORRECT?

A I SEEM TO RECALL THAT. CAN YOU POINT OUT WHERE YOU SEE THIS?

Q I SURE CAN.

THIS IS AT -- IF YOU LOOK AT THE METHODS IN THE STUDY ON PAGE 2, IN THE BOTTOM LEFT IT SAYS EXPOSURE TO METALS AND THEN WE CAN BLOW THAT UP.

AND DO YOU SEE RIGHT IN THAT FIRST SENTENCE THEY MEASURED CONCENTRATIONS OF METALS IN TOENAIL SAMPLES COLLECTED AT THREE TIME PERIODS, INCLUDING MATERNAL TOENAILS AT A MEDIAN OF 27 GESTATIONAL WEEKS AND A MEDIAN OF 4 WEEKS POST-PARTUM AND INFANT TOENAILS COLLECTED AT A MEDIAN OF 6 WEEKS OF LIFE.

DO YOU SEE THAT?

A YES. UM-HMM.

Q ALL RIGHT. SO THAT'S HOW THEY DID THE STUDY.

AND THEY MEASURED FOR METALS IN THOSE TOENAILS; TRUE?

A YES.

Q AND THEN THEY SAW WHICH OF THE CHILDREN DEVELOPED ASD AND WHICH CHILDREN DID NOT DEVELOP ASD; CORRECT?

A IT WASN'T REALLY ASD. IT WAS ASD BEHAVIORS, RIGHT.

Q ASD BEHAVIORS. YOU'RE RIGHT. THANK YOU FOR THAT CLARIFICATION.

BUT THEY COMPARED THOSE TO CHILDREN; CORRECT?

A THEY COM --

Q TO TWO SETS OF CHILDREN?

A THEY COMPARED CHILDREN WITH MORE OR LESS ASD-LIKE BEHAVIORS. THEY COMPARED THE EXPOSURES IN CHILDREN WITH MORE OR LESS ASD-LIKE BEHAVIORS, YES.

Q RIGHT.

AND SO -- AND WHEN THEY LOOKED AT LEAD, THEY FOUND NO RELATIONSHIP BETWEEN THE EXPOSURES IN ANY OF THESE TIME PERIODS, ANY OF THE TOENAIL SAMPLE TIME PERIODS AND THESE ASD OR AUTISTIC BEHAVIORS; TRUE?

A YOU HAVE TO SHOW ME THE RESULTS.

Q ALL RIGHT.

A AND WE ARE TALKING PRENATAL BASICALLY, RIGHT.

Q WELL, DIDN'T THEY TAKE THE INFANT TOENAILS AT SIX WEEKS OF LIFE?

A YEAH, BUT THEY ARE SAYING THAT IT REFLECTS REALLY 6 TO 12 MONTHS IN ADULTS, AND IT PROBABLY REFLECTS THE LAST TRIMESTER AND THE FIRST MONTH OF LIFE IN CHILDREN.

Q ALL RIGHT.

AND WE'LL GO TO THEIR FINDINGS ON PAGE 6 OF THE STUDY.

YOU SEE, I'M NOT GOING TO MAKE YOU READ THOSE GRAPHS WHICH HAVE THE FINDINGS, BUT LET'S LOOK AT THE TEXT AND SEE WHAT THEY SAY.

IN THE LEFT COLUMN STARTING WITH THE PARAGRAPH I GUESS SAYING, "HOWEVER."

A YES, I SEE IT.

Q OKAY.

OKAY. AND DO YOU SEE IT SAYS, "IN ADDITION TO THESE FINDINGS, WE ALSO OBSERVED ASSOCIATIONS THAT ARE NOT SUPPORTED BY THE PRIOR LITERATURE, INCLUDING THE LACK OF ADVERSE ASSOCIATIONS OF LEAD."

DO YOU SEE THAT?

A YES. AND THEY WONDER WHY.

Q RIGHT.

SO WOULD YOU -- YOU WOULD AGREE WITH ME THAT THIS IS A NULL STUDY?

A WELL, THEY ARE SAYING -- THEY ARE REALLY WONDERING WHY THEY ARE NOT SEEING IT AND THEY ARE THEN GOING INTO RESIDUAL CONFOUNDING BECAUSE THEIR STUDY WAS REALLY AN ARSENIC STUDY AND SO THEY WONDERED WHETHER IT WAS CONFOUNDED BY ARSENIC, I GUESS; AND "ADDITIONALLY, SUCH RESULTS MAY BE OWING TO CHANCE AS WE DID NOT CORRECT FOR MULTIPLE TESTING OWING TO THE DEPENDENCE AMONG THE OUTCOMES."

SO THEY ARE SAYING, WELL, BASICALLY WE ARE DOING A LOT OF TESTING HERE, STATISTICAL TESTING, AND JUST BY CHANCE WE COULD SEE NO ASSOCIATION EVEN IF THERE WAS ONE.

Q BUT YOU WOULD CHARACTERIZE THIS AS A NULL STUDY; TRUE?

A YES.

Q OKAY. LET'S GO BACK TO THE DEMONSTRATIVE.

AND SO, DOCTOR, ARE YOU AWARE OF -- IF YOU LOOK AT THESE EIGHT STUDIES THAT ARE HIGHLIGHTED HERE THAT

PROVIDE TEMPORALITY IN THEIR MEASUREMENTS OF LEAD, ARE YOU AWARE OF -- I'LL STRIKE THAT.

ISN'T IT TRUE THAT THE RESULTS OF THE STUDIES THAT -- ON LEAD AND ASD WHERE LEAD IS MEASURED BEFORE THE DEVELOPMENT OF ASD ARE TOTALLY INCONSISTENT; ISN'T THAT TRUE?

A THERE'S STRONG INCONSISTENCY BETWEEN THIS RESULT -- BETWEEN THESE STUDIES IN MANY WAYS; FOR EXAMPLE, LONG SHOULD HAVE NEVER TRIED TO EVEN ESTIMATE ANY DIFFERENCES GIVEN THEIR SAMPLE SIZE, SO THAT STUDY IS COMPLETELY UNINFORMATIVE.

DOHERTY WONDERED THEMSELVES WHAT THEY HAD DONE WRONG, SO I WONDER TOO WHAT THE PROBLEM IS WITH THE STUDY.

ABDULLAH, I NEVER FIGURED OUT HOW THEY ACTUALLY DREW THEIR CONTROLS. I TRIED VERY HARD, FOR THE TEETH, AND I HAVE NO IDEA WHETHER THEIR CONTROL SELECTION WAS ADEQUATE.

THEY ALSO EVEN IF -- IF WE ASSUME THAT THEIR CONTROL SELECTION WAS ADEQUATE, THEY DIDN'T DO WHAT ARORA DID WHICH WAS GO WAY BEYOND AND CONTROL FOR GENETICS.

SO IF WE ALL AGREE THAT GENETICS INTERACT WITH THE ENVIRONMENT, THEN ARORA IS THE STUDY YOU WANT TO INTERPRET. ABDULLAH, YOU QUESTION WHAT THEY DID.

BUT YES, IT IS A NEGATIVE STUDY.

Q AND IS IT TRUE THAT WHEN YOU LOOK AT THESE EIGHT STUDIES, THEY WERE DONE IN DIFFERENT GEOGRAPHIES

USING DIFFERENT BIOMARKERS AND DIFFERENT STUDY DESIGNS; TRUE?

A YES.

Q BY THE WAY, I THINK YOU JUST SAID ABOUT THE LONG STUDY, THEY SHOULDN'T HAVE DONE THE STUDY BECAUSE IT WAS TOO SMALL OR SOMETHING TO THAT EFFECT.

DID YOU SAY THAT?

A WELL, THE COMPARISONS THEY TRIED TO DO IN THE WAY THEY DID IT, AND I KNOW THIS GROUP VERY WELL. AND IF YOU LOOK AT THE AUTHORSHIP LIST, THEY WORKED WITH THE BEST EPIDEMIOLOGISTS IN THE COUNTRY AND HIS NAME IS NOT ON THIS. THAT'S YAN OLSEN. HE WAS PART OF THE STUDY GROUP. SO YOU WONDER WHY HE'S NOT ON IT. PROBABLY BECAUSE HE DISAGREED ON HOW THIS ANALYSIS WAS DONE AND HOW IT WAS PRESENTED.

IT WAS A BUNCH OF TOXICOLOGISTS TRYING TO DO EPIDEMIOLOGY AND PRESENTING RESULTS THAT, YOU KNOW, I WOULD QUESTION IN THE WAY THEY ARE PRESENTED.

Q WELL, LET'S LOOK AT WHAT YOU SAID ABOUT THE LONG STUDY IN YOUR REPORT.

LET'S GO TO EXHIBIT 4 AGAIN AT PAGE 23.

A I KNOW WHAT I SAID ABOUT IT. I SAID IT IS SMALL AND IT HAS, YOU KNOW, WHATEVER IT HAS.

IT'S INTERESTING BECAUSE OF THE MARKERS. BUT IT ISN'T PRESENTED IN THE WAY THAT I AS AN EPIDEMIOLOGIST WOULD HAVE LIKED THEM TO DO IT.

Q LET'S LOOK AT EXACTLY WHAT YOU SAID. IT LOOKS LIKE AT THE FIRST -- IT'S THE VERY FIRST STUDY YOU

DISCUSSED UNDER YOUR ANALYSIS OF LEAD AND ASD, AND SO LET'S LOOK AT WHAT YOU SAID ABOUT IT.

"A CASE CONTROL STUDY OF AUTISM NESTED WITHIN THE HISTORIC BIRTH COHORT AT STATENS SEREM INSTITUTE IN DENMARK IS PARTICULARLY NOTEWORTHY IN TERMS OF ACCURACY OF TIMING OF EXPOSURE AND ESTIMATING EXPOSURE LEVELS DURING THE MOST IMPORTANT AND SENSITIVE NEURODEVELOPMENTAL PERIODS FOR ASD."

DO YOU SEE THAT?

A CORRECT.

Q AND WHEN YOU SAID, "DURING THE MOST IMPORTANT AND SENSITIVE NEURODEVELOPMENT PERIODS FOR ASD," THE MEASUREMENTS THAT WERE DONE OF THE AMNIOTIC FLUID, THE AVERAGE WAS AT 15 WEEKS OF GESTATION; CORRECT?

A I THOUGHT IT WAS LATER, BUT I DON'T REMEMBER.

Q WHATEVER IT WAS, THAT PERIOD YOU VIEWED AS THE MOST IMPORTANT AND SENSITIVE NEURODEVELOPMENTAL PERIOD FOR ASD, CORRECT; THAT'S WHAT YOU SAID?

A THAT'S WHAT THIS SAYS. BUT I DON'T KNOW WHAT THE TIMING WAS IN THAT STUDY. WE HAVE TO GO BACK TO IT.

Q ALL RIGHT. WELL, WE'LL TAKE A LOOK AT IT.

LET'S GO BACK TO EXHIBIT 92. AND WE'LL GO TO PAGE 7. AND WE'LL GO UNDER "RESULTS," THE FIRST PARAGRAPH, "CHARACTERISTICS OF THE STUDY POPULATION."

AND YOU SEE THE SECOND -- THE THIRD SENTENCE: "THE MAJORITY OF AMNIOTIC FLUID SAMPLES WERE OBTAINED IN GESTATIONAL WEEK 15."

DO YOU SEE THAT?

A YES.

Q AND SO THAT IS THE PERIOD THAT YOU SAID WAS THE MOST IMPORTANT AND SENSITIVE NEURODEVELOPMENTAL PERIOD FOR ASD; CORRECT?

A THAT'S WHAT I SAID.

Q ALL RIGHT.

OKAY. AND YOU -- YOU AGREE --

A BUT I DIDN'T SAY 15 WEEKS. I DIDN'T SAY 15 WEEKS. I SAID THAT THE PRENATAL PERIOD IS THE MOST SENSITIVE.

Q THE -- IN FACT, THE -- YOU AGREE THAT THE PRENATAL PERIOD -- PRENATAL PERIOD IS STRONGLY IMPLICATED IN AUTISM ETIOLOGY; CORRECT?

A IN NEURODEVELOPMENT. WHETHER YOU -- FOR AUTISM, I -- ACTUALLY, NO.

Q OKAY.

A I MISSPOKE.

IT IS VERY, VERY IMPORTANT FOR NEURODEVELOPMENT. NOBODY WOULD ASK THAT -- WOULD QUESTION THAT BECAUSE YOU HAVE THE NEURAL TUBE DEFECTS THAT ARE ACTUALLY HAPPENING IN THE FIRST TRIMESTER. THEN YOU HAVE THE BRAIN BEING SET UP STRUCTURALLY IN A MAJOR WAY AND THEN YOU HAVE SYNAPTIC FORMATION.

SO IT REALLY DEPENDS ON WHAT WE'RE TALKING ABOUT HERE. ARE WE TALKING ABOUT STRUCTURAL DEFECTS OR ARE WE TALKING ABOUT ASD AS A SPECTRUM?

AND I HAVE TO SAY I SHOULD -- I PROBABLY SHOULD

HAVE SAID AUTISM, NOT ASD, BECAUSE ASD IS A SPECTRUM AND WE KNOW THAT NEURONS MATURE PRIOR TO BIRTH AND THEY MATURE AFTER BIRTH, AND ON THE SPECTRUM THAT BRAIN DEVELOPMENT GOES FAR INTO EARLY CHILDHOOD.

Q LET'S LOOK AT ONE OF YOUR PUBLICATIONS ON AUTISM. IT'S EXHIBIT 683. IT'S THE LEAD AUTHOR IS SOMEONE NAMED TRACY BECERRA.

DO YOU REMEMBER THAT PUBLICATION?

A YES.

Q OKAY. LET'S PULL THAT UP. THIS IS CALLED "AUTISM SPECTRUM DISORDERS AND RACE, ETHNICITY AND NATIVITY, A POPULATION BASED STUDY."

DO YOU SEE THAT?

A YES.

Q AND YOU'RE ONE OF THE AUTHORS ON THE STUDY. INDEED YOU'RE THE SENIOR AUTHOR ON THE STUDY; CORRECT?

A YES, IT LOOKS LIKE IT, UM-HMM.

Q AND LET'S LOOK AT THE SECOND PAGE OF THAT STUDY. THE PARAGRAPH ON THE LEFT COLUMN THAT STARTS WITH "THE PRENATAL PERIOD."

AND WHAT YOU AND YOUR CO-AUTHORS SAID IN THIS STUDY IS WHAT I JUST ASKED YOU: "THE PRENATAL PERIOD IS STRONGLY IMPLICATED IN ASD ETIOLOGY;" CORRECT?

A YES, AND I'M QUOTING THOSE CITATIONS.

Q RIGHT.

BUT IT'S IN YOUR -- IT'S IN YOUR -- THE STUDY THAT YOU PUBLISHED IN A PEER-REVIEWED JOURNAL; CORRECT?

A WELL, THIS IS WHERE I REVIEWED THE LITERATURE

AND I QUOTE THE LITERATURE 9 TO 11 THAT SAYS THE PRENATAL PERIOD IS STRONGLY IMPLICATED.

ACTUALLY, LATER IF YOU WOULD LOOK AT MY PAPERS, THE EPIDEMIOLOGISTS WHO ACTUALLY THEN STARTED STUDYING ASD AND ENVIRONMENT AND ACTUALLY FOR THE FIRST TIME WERE ABLE TO LOOK AT DIFFERENT DEVELOPMENTAL PERIODS BECAUSE, YOU KNOW, SCIENCE DEVELOPS.

YOU BELIEVE THAT, YOU KNOW, CERTAIN PERIODS ARE MORE IMPORTANT THAN OTHERS, BUT PEOPLE HAVE REALLY NOT COLLECTED ENOUGH DATA ON IT. NOW THAT WE HAVE COLLECTED A LOT MORE DATA, YOU KNOW, THIS WAS, YOU KNOW, 20 -- WHAT WAS IT -- '13 OR 2014.

Q 2014.

A YEAH.

SO IN THE MEANTIME I'VE DONE A LOT OF OTHER STUDIES. I'VE LOOKED AT WHEN THE EXPOSURES WERE MOST AFFECTING THE INCIDENCE OF ASD. AND WHEN I LOOK AT THOSE, MY OWN STUDIES THAT CAME LATER, THE AIR POLLUTION STUDIES, I ACTUALLY REVISED MY OPINION TO IT'S MORE LIKELY LATE PREGNANCY AND EARLY CHILDHOOD.

AND IF YOU LOOK AT MY DANISH STUDY WHERE I HAD THE BEST DATA TO EVALUATE THAT BECAUSE IT WAS A LOT -- IT WAS THOUSANDS OF ASD CHILDREN, IT WAS CLEARLY LATE PREGNANCY AND DEFINITELY EARLY LIFE AND NOT -- NOT THIS VERY EARLY PERIOD.

SO I CORRECTED MYSELF.

Q OKAY.

LET'S SEE WHO YOU SAID -- YOU MENTIONED THAT

YOU CITED FOOTNOTE REFERENCES 9 TO 11 --

A YES.

Q -- FOR THIS PROPOSITION.

LET'S SEE WHO WOULD HAVE SAID SUCH A THING.

LET'S GO TO THE FOOTNOTES, WHICH ARE ON PAGE, IT'S LABELED E70, I DON'T KNOW HOW TO -- IT'S THE SECOND TO LAST PAGE OF THE STUDY AND LOOK AT FOOTNOTE REFERENCES 9 TO 11.

ONE SECOND, DOCTOR.

A ARE YOU SHOWING ME THIS?

Q JUST ONE SECOND.

FOOTNOTE REFERENCE 10 IS HANNA GARDENER, ET AL., THAT'S ONE THE STUDIES YOU CITED FOR THE PROPOSITION THAT THE PRENATAL PERIOD IS STRONGLY IMPLICATED IN ASD ETIOLOGY; CORRECT?

A YES.

Q ALL RIGHT.

WE CAN TAKE THAT DOWN.

A BUT AS I SAID --

Q YOU --

A -- THIS WAS 2014, AND YOU KNOW, SCIENCE GOES IN LEAPS AND SPURTS, AND ALL OF SCIENCE ON AUTISM SPECTRUM, THE EPIDEMIOLOGY OF AUTISM SPECTRUM HAS REALLY DEVELOPED AFTER THE 2000S AND AFTER, YOU KNOW, THAT PERIOD.

I MEAN, MY FIRST STUDY WAS IN 2012. THIS ONE YOU'VE JUST CITED WAS IN 2014. I HAVE A LOT MORE PUBLICATIONS AFTERWARDS, AND YOU'RE NOT CITING THOSE, WHERE I'M ACTUALLY CLEARLY SAYING IT IS LATE PREGNANCY

AND EARLY CHILDHOOD THAT THE EPIDEMIOLOGICAL DATA IS POINTING TO NOW. WE ARE SURPRISED TO SEE THAT, BUT THAT'S WHAT ALL OUR DATA SAYS. AND WE CORRECTED OUR OPINION ACCORDING TO WHAT THE DATA SAYS, NOT WHAT OUR PRIOR -- WHAT OUR PRIOR OPINION IS.

Q DIDN'T YOU COME TO BELIEVE, DOCTOR, THAT THE THE ETIOLOGY OF ASD LIKELY ORIGINATES IN EARLY PREGNANCY?

A THERE IS SOME AUTISM THAT DEFINITELY ORIGINATES AT CONCEPTION EVEN BECAUSE WE KNOW THAT, YOU KNOW, THERE ARE MONOGENIC FORMS, FRAGILE X SYNDROME IS ONE OF THEM, GENETIC AUTISM IS CAUSED AT CONCEPTION OR THE CAUSE GOES BACK TO CONCEPTION, AND THEN OF COURSE THE WHOLE PREGNANCY NEURODEVELOPMENT THAT IS BASED ON THAT GENETIC BLUEPRINT IS HAPPENING IN, YOU KNOW, IN FETAL DEVELOPMENT EARLY ON AND THERE'S STRUCTURAL BRAIN DEFECTS, THERE ARE CHILDREN WITH MICROCEPHALY WHO HAVE AUTISM. THAT MEANS THEY HAVE A VERY SMALL BRAIN. THAT'S A STRUCTURAL DEFECT THAT GOES BACK TO VERY EARLY PREGNANCY.

THESE KIND OF THINGS DEVELOP -- AS I SAID, IN 2000 YOU COULD HAVE ASKED ME AND I WOULD HAVE SAID, OH, AUTISM IS ALL GENETIC. BECAUSE THE ONLY STUDIES WE HAD WERE GENETIC STUDIES. AND THAT'S WHAT GENETIC STUDIES TOLD US.

IN THE MEANTIME, WE HAVE LEARNED MORE. WE HAVE MOVED ON. WE HAVE DONE EPIDEMIOLOGIC STUDIES AND WE HAVE LEARNED THAT THERE ARE MANY DIFFERENT SENSITIVE

PERIODS, AND DEPENDING ON WHAT AGENT WE ARE TALKING ABOUT, THESE SENSITIVE PERIODS ARE DIFFERENT ONES. AND FOR AIR POLLUTION I NOW STRONGLY BELIEVE IT'S LATE PREGNANCY AND EARLY CHILDHOOD.

FOR OTHER AGENTS WE HAVE TO DISCUSS. FOR LEAD, IT PROBABLY DEPENDS ON WHEN THE LEAD EXPOSURE IS THE HIGHEST. AS I TOLD YOU EARLIER, IF WE HAVE REALLY HIGH LEAD EXPOSURE IN A MOTHER VERY EARLY IN PREGNANCY, SHE PROBABLY LOSES THE BABY. SHE PROBABLY HAS A MISCARRIAGE OR A STILLBIRTH, SO WE WON'T EVEN SEE THE AUTISM.

Q LET'S LOOK AT ONE OF YOUR LATER PUBLICATIONS. IT'S A PUBLICATION WITH THE FIRST AUTHOR IS NAMED VIRK, V-I-R-K.

DO YOU RECALL THAT PUBLICATION?

A YES, I --

Q ALL RIGHT.

A -- THAT'S HERE, IF THAT'S WHAT YOU'RE ASKING.

Q OKAY. THIS IS EXHIBIT 684.

IT'S CALLED "PRECONCEPTIONAL AND PRENATAL SUPPLEMENTARY FOLIC ACID AND MULTI VITAMIN INTAKE AND AUTISM SPECTRUM DISORDERS."

AND AGAIN, YOU'RE THE SENIOR AUTHOR ON THE ARTICLE; CORRECT?

A YES, SHE WAS MY POST DOC.

Q ALL RIGHT. AND LET'S LOOK AT THE VERY FIRST SENTENCE OF THE ARTICLE UNDER "INTRODUCTION."

"THE ETIOLOGY OF AUTISM SPECTRUM DISORDERS LIKELY ORIGINATES EARLY IN PREGNANCY, A TIME

WHEN FOLATE, THYROID HORMONES SUCH AS IODINE AND OTHER VITAMINS, HORMONES AND/OR OTHER TRACE ELEMENTS ARE CRITICAL FOR NEURODEVELOPMENT."

DO YOU SEE THAT?

A YES. AND THIS IS ONE OF THOSE EXAMPLES WHERE I'M TELLING YOU, YES, ASD IS CAUSED BY MANY, MANY DIFFERENT THINGS. ONE OF THEM IS PROBABLY FOLATE DEFICIENCY. AND LIKE WITH GENETIC CAUSES, THESE CAUSES, THESE OTHER CAUSES HAVE THEIR TIMING. AND THE TIMING FOR FOLATE IS EARLY IN PREGNANCY. THE TIMING FOR THYROID HORMONES CAN BE EITHER EARLY, AND IF THEY ARE VERY EARLY, THEY MIGHT CONTRIBUTE TO STRUCTURAL DEFECTS JUST LIKE FOLATE IN THE BRAIN.

IF THEY ARE LATE, THEN IT'S THE ASD SPECTRUM ON THE OTHER SIDE WHERE IT'S REALLY JUST SYNAPSE FORMATION -- NOT JUST -- IT'S SYNAPSE FORMATION, IT'S PRUNING AFTER BIRTH, ET CETERA.

SO THE TIMING IS SEVERE WHEN IT'S EARLY AND MAYBE LESS SEVERE WHEN IT'S LATE OR IT IS OTHER TYPES OF STRUCK -- OF EFFECTS IT HAS ON THE BRAIN.

SO, IN ESSENCE, THE BRAIN IS AN ORGAN THAT DEVELOPS OVER MANY, MANY, MANY YEARS, AND DEPENDING ON WHEN YOU HIT IT WITH WHAT, YOU GET DIFFERENT TYPES OF AUTISM.

AND HERE WE WERE INTERESTED IN FOLATE, AND WE KNOW THAT ONE PLACE WHERE FOLATE IS REALLY IMPORTANT IS EARLY IN PREGNANCY AND THAT'S WHY THIS FIRST SENTENCE POINTS TO EARLY IN PREGNANCY BECAUSE THAT IS THE TIME WE

ARE INTERESTED IN NOW BECAUSE FOLATE IS RESPONSIBLE FOR METHYLATION AND THE METHYLATION IN EARLY PREGNANCY, THE METHYLATION OF THESE -- OF THE BRAIN IS REALLY IMPORTANT EARLY IN PREGNANCY AND THAT'S WHAT THIS POINTS OUT.

Q OKAY.

A BUT THAT DOESN'T MEAN THERE ARE NO REASONS TO THINK THAT, YOU KNOW, OTHER AGENTS MAY AFFECT THE BRAIN LATER IN TIME.

THERE'S NOT ONLY ONE TIME.

Q OKAY. DOCTOR, BUT THANK YOU FOR THAT ANSWER.

LET'S -- I WANT TO ASK YOU ABOUT THE ARORA STUDY WHICH YOU'VE REFERRED TO SEVERAL TIMES IN THE TWIN TEETH STUDY THAT YOU REFERRED TO SEVERAL TIMES IN YOUR TESTIMONY YESTERDAY AND A COUPLE OF TIMES TODAY.

AND YOU -- THIS STUDY YOU SAID GREATLY INFLUENCED YOUR CONCLUSIONS ABOUT METALS AND AUTISM DEVELOPMENT; ISN'T THAT TRUE?

A YES.

Q AND AS YOU DESCRIBED YESTERDAY, THIS STUDY THAT GREATLY INFLUENCED YOUR CONCLUSIONS MEASURED LEVELS OF METALS IN SHED TEETH OF WHAT ARE CALLED DISCORDANT TWIN PAIRS IN SWEDEN; CORRECT?

A YES, THEY WERE BOTH. THEY WERE CONCORDANT AND DISCORDANT.

Q RIGHT.

AND I WANT TO ASK YOU ABOUT SOME OF THE STATEMENTS THAT THE AUTHORS MADE IN THIS STUDY.

LET'S GO TO THE SECOND PAGE.

THE PARAGRAPH THAT BEGINS WITH "STUDIES OF TOXIC METALS."

SO WE TALKED ABOUT THE FIRST COUPLE OF SENTENCES OF THIS PARAGRAPH. I WANTED TO ASK YOU ABOUT A COUPLE OF THE OTHER SENTENCES.

THE THIRD SENTENCE SAYS, "PREVIOUS RESEARCH SHOWS METHODOLOGICAL SHORTCOMINGS THAT LIMIT INTERPRETATION AND GENERALIZABILITY OF THE FINDINGS; FIRST, ELEMENTAL EXPOSURE HAS FREQUENTLY BEEN ESTIMATED USING CONCENTRATIONS IN BLOOD OR OTHER BIOMARKERS POST DIAGNOSIS."

DO YOU SEE THAT?

A YES. HE'S CITING 11. WHO IS THAT?

Q WELL, LET ME -- BEFORE I SHOW YOU THAT, LET ME ASK YOU A QUESTION.

THAT -- WHAT THAT SENTENCE IS REFERRING TO IS THE TEMPORALITY PROBLEM, THAT ELEMENTS HAVE BEEN MEASURED USING CONCENTRATIONS IN BLOOD OR OTHER BIOMARKERS POST DIAGNOSIS OF THE DISEASE; CORRECT?

A I DON'T KNOW WHETHER I WOULD INTERPRET IT IN THIS WAY. I SAW IT MORE AS HIM WORRIED ABOUT THE TOOTH BEING A LONGER TERM, MORE TIME-DEFINED MEASURE THAN BLOOD.

Q OKAY.

THEY SAY DOWN LATER, "ASSESSING" -- IN THE THIRD -- "ASSESSING THE CONTRIBUTION OF ENVIRONMENTAL FACTORS IN THE ETIOLOGY OF ASD NEEDS CONTROL FOR GENETIC FACTORS."

DO YOU SEE THAT?

A WHERE IS THAT?

Q I'M SORRY, IT SAYS THAT RIGHT THERE.

A OH, YEAH. UM-HMM, YES.

Q AND DO YOU AGREE WITH THAT?

A WELL, THAT'S HIS OPINION. AND YES, GENERALLY, IT IS A GOOD IDEA TO CONTROL FOR GENETIC FACTORS BECAUSE WE KNOW THAT THERE'S DIFFERENCE SUSCEPTIBILITIES.

WHETHER YOU CAN DO THAT IN EVERY STUDY IS ANOTHER QUESTION.

SO GENERALLY WHAT THAT MEANS IS IF YOU CANNOT CONTROL -- AND THEY COULD CONTROL. THAT'S WHY HE SAYS OUR STUDY IS SO MUCH BETTER THAN ALL THE OTHERS, AND I WOULD AGREE WITH THAT -- THE PROBLEM IS WHEN YOU CAN'T CONTROL FOR GENETIC FACTORS, THEN YOU ARE MIXING TYPES, AND WHEN YOU'RE MIXING TYPES, IT'S THAT SIGNAL TO NOISE RATIO.

SO IF YOU CANNOT CONTROL FOR GENETIC FACTORS, MOST LIKELY YOU WON'T SEE ANYTHING, AND THAT'S THE PROBLEM WITH MOST ENVIRONMENTAL STUDIES. THAT'S ACTUALLY WHY IN THE LAST 20 YEARS I HAVE ALSO PIVOTED TOWARDS WHAT IS CALLED GENE ENVIRONMENT INTERACTION STUDIES SO I CAN CONTROL FOR GENES WHEN I'M MEASURING ENVIRONMENTAL FACTORS, BUT THAT'S REALLY EXPENSIVE AND NOT POSSIBLE IN EVERY CASE.

Q ALL RIGHT. AND THE WAY THAT THEY TRIED TO CONTROL FOR GENERIC FACTORS HERE, ONE WAY TO DO IT AS IT SAYS IN THE NEXT SENTENCE WOULD BE HAVING MONOZYGOTIC

TWINS, IN OTHER WORDS, IDENTICAL TWINS THAT ARE DISCORDANT FOR ASD; MEANING, ONE HAS ASD AND ONE DOESN'T; CORRECT?

A YES.

Q OKAY.

NOW, DOCTOR, ISN'T IT TRUE THAT IN THIS STUDY THEY ONLY HAD THREE DISCORDANT MONOZYGOTIC TWIN PAIRS?

A CAN YOU SHOW ME?

Q SURE.

THE NEXT PAGE, ACTUALLY, THERE'S A CHART WHICH IS A FLOW CHART OF THEIR NUMBERS AND METHODS.

AND DO YOU SEE AT THE BOTTOM AND UNDER --

A UM-HMM.

Q -- WHEN THEY DESCRIBE WHAT NUMBER OF ASD DISCORDANT TWINS THEY HAD, THEY ONLY HAD THREE DISCORDANT MONOZYGOTIC TWINS; CORRECT?

A YES, BUT THEY ALSO HAD FIVE CONCORDANT MONOZYGOTIC TWINS AND THEN NINE MONOZYGOTIC TWINS WITH -- PAIRED WITH SOMEONE ELSE; SO THEY ARE NOT JUST COMPARING MONOZYGOTIC TWINS TO EACH OTHER, THEY ARE ACTUALLY DOING A MUCH BROADER COMPARISON WHICH IS VERY, VERY USEFUL BECAUSE IT TELLS YOU SOMETHING ABOUT GENETICS AS WELL AS THE ENVIRONMENTS AND WHAT IT DOES TOGETHER.

Q RIGHT.

A AND THAT'S WHY ACTUALLY THIS IS ACTUALLY SUCH A BRILLIANT STUDY AND WAS PUBLISHED IN A GOOD JOURNAL.

Q RIGHT.

AND IN TERMS OF THE NUMBER OF TWIN PAIRS WHERE THE ONE TWIN HAD ASD -- THE NUMBER OF IDENTICAL TWIN PAIRS WHERE ONE HAD ASD AND ONE DIDN'T IS A TOTAL OF THREE?

A THAT'S WHAT IT LOOKS LIKE, YES.

Q ALL RIGHT.

AND THEY FOUND BETWEEN THOSE SEVEN DISCORDANT TWIN PAIRS THAT ARE SHOWN THERE, THE THREE MONOZYGOTIC PLUS THE FOUR DIZYGOTIC, THAT MEANS NON IDENTICAL TWINS; CORRECT?

A YES, THEY SHARE THE UTERUS, BUT NOT THE GENES -- THEY ARE LIKE SIBLING.

Q JUST LIKE SIB --

A YEAH, IN THAT SENSE THEY ARE ACTUALLY ARE CONTROLLING FOR GENETICS BECAUSE SIBLINGS ARE SO MUCH CLOSER IN THEIR GENETICS THAN ANYONE ELSE IN THE WORLD EXCEPT FOR THE PARENTS.

Q AND THEY FOUND AN ASSOCIATION BETWEEN -- IN THESE SEVEN TWIN PAIRS, THE THREE MONOZYGOTIC AND THE TWO DIZYGOTIC -- I MEAN, FOUR DIZYGOTIC TWIN PAIRS -- THEY FOUND AN ASSOCIATION BETWEEN LEAD LEVELS AND THE AUTISM -- THE TWIN THAT HAD AUTISM ONLY -- ONLY AT THE TIME 10 TO 20 WEEKS POST-NATALLY; CORRECT?

A NO. THEY LOOKED AT THE WHOLE TIME PERIOD AND IT WASN'T ALWAYS STATISTICALLY SIGNIFICANT, BUT WHEN YOU LOOK AT THE PATTERNS, THE HIGHER LEAD LEVEL WAS FAIRLY CONSISTENT THROUGHOUT. BUT FOR SOME REASON THERE WAS -- YOU CAN GO TO THE FIGURES -- FOR SOME REASON IT WASN'T

ALWAYS STATISTICALLY SIGNIFICANT, SO THEY WERE VERY CAREFUL IN THEIR DESCRIPTIONS.

Q WELL, LET'S SEE HOW THE AUTHORS DESCRIBED THEIR OWN RESULTS.

LET'S GO TO PAGE 4 OF THE STUDY.

THIS IS UNDER THE "RESULTS" SECTION WHERE THE AUTHORS SAY WHEN THEY COMPARED DISCORDANT TWINS WITH NON, THEY FOUND LEAD LEVELS WERE CONSISTENTLY HIGHER IN ASD CASES FROM 20 WEEKS BEFORE BIRTH TO 30 WEEKS AFTER BIRTH; HOWEVER, AFTER ADJUSTING FOR INTER-TWIN CORRELATIONS, THIS ASSOCIATION WAS ONLY EVIDENT BETWEEN 10 TO 20 WEEKS POST-NATALLY; CORRECT?

A YES.

Q NOW, DOCTOR, IF YOU THINK ABOUT THE 30 WEEKS POST-BIRTH IN THIRDS, THEY FOUND NO STATISTICALLY SIGNIFICANT ASSOCIATION BETWEEN BIRTH AND WEEK 10, NO STATISTICALLY SIGNIFICANT ASSOCIATION BETWEEN WEEKS 20 AND 30, AND ONLY A STATISTICALLY SIGNIFICANT ASSOCIATION BETWEEN WEEKS 10 AND 20; IS THAT CORRECT?

A WELL, WHEN YOU HAVE THESE KIND OF NUMBERS AND YOU ADJUST, LIKE THEY SAY HERE FOR ALL THE THESE CORRELATIONS, THAT IS WHAT I WOULD EXPECT TO HAPPEN BECAUSE YOU NEEDED A LARGER SAMPLE SIZE TO MAKE THE OTHER DIFFERENCES.

IF WE GO TO THE FIGURES, YOU'LL SEE THEY ARE ALL ABOVE. THE TWIN WITH ASD ALWAYS HAS HIGHER LEAD LEVELS, BUT THEY DON'T REACH THE LEVEL OF STATISTICAL SIGNIFICANCE WHEN YOU DO ALL THIS CO-ADJUSTMENT.

IT DOESN'T MEAN IT'S NOT MEANINGFUL. IT DOESN'T MEAN IT'S NOT CONSISTENT. IT JUST MEANS I WISH WE HAD MORE NUMBERS, MORE NUMBERS OF THESE KIDS TO COMPARE.

Q AND BY THE WAY, EVEN THE SIGNIFICANT THING THEY SAW, IF YOU LOOK AT THE NUMBERS THERE, THE 95 PERCENT CONFIDENCE INTERVAL IS .0.9 TO 2.5 SO IT CROSSES ONE.

EVEN THAT IS NOT STATISTICALLY SIGNIFICANT; CORRECT?

A I DON'T KNOW WHAT YOU'RE TALKING ABOUT. CAN YOU SHOW ME THAT?

Q IT'S RIGHT ON THE SCREEN.

IT SAYS WITH THE GREATEST DIFFERENCE WAS OBSERVED AT 15 WEEKS POST-NATALLY WHEN LEAD LEVELS IN ASD CASES WERE 1.5 TIMES HIGHER AND THEN THEY HAD THE 95 PERCENT CONFIDENCE INTERVAL .9 -- 0.9 TO 2.5.

DO YOU SEE THAT?

A YES. BUT AGAIN, YOU KNOW, IT INDICATES THERE IS QUITE A LOT -- A 1.5 FOLD HIGHER, AND YOU KNOW, WHEN YOU HAVE THESE NUMBERS, I'M REALLY AMAZED THAT THEY CAN SEE ANYTHING.

SO THE MOST LIKELY RESULT FROM A STUDY LIKE THIS WOULD BE SEEING ABSOLUTELY NOTHING. AND THAT THEY SEE A 1.5 FOLD HIGHER AND THAT THEY CAN EVEN BON-FERRONI CORRECT AND THE CONFIDENCE INTERVAL IS .9, THAT'S PRETTY CLOSE TO ONE, I FIND QUITE SURPRISING.

SO THIS TO ME IS RELATIVELY STRONG DATA GIVEN WHAT YOU JUST SAID.

Q ALL RIGHT.

WELL, LET'S SEE HOW THE AUTHORS CHARACTERIZE THEIR CONCLUSIONS IN THIS STUDY.

LET ME START ON PAGE 7 OF THE STUDY.

A WELL, THEY SAID UP THERE "CONSISTENTLY HIGHER," RIGHT.

Q I WAS LOOKING AT PAGE 7 OF THE STUDY. AT THE FIRST PARAGRAPH THERE.

A YES.

Q LET ME ASK YOU SOMETHING.

THE AUTHORS SAY, "EARLY SIGNS OF ASD FIRST MANIFEST 6 TO 12 MONTHS AFTER BIRTH SUGGESTING A NARROW WINDOW FOR ENVIRONMENTAL FACTORS TO CONTRIBUTE TO ASD RISK."

DO YOU SEE THAT?

A YES. AND THEY ARE CITING A REFERENCE .9 FOR THAT. WHAT'S THAT?

Q I -- WELL, LET ME -- BEFORE I SHOW YOU THE REFERENCE, DO YOU AGREE WITH THE AUTHORS THAT EARLY SIGNS OF ASD FIRST MANIFEST 6 TO 12 MONTHS AND THAT SUGGEST A NARROW WINDOW FOR ENVIRONMENTAL FACTORS TO CONTRIBUTE TO ASD RISK?

A WELL, WE PROBABLY AGREE THAT ASD IS A SPECTRUM DISEASE AND THAT THERE ARE VERY DIFFERENT AGES AT FIRST MANIFESTATION; AND YES, THERE ARE CHILDREN WHO FIRST MANIFEST EARLY, VERY EARLY IN LIFE.

THERE ARE CERTAINLY CHILDREN WHO ALSO MANIFEST MUCH LATER IN LIFE. AND YOU KNOW, THAT NARROW WINDOW

BECOMES QUITE WIDE IF WE'RE LOOKING AT KIDS WHO HAVE ASD FIRST DIAGNOSED LATER, THEN, YOU KNOW, THE WINDOW ISN'T AS NARROW. BUT FOR THE KIDS WHO MANIFEST THIS EARLY YES, IT'S NARROW. I AGREE.

Q OKAY.

AND THEN LET'S LOOK AT THE CONCLUSION SECTION OR THE CONCLUSION PARAGRAPH.

THIS IS ON PAGE 8 OF THE STUDY RIGHT AT THE TOP PARAGRAPH WHERE THEY TALK ABOUT STRENGTHS AND WEAKNESSES.

SO ONE LIMITATION OF THIS STUDY WAS A RELATIVE -- IT WAS A RELATIVELY SMALL NON RANDOM SAMPLE; CORRECT?

A YES. WHY THEY SAY NON RANDOM, I HAVE NO IDEA WHAT THEY MEAN BY THAT.

Q OKAY.

A IT'S SMALL. IT'S RELATIVELY SMALL. I AGREE WITH THAT.

Q AND THEN IF YOU GO DOWN IN THAT PARAGRAPH WITH -- STARTING WITH THE WORDS "NEVERTHELESS," THIS IS WHAT AT AUTHORS SAY ABOUT THEIR FINDINGS.

"NEVERTHELESS, CAUTION SHOULD BE EXERCISED WHEN GENERALIZING OUR FINDINGS AND ADDITIONAL STUDIES ARE NEEDED IN DIFFERENT POPULATIONS, PARTICULARLY LARGER NON TWIN ASD SAMPLES TO CORROBORATE OUR FINDINGS AND DIFFERENTIATE GENETIC AND NON GENETIC CONTRIBUTIONS IN UNDERSTANDING THE RELATION BETWEEN METALS AND ASD."

DO YOU SEE THAT?

A YES, I SEE THAT.

Q AND DO YOU AGREE WITH THE AUTHORS' INTERPRETATION OF THEIR HOW THEIR FINDINGS SHOULD BE USED?

A YES, AND I REALLY APPLAUD THEM FOR THIS VERY, VERY CAUTIOUS STATEMENT BECAUSE THAT'S WHAT WE WOULD LIKE TO SEE AUTHORS DO, THAT THEY ARE, YOU KNOW, ENTHUSIASTIC ABOUT THEIR RESULTS, BUT SAY, WELL, WE'D BETTER BE CAUTIOUS. THAT'S GREAT. AND OF COURSE IF WE WANT TO DIFFERENTIATE GENETICS FROM NON GENETICS, WE NEED MUCH LARGER STUDIES BECAUSE IT IS REALLY HARD.

AS SOON AS YOU GO INTO DIFFERENTIATING BETWEEN DIFFERENT CAUSES AND YOU ARE TARGETING MORE THAN ONE CAUSE IN ONE STUDY, YOU NEED AT LEAST FOUR TIMES THE SAMPLE SIZE, AND THAT'S BASICALLY WHAT THEY ARE ACKNOWLEDGING HERE.

SO FOR THESE --

Q AND --

A -- DIFFERENTIATIONS, WE NEED LARGER SAMPLE SIZE, BUT THAT --

Q AND WHEN I --

A -- BUT THAT DOESN'T MEAN THEY DIDN'T SHOW THAT ENVIRONMENT CONTRIBUTED.

Q AND WHEN I ASKED YOU ABOUT THIS VERY STATEMENT IN YOUR DEPOSITION, DIDN'T YOU TELL ME THAT MANISH ARORA PUT THE STATEMENT IN THERE BECAUSE HE WANTED MORE MONEY FOR MORE STUDIES? ISN'T THAT WHAT YOU TOLD ME?

A I DON'T RECALL THIS. MAYBE I DID. BUT THAT'S USUALLY WHAT WE ARE SAYING WHEN WE ARE PROMOTING OUR SCIENCE, WE WANT MORE BECAUSE WE'RE NEVER, YOU KNOW, WE'RE NEVER HAPPY JUST WITH ONE STUDY. AND THIS IS A NEW METHOD THAT HE'S USED ON THESE TEETH. IT'S AN EXCITING METHOD.

AND YES, I WISH HAD HE GOTTEN MORE MONEY SO HE COULD DO THIS AGAIN AND DO IT IN MORE CHILDREN AND, YOU KNOW, FIND OUT MORE AND TELL US MORE.

Q ALL RIGHT. WELL, LET'S -- WE HAVE ONLY A FEW MINUTES REMAINING. LET'S SEE EXACTLY WHAT YOU SAID AND THEN I WANT TO ASK YOU ONE MORE QUESTION ABOUT THE STUDY.

LET'S GO TO YOUR DEPOSITION, EXHIBIT 7 ON PAGE 222.

MR. WISNER: YOUR HONOR, I'M JUST GOING TO OBJECT TO THE RELEVANCE OF ANY OF THIS.

THE COURT: OVERRULED.

MR. WISNER: OKAY.

MR. PETROSINELLI:

Q AND SO WHEN I READ YOU THIS STATEMENT, WHICH IS AT THE TOP, AND THE QUESTION, AND I ASKED YOU IF YOU AGREED WITH IT, RIGHT AT THE BOTTOM STARTING AT LINE 13, YOU SAID, "THAT'S WHAT WE ALWAYS TEACH OUR STUDENTS TO

SAY, RIGHT. YOU NEVER CONCLUDE ANYTHING FROM JUST ONE STUDY. YOU ALWAYS ASK FOR MORE RESEARCH AND YOU ASK FOR MORE STUDIES AND NON TWINS. AND GUESS WHAT, MANISH" -- THAT'S

MANISH ARORA -- "WANTED MORE MONEY FOR MORE STUDIES AND THIS IS ONE THE ARGUMENTS YOU MAKE."

YOU TESTIFIED -- THAT'S WHAT YOU SAY?

A YEAH, THAT'S EXACTLY WHAT I JUST SAID.

Q OKAY.

A AND I WISH HE HAD GOTTEN MORE MONEY BECAUSE I WISH HE WOULD DO MORE OF THOSE.

Q LAST QUESTION I WANT YOU TO ASK YOU ABOUT THE ARORA STUDY ON THAT SAME WE WERE AT; AGAIN, THIS IS PAGE 8 IN THE CONCLUSIONS OF THE STUDY,

"FURTHERMORE," THIS IS WHAT THE AUTHORS SAID -- "WHILE THE DIFFERENCES WE OBSERVE BETWEEN CASES AND CONTROLS PRECEDE THE ONSET OF ASD SYMPTOMS" -- IN OTHER WORDS, THEY HAVE ESTABLISHED TEMPORALITY -- "THESE DATA DO NOT ESTABLISH CAUSALITY."

DO YOU SEE THAT?

A YES.

Q AND YOU CERTAINLY AGREE WITH THAT?

A NO ONE STUDY ESTABLISHES CAUSALITY, NO.

Q OKAY.

A AND THAT'S WHY I'M SAYING THESE AUTHORS ARE VERY CAREFUL IN HOW THEY INTERPRET THEIR RESULTS AND I REALLY APPLAUD THEM FOR IT. AND I WISH WE HAD MORE CAREFUL -- CAREFULLY DONE STUDIES BY PEOPLE WHO ARE SO HUMBLE AND STATE WHAT THEY SAID.

Q OKAY.

THERE WAS ONE MORE STUDY YOU MENTIONED YESTERDAY THAT I THINK I'LL CONCLUDE WITH FOR TODAY, AND THAT IS A STUDY CALLED FILON, F-I-L-O-N, WHICH IS EXHIBIT 57.

DO YOU RECALL TALKING ABOUT THAT STUDY YESTERDAY?

A I THINK WE DID, YES.

Q ALL RIGHT. AND I WANT TO -- THIS IS A CASE CONTROL STUDY FROM ONE REGION IN POLAND; TRUE?

A LET ME SEE. YELINSTOCK, YES.

Q OKAY.

AND I WANT TO ASK YOU ABOUT SOME OF THE STATEMENTS THAT THE AUTHORS MAKE IN THIS STUDY STARTING ON PAGE 2.

IN THE BOTTOM PARAGRAPH, THIS IS IN THE BACKGROUND SECTION.

IT SAYS, "ASD IS A NEURODEVELOPMENTAL DISORDER THIS SUGGESTS A POSSIBLE ROLE OF HEAVY METALS IN ITS UNDERLYING CAUSE CONDUCTION; HOWEVER, INVESTIGATIONS ON ASSOCIATIONS BETWEEN ASD AND NEUROTOXIC HEAVY METALS ARE INCONCLUSIVE. OVER THE LAST DECADES, NUMEROUS STUDIES HAVE REPORTED A RELATIONSHIP BETWEEN ASD AND LEAD AND ARSENIC EXPOSURE, HOWEVER, THERE ARE ALSO SOME REPORTS THAT CONCLUDE THAT HEAVY METAL EXPOSURE IS NOT A RISK FACTOR FROM ASD, THEREFORE, AN ACCURATE EVALUATION OF THE RELATIONSHIP BETWEEN ASD AND HEAVY METALS NEEDS

MORE SPECIFIC RESEARCH."

DO YOU SEE THAT?

A YES.

Q AND THIS STUDY THAT WE'RE LOOKING AT WAS PUBLISHED IN THE YEAR 2020; TRUE?

A CAN WE LOOK AT THAT? WHERE IS THIS --

Q SURE.

A -- PARAGRAPH FROM? THE INTRO, RIGHT?

Q YEAH. YOU CAN LOOK AT, I GUESS, RIGHT AT THE TOP AND THE TOP LEFT.

A YES.

Q DO YOU SEE THE CITATION? "2020"?

A YEAH, ACTUALLY THEY ARE DOING EXACTLY WHAT I TOLD YOU EVERY AUTHOR DOES WHO WANTS HIS ARTICLE IN A GOOD JOURNAL, AND BMC IS A GOOD JOURNAL. THEY SAY, WELL, THERE'S STILL SOMETHING WE NEED TO ADDRESS. WHAT IS IT? WELL, THERE ARE LOTS AND LOTS STUDIES SHOWING THESE EFFECTS, BUT GUESS WHAT, THERE ARE ALSO SOME WHO DON'T. SURPRISE. SURPRISE. NOBODY WOULD BE SURPRISED ABOUT THAT.

BUT THEN THE NEXT SENTENCE THEY SAID THAT IF YOU DIDN'T READ WAS THAT THERE IS NO STUDY IN POLAND, AND THAT IS ACTUALLY AN ARGUMENT THAT IS MADE AGAIN AND AGAIN, WHERE, YOU KNOW, PEOPLE SAY, OKAY, THIS HAS BEEN SHOWN IN THIS PART OF THE WORLD, BUT THAT DOESN'T APPLY TO US, SO THEIR NEXT ARGUMENT THERE WAS WE REALLY NEED A POLISH STUDY BECAUSE IN ORDER TO SET STANDARDS IN POLAND WE NEED TO POLISH DATA AND THAT'S WHAT THEY WERE TRYING

TO SAY HERE.

Q OKAY. WELL, LET'S SEE -- AFTER THEY DID THE STUDY, LET'S SEE WHAT THEY SAID ABOUT THE RESULTS.

LET'S GO TO PAGE 6 OF THE STUDY.

IN THE LEFT COLUMN, IT'S RIGHT AT END OF THE DISCUSSION SECTION UNDER THE WORD -- THE PARAGRAPH "DESPITE."

A YEAH.

Q WE'LL HIGHLIGHT THAT FOR YOU FOR A SECOND.

"DESPITE A NUMBER OF STUDIES AND ANALYSES, AUTISM IS STILL NOT UNDERSTOOD BY SCIENTISTS BECAUSE NO SPECIFIC FACTOR CAUSING THIS CONDITION HAS BEEN FOUND. EACH EXPERIMENT PROVIDES NEW VALUABLE DATA BUT FAILS TO DELIVER AN EXPLANATION FOR SYMPTOM OCCURRENCE."

DO YOU SEE THAT?

A YEAH. THAT IS SO NON SPECIFIC AND SO WRONG THAT I DON'T EVEN KNOW WHAT TO SAY ABOUT THIS BECAUSE WE HAVE SPECIFIC CAUSES, THEY ARE CALLED GENES, MONOGENETIC GENETIC DISORDERS CAUSE AUTISM AND NOT ONLY DO THEY -- DO WE KNOW THIS, WE ALSO KNOW THAT THOSE GENES HAVE CERTAIN EFFECTS ON THE BRAIN, AND YOU KNOW, STRUCTURAL EFFECTS ON THE BRAIN. AND THAT IS ONE TYPE OF AUTISM.

HOWEVER, AS WE ALSO AGREED, AUTISM IS A SPECTRUM DISORDER, AUTISM SPECTRUM DISEASE; MEANING, THERE ARE VERY SEVERE FORMS, STRUCTURAL DEFECTS, AND THERE ARE VERY MINOR FORMS WITH AUTISM-LIKE SPECTRUM BEHAVIOR. AND THEY HAVE DIFFERENT CAUSES. AND YES, WE

DON'T KNOW ALL THE CAUSES.

BUT SPECIFICITY, I THINK I ARGUED AGAINST THAT BEFORE.

Q SO YOU SAY YOU DON'T KNOW WHERE TO BEGIN BECAUSE IT'S SO WRONG. BUT THIS IS A STUDY THAT YOU DISCUSSED YESTERDAY IN YOUR DIRECT TESTIMONY.

DO YOU REMEMBER THAT?

A YES, BUT I CAN, NEVERTHELESS, DISAGREE WITH A SENTENCE IN THE DISCUSSION, RIGHT. I CAN EVEN STRONGLY DISAGREE --

Q OKAY.

A -- WITH A SENTENCE IN THE DISCUSSION, BUT THE DATA IS ALWAYS VALUABLE. I'M NOT -- I WOULD NEVER THROW OUT ANY DATA. THE DATA THEY ARE GIVING ME IS VALUABLE EVEN IF I DISAGREE WITH THE SENTENCE IN THE DISCUSSION.

Q OKAY. WE CAN TAKE THAT DOWN.

YOUR HONOR, I'M ABOUT TO MOVE TO A DIFFERENT TOPIC. I SEE IT'S 4:25. SHALL WE BREAK FOR THE DAY AND THEN MR. WISNER AND I CAN TALK ABOUT SCHEDULING WITH DR. RITZ?

THE COURT: OKAY. LET'S EXCUSE THE WITNESS FOR NOW.

THANK YOU VERY MUCH, DOCTOR. I APPRECIATE YOUR PATIENCE.

AND LET'S JUST TALK AMONG THE THREE OF US FOR A MINUTE ABOUT SCHEDULING.

HOW MUCH MORE DO YOU THINK YOU HAVE?

MR. PETROSINELLI: I WOULD SAY, I MEAN, THE

ANSWERS HAVE BEEN QUITE LONG, BUT I WOULD SAY, AS I THINK YOUR HONOR HAS SEEN, I WOULD SAY WITH REASONABLY RESPONSIVE ANSWERS, 30 MINUTES AT THE -- PROBABLY 30 MINUTES OR SO.

THE COURT: OKAY. GOOD. SO THAT SOUNDS MANAGEABLE. IT'S SORT OF LIKE WHAT FELL OVER/LEFT OVER -- WAS LEFT OVER FROM MR. WISNER.

SO THE NEXT TIME THAT I HAVE SET ASIDE IS WHEN? TODAY IS TUESDAY. DO I HAVE TOMORROW AFTERNOON WITH YOU AS WELL?

MR. PETROSINELLI: YES.

THE COURT: OKAY. SO IF WE START WITH -- BUT DR. RITZ CANNOT DO TOMORROW, THAT'S THE ISSUE.

MR. WISNER: THAT'S CORRECT.

MR. PETROSINELLI: WE HAVE ANOTHER WITNESS -- I THINK MR. WISNER HAS HIS OTHER EPIDEMIOLOGIST TOMORROW.

THE COURT: RIGHT.

MR. PETROSINELLI: AND I THINK WE COULD GO FORWARD WITH HER. AND THEN THE QUESTION WOULD BE IS DR. RITZ AVAILABLE ON FRIDAY MORNING OR SOMETIME FRIDAY TO FINISH UP HER TESTIMONY.

THE COURT: OKAY. THANK YOU. THE OTHER POSSIBILITY BECAUSE I HAVE NOTHING AT ALL NEXT WEEK AND THEN I'M --

MR. WISNER: THE TRIAL WENT OFF.

THE COURT: WE THINK.

MR. WISNER: OH, OKAY.

THE COURT: I'D BETTER CHECK. WAIT. I'D

BETTER CHECK. I AM JUST BARELY ABOVE WATER FROM DAY-TO-DAY HERE LET ME TELL YOU.

MR. WISNER: I CAN IMAGINE, YOUR HONOR.

THE COURT: THE NEXT WEEK, YEAH, THAT TRIAL IS GOING OFF, YES, BUT ANYWAY, THEN I'M -- THE COURTROOM IS DARK AND I'M GONE UNTIL THE DAY AFTER PRESIDENTS' DAY WHICH IS THE 22ND AND ON THAT DAY I HAVE A JURY TRIAL RIGHT NOW. IT'S SET TO GO.

ANYWAY, SO I SUPPOSE AS A DEFAULT WHAT THE PARTIES COULD DO IS RECORD THE LAST HOUR -- HALF-HOUR OF HER TESTIMONY WHEN IT'S CONVENIENT TO YOU AND THEN PLAY IT TO THE COURT OR GIVE IT TO THE COURT TO PLAY SOMETIME CONVENIENT TO ME SINCE WE HAVE SO LITTLE LEFT. THAT SEEMS LIKE IT WOULD BE GOOD ENOUGH. WHAT DO YOU THINK?

MR. WISNER: THAT'S FINE WITH ME, YOUR HONOR. I'M SURE WE CAN WORK SOMETHING OUT. IF YOU ARE AVAILABLE NEXT WEEK --

THE COURT: OKAY.

MR. WISNER: -- I HAVE TO CHECK WITH DR. RITZ, BUT MAYBE WE CAN -- YOU -- OH, YOU'RE NOT AVAILABLE.

THE COURT: NO, NEXT WEEK IS CRAZY.

MR. WISNER: OH, I'M SORRY. I MISHEARD YOU. I'M SORRY, YOUR HONOR.

THE COURT: OKAY. THE TRIAL WENT AWAY. WELL, NO, ACTUALLY, I MAY BE SPEAKING TOO STRONGLY HERE. LET ME JUST LOOK FOR A MINUTE. OKAY. LET'S SEE. YEAH, I'M -- YEAH, I -- IT'S NOT AS BAD AS I THOUGHT BECAUSE, YOU'RE RIGHT, A LOT OF THE MARKS ARE FOR THE TRIAL THAT

I THINK IS GOING AWAY.

OKAY. SO IT WOULD BE AGAIN AFTERNOONS. OR THE 10TH IS A PRETTY GOOD DAY.

MR. WISNER: OKAY. LET ME CHECK WITH DR. RITZ AND MAKE SURE THE TIME WORKS FOR HER. OBVIOUSLY THE SOONER THE BETTER BECAUSE IT'S STILL FRESH AND THERE'S STUFF I WANT TO REDIRECT ON AND EVERYTHING, SO, AND OBVIOUSLY I DON'T WANT TO BE TALKING WITH HER WHILE SHE'S STILL UNDER THE RUBRIC OF CROSS, BUT I DO HAVE TO INTERACT WITH HER QUITE A BIT BECAUSE SHE'S ONE OF OUR EXPERTS IN OUR CASE AND WE'RE STILL MOVING ALONG. SO WE'LL NAVIGATE THAT ACCORDINGLY.

SO LET GET BACK TO THE COURT. I'LL MEET AND CONFER WITH COUNSEL. I'M SURE WE CAN GET YOU A TIME AND MAKE SURE TO CLEAR IT WITH THE COURT TOMORROW MORNING OR TOMORROW AFTERNOON WHEN WE MEET.

THE COURT: YEAH. SO I WILL JUST SEE YOU TOMORROW AFTERNOON AND THE WITNESS IS GOING TO BE DR. GARDENER.

MR. WISNER: THAT'S CORRECT, YOUR HONOR.

THE COURT: OKAY. ALL RIGHT. VERY GOOD. THANK YOU VERY MUCH. I APPRECIATE THAT YOU'RE ALL WORKING VERY HARD.

{TIME NOTED: 4:29 P.M.}

STENOGRAPHIC REPORTER'S CERTIFICATION

I, JEANESE JOHNSON, CERTIFIED SHORTHAND REPORTER, OFFICIAL REPORTER PRO TEMPORE, IN AND FOR THE STATE OF CALIFORNIA, DO HEREBY CERTIFY:

THAT THE FOREGOING PROCEEDINGS WERE REPORTED STENOGRAPHICALLY BY ME;

THAT THE FOREGOING IS A TRUE RECORD OF THE PROCEEDINGS TAKEN AT THAT TIME.

I FURTHER CERTIFY THAT I AM NOT ATTORNEY OR COUNSEL OF ANY OF THE PARTIES, NOR AM I A RELATIVE OR EMPLOYEE OF ANY ATTORNEY OR COUNSEL OF ANY PARTY CONNECTED WITH THE ACTION, NOR AM I FINANCIALLY INTERESTED IN THE ACTION.

IN WITNESS WHEREOF, I HAVE SUBSCRIBED MY NAME THIS 3RD DAY OF FEBRUARY, 2022.

JEANESE JOHNSON, CSR NO. 11635, CLR
CERTIFIED STENOGRAPHIC REALTIME REPORTER
OFFICIAL REPORTER PRO TEMPORE

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